Appendix F

Water use license(s) authorisation, SAHRA information, service letters from municipalities, water supply information

Peach Tree X23 Industrial

Our Ref: 10192

an agency of the
Department of Arts and Culture

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South African Heritage Resources Agency | 111 Harrington Street | Cape Town
P.O. Box 4637 | Cape Town | 8001
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Enquiries: Andrew Salomon
Tel: 021 462 4502
Email: asalomon@sahra.org.za
CaseID: 10192

Date: Friday October 14, 2016

Letter

In terms of Section 38 of the National Heritage Resources Act (Act 25 of 1999)

Attention: Tembibex (Pty) Ltd

The proposed Peach Tree Ext 23 Industrial development is for the establishment of an Industrial Township which is situated on Portions 109 & 331 of the Farm Knopjeslaagte 385 JR, City of Tshwane, Gauteng.

Thank you for your notification regarding this development.

In terms of the National Heritage Resources Act, no 25 of 1999, heritage resources, including archaeological or palaeontological sites over 100 years old, graves older than 60 years, structures older than 60 years are protected. They may not be disturbed without a permit from the relevant heritage resources authority. This means that prior to development it is incumbent on the developer to ensure that a **Heritage Impact Assessment** is done. This must include the archaeological component (Phase 1) and any other applicable heritage components. Appropriate (Phase 2) mitigation, which involves recording, sampling and dating sites that are to be destroyed, must be done as required.

The quickest process to follow for the archaeological component is to contract an accredited specialist (see the web site of the Association of Southern African Professional Archaeologists www.asapa.org.za) to provide a Phase 1 Archaeological Impact Assessment Report. This must be done before any large development takes place.

The Phase 1 Impact Assessment Report will identify the archaeological sites and assess their significance. It should also make recommendations (as indicated in section 38) about the process to be followed. For example, there may need to be a mitigation phase (Phase 2) where the specialist will collect or excavate material and date the site. At the end of the process the heritage authority may give permission for destruction of the sites.

Where bedrock is to be affected, or where there are coastal sediments, or marine or river terraces and in potentially fossiliferous superficial deposits, a Palaeontological Desk Top study must be undertaken to assess whether or not the development will impact upon palaeontological resources - or at least a letter of exemption

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from a Palaeontologist is needed to indicate that this is unnecessary. If the area is deemed sensitive, a full Phase 1 Palaeontological Impact Assessment will be required and if necessary a Phase 2 rescue operation might be necessary. **Please note that a nationwide fossil sensitivity map is now available on SAHRIS to assist with determining the fossil sensitivity of a study area .**

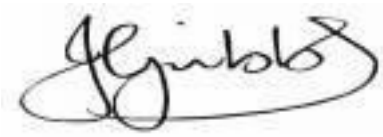
If the property is very small or disturbed and there is no significant site the heritage specialist may choose to send a letter to the heritage authority motivating for exemption from having to undertake further heritage assessments.

Any other heritage resources that may be impacted such as built structures over 60 years old, sites of cultural significance associated with oral histories, burial grounds and graves, graves of victims of conflict, and cultural landscapes or viewscapes must also be assessed.

Should you have any further queries, please contact the designated official using the case number quoted above in the case header.

Yours faithfully

Andrew Salomon
Heritage Officer: Archaeology
South African Heritage Resources Agency



John Gribble
Manager: Maritime and Underwater Cultural Heritage Unit / Acting Manager: Archaeology, Palaeontology and Meteorites Unit
South African Heritage Resources Agency

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CaseID: 10192

Date: Friday October 14, 2016

ADMIN:
Direct URL to case: http://www.sahra.org.za/node/373788
(GDARD, Ref:)

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Appendix G

Specialist Reports

Appendix G1

Motivating Memorandum

1. GENERAL INFORMATION

1.1 Application is hereby made in terms of Section 16(4) of the City of Tshwane Land Use Management By-Law (2016) for the establishment of a township situated on a part of Portion 109 and a part of the Remainder of Portion 331 of the farm Knopjeslaagte 385-JR (hereinafter referred to as "the subject properties"), to be known as Peach Tree Extension 23.

1.2 The intension is to obtain land use rights to enable the establishment of a township, which will comprise of seven (9) erven zoned as follows:

- Seven (7) erven zoned "Industrial 2" for the main purposes of "Commercial Use" and "Light Industry", subject to certain conditions;
- Two (2) erven zoned "Special" for "access and access control".

1.3 According to the City of Tshwane Town Planning Scheme 2008 (revised 2014) the "Industrial 2" zoning allows for "Business Buildings, Cafeteria, Car Wash, Commercial Use, Light Industry, Parking Garage, Parking Site, Place of Refreshment, Retail Industry, and Shops" subject to certain conditions.

1.4 It is confirmed that the proposed township name has been reserved by the Toponymy Unit of the Tshwane City Planning and Development Department (letter of confirmation of township name attached as ***Annexure A***).

1.5 This memorandum provides the relevant property information, and motivates the merits of the development proposal from a development planning perspective.

2. PROPERTY INFORMATION

2.1 Locality

2.1.1 The subject properties are situated to the east of the R511, between the R114 (M34) to the north and the N14-Hghway to the south in Knopjeslaagte. The site is furthermore situated to the south-west of the Copperleaf Golf Estate and the north-east of Diepsloot West. Leazonia Agricultural Holdings are also located directly west of the site. A locality plan is attached hereto as ***Annexure B***.

2.2 Property description, ownership and extent

2.2.1 The details related to description, ownership and size of the subject properties are provided in the table below:

PROPERTY DESCRIPTION	REGISTERED OWNER	DEED OF TRANSFER NUMBER	SIZE
Knopjeslaagte 385 JR: Portion 109	Tembibex (Pty) Ltd	T145496/2004	8.5653 hectares
Knopjeslaagte 385 JR: Portion 331	Dexalink (Pty) Ltd	T100157/1992	43.2787 hectares

2.2.2 Deeds of Transfer T145496/2004 and T100157/1992 and the relevant Power of Attorney documents (with proof of Company Registration) are respectively attached as ***Annexures C*** and ***D***.

2.2.4 The following Surveyor General diagrams relate to the subject properties, and are attached as ***Annexure E***:

- Diagram A6872/1946 – Portion 109 of the farm Knopjeslaagte 385 JR.
- Diagram A7234/1989 – Portion 331 of the farm Knopjeslaagte 385 JR.

2.3 Mortgage Bonds, Conditions of Title, Servitudes and Mineral Rights

2.3.1 Mortgage Bonds

The subject properties are not encumbered by any bonds.

2.3.2 Conditions of Title

A Conveyancers' Report has been prepared and is attached hereto as ***Annexure F***.

A part of the Remainder of Portion 331 (a Portion of Portion 23) of the farm Knopjeslaagte 385 JR is subject to the following conditions of title in terms of Deed of Transfer T100157/1992 which may prove to be restrictive to the proposed development:

- Condition (1) on page 3 of Deed of Transfer T100157/1992 which reads as follows:

  (I) "kragtens Notariële Akte 594/1972S is die reg aan ELEKTRISITEITSVOORSIENING-KOMMISIE verleen om elektrisiteit oor die hierinvermelde eiendom te vervoer, tesame met bykomende regte en onderworpe aan voorwaardes soos meer volledig sal blyk uit genoemde Akte en soos aangedui deur figure cd en ef op aangehegde Kaart."

- Condition (2) on page 3 of Deed of Transfer T100157/1992 which reads as follows:

  (II) "Aan 'n Reg van Weg 6 meter wyd ten gunste van die RESTERENDE GEDEELTE van Gedeelte 23 van die genoemde plaas, groot 85,1994 hektaar, soos aangedui deur die figuur TUVWXYZT op die genoemde Kaart L.G. No. A 7234/1989."

- Condition (3) on page 7 of Deed of Transfer T100157/1992 which reads as follows:

  (III) "By virtue of Notarial Deed of Servitude K9594/2005S dated 23 November 2005 the within mentioned property is subject to a servitude as follows:

  The servient owner hereby gives to the City Council a servitude perpetuity over that portion of the servient property substantially in accordance with the figure marked on the sketch plan annexed thereto marked A measuring approximately 5m² (such servitude area to be duly surveyed and reflected on and approved Surveyor General's diagram for registration purposes) (the servitude area) with the right to use the said Servitude are in perpetuity to convey portable water with ancillary rights.."

These conditions can be removed by way of Court Order or when dealing with the Conditions of Establishment during the proclamation of the township, provided a certificate from the Land Surveyor can be obtained confirming the conditions does not affect the relevant property.

A part of Portion 109 (a Portion of Portion 105) of the farm Knopjeslaagte 385 JR is subject to the following conditions of title in terms of Deed of Transfer T145496/2004 which may prove to be restrictive to the proposed development:

- Condition (1) on page 3 of Deed of Transfer T145496/2004 which reads as follows:

(1) "The land may not be subdivided nor may any share in it or portion of it be sold, leased or disposed of in any way without the written approval of the controlling authority as defined in Act 21 of 1940."

- Condition (2) on page 3 of Deed of Transfer T145496/2004 which reads as follows:

(2) "Not more than one dwelling-house together with such outbuildings as are ordinarily required to be used in connection therewith shall be erected on the land except with the written approval of the controlling authority as defined in Act 21 of 1940."

- Condition (3) on page 3 of Deed of Transfer T145496/2004 which reads as follows:

(3) "The land shall be used for residential and agricultural purposes only and no store or place of business or industry whatsoever may be opened or conducted on the land without the written approval of the controlling authority as defined in Act 21 of 1940."

- Condition (4) on page 3 of Deed of Transfer T145496/2004 which reads as follows:

(4) "No building or any structure whatsoever shall be erected within a distance of 37,78 metres from the centre line of the road, without the written approval of the controlling authority as defined in Act 21 of 1940."

The consent of the controlling authority will be obtained upon approval of the application for township establishment.

2.3.3 Servitudes

A Land Surveyor Certificate has been prepared and is attached hereto as ***Annexure G***.

A part of Portion 109 of the farm Knopjeslaagte 385 JR Diagram SG A6872/1946

- There are no servitudes that affect the proposed township

A part of the Remainder of Portion 331 of the farm Knopjeslaagte 385 JR Diagram SG A7234/1989

1. The portion is subject to a right of way servitude 6m wide as indicated on the SG Diagram that does not affect the proposed township.
2. The portion is subject to a servitude for Electrical Power lines as indicated on the SG Diagram that does not affect the proposed township.
3. The portion is subject to Water Pipeline Servitude 5m wide as indicated on the SG Diagram and does not affect the proposed township.

2.3.4 Mineral Rights

Written confirmation has been requested from the Department of Minerals and Resources that the proposed development complies in all respects with the requirements emanating from the Minerals and Energy Act, and proof of submission is attached hereto as ***Annexure H***.

2.4 Zoning

2.4.1 The subject properties are currently zoned *"Undetermined"* in terms of the Tshwane Town-Planning Scheme, 2008 (revised 2014).

2.4.3 The relevant Zoning Certificates are attached hereto as ***Annexure I***.

2.4.4 ***Annexure J*** hereto contains the relevant Zoning Map illustrating the zoning pattern of the surrounding area, which indicates predominantly *"Undetermined"* zonings.

3. PHYSICAL CHARACTERISTICS OF THE SUBJECT PROPERTIES

3.1 Gradient

3.1.1 The subject properties slope and drains towards the northwest with the highest lying point at the 1 485m contour line, and the lowest point at the 1 471m contour line.

3.1.2 Detailed contours are indicated on the Township Layout Plan, attached hereto as ***Annexure K.***

3.1.3 Consulting civil engineers have been appointed to confirm whether the township is affected by flood lines with an expected frequency of 1:50 years or 1:100 years. It is expected that the subject properties will not be affected by the afore-mentioned flood lines, but will be confirmed and certified by the consulting engineer.

3.2 Geotechnical Conditions

3.2.1 Louis Kruger Geotechnics CC has prepared a geotechnical report (attached hereto as ***Annexure L***), which report confirms that the soil conditions will not hamper the development potential of the site.

3.2.2 Fourteen test pits were excavated, logged and described to profile the soil conditions of the subject properties.

3.2.3 With reference to ***Annexure L*** it is confirmed that the subject properties are underlain by hillwash, nodular ferricrete and very soft rock granite with soft patches. The site is classified as NHBRC Zone P (Fill, perched water table)-C2-S2.

3.2.4 The application will also be circulated to the controlling authority for comment – the Council for Geoscience - as prescribed.

3.3 Environmental Considerations

3.3.1 Bokamoso Landscape Architects & Environmental Consultants has been appointed to obtain the relevant environmental authorisation, as the proposed development does not encompass a listed activity in terms of relevant environmental legislation, i.e. the National Environmental Management Act. A copy of the Executive Summary of the Basic Assessment Report is attached hereto as ***Annexure M***.

3.3.2 The application will also be circulated to the relevant authority for comment (GDARD) as prescribed.

4. DEVELOPMENT PROPOSAL

4.1 As indicated on the proposed Township Layout Plan (***Annexure K***), provision is made for nine (9) erven zoned as follows:

ERF NR.	PROPOSED ZONING	PROPOSED USE	PROPOSED ERF SIZE
1	Industrial 2	Business Building, Cafeteria, Car Wash, **Commercial Use, Light Industry**, Parking Garage and Parking Site, Place of Refreshment, Retail Industry and Shop.	1,9485 hectares
3	Industrial 2	Business Building, Cafeteria, Car Wash, **Commercial Use, Light Industry**, Parking Garage and Parking Site, Place of Refreshment, Retail Industry and Shop.	1,7940 hectares
3	Industrial 2	Business Building, Cafeteria, Car Wash, **Commercial Use, Light Industry**, Parking Garage and Parking Site, Place of Refreshment, Retail Industry and Shop.	1,3350 hectares
4	Industrial 2	Business Building, Cafeteria, Car Wash, **Commercial Use, Light Industry**, Parking Garage and Parking Site, Place of Refreshment, Retail Industry and Shop.	1,1090 hectares
5	Industrial 2	Business Building, Cafeteria, Car Wash, **Commercial Use, Light Industry**, Parking Garage and Parking Site, Place of Refreshment, Retail Industry and Shop.	1,0770 hectares
6	Industrial 2	Business Building, Cafeteria, Car Wash, **Commercial Use, Light Industry**, Parking Garage and Parking Site, Place of Refreshment, Retail Industry and Shop.	1,7915 hectares
7	Industrial 2	Business Building, Cafeteria, Car Wash, Commercial Use, Light Industry, Parking Garage and Parking Site, Place of Refreshment, Retail Industry and Shop.	1,8265 hectares
8	Special	Access and Access Control	0,4760 hectares
9	Special	Access and Access Control	0,4000 hectares

4.2 These aforementioned land use rights will be incorporated into the Tshwane Town-Planning Scheme, 2008 (revised 2014).

4.3 Access to the proposed development will be obtained via a proposed public street from the M34 (R114) Pretoria Krugersdorp Road as indicated on the proposed township layout plan.

4.4 Parking will be provided in accordance with the provisions of the Tshwane Town-Planning Scheme, 2008 (revised 2014).

4.5 The proposed development will be subject to the approval of a site development plan and building plans. These plans will address the siting of buildings, building lines, height, privacy of adjacent property owners, etc.

4.6 The proposed conditions of establishment are attached hereto as ***Annexure N***.

4.7 The proposed scheme documents are attached hereto as ***Annexure O***.

5. ELECTRICAL AND CIVIL ENGINEERING SERVICES

5.1 Consulting engineers have been appointed to conduct electrical and civil services reports.

5.2 Elektroplan Consulting Engineers CC has compiled an electrical services report (attached as ***Annexure P***), which report recommends that the developer enters into negotiation with the City of Tshwane for the supply of bulk power to the development.

5.3 CivilConsult was appointed by the registered property owner as consulting engineers for Peach Tree Extension 23, i.e. a part of Portion 109 and a part of the Remainder of Portion 331 of the farm Knopjeslaagte 385-JR. ***Annexure Q*** hereto contains a copy of the civil services report, conducted by Civil Consult Engineers dated June 2016.

Civil Engineering services are discussed in great detail in the service report. All design standards to be followed for the design of infrastructure will be based on the technical requirements of the Engineering Department of the City of Tshwane for the provision of municipal services.

The design of the water reticulation will be done in accordance with the latest edition of the Design Guidelines for Water Reticulation and Supply issued by the Water and Sanitation Division of the City of Tshwane. No formal City of Tshwane water reticulation is available in the vicinity of the proposed development.

Sewer design will be done according to the Tshwane Manual for the Design of Streets and Storm Water, issued by the Town Engineer's office of the City of Tshwane. No formal City of Tshwane sewer reticulation is available in the vicinity of the proposed development. Permanent and Interim Solutions are listed and discussed in the relevant services report.

5.4 According to the report, the proposed development may require the upgrading of existing engineering infrastructure and the developer will enter into services agreements with the Municipality, as required.

5.5 The amount of Bulk Services Contributions for civil services payable to the City of Tshwane will be determined with the compilation of the services agreements.

6. TRAFFIC ENGINEERING

6.1 Route 2 Transport Strategies Consulting was appointed in September 2015 to compile a traffic impact study for peach Tree Extension 23. The scope of the report includes an assessment on the roads that are to be affected by the development; peak hours' analysis of traffic volumes and also assessment scenarios. The report proposes the following:

- Provision of a 1.5m wide sidewalks along the site frontage on the M34(R114) and internal roads;
- The main access road should have two lanes in and two lanes out;
- The implementation of bus and mini-bus taxi layby's on both sides of the new road to the access road along the M34;
- A detailed site development plan should be compiled showing parking, on-site circulation and refuse removal.

The report's findings state that, bases on the site observations, the existing and base traffic volumes shown in the figures, as well as the mentioned capacity analyses, it can be said that the proposed development traffic will not have an impact on the weekly AM and PM peak hour intersection capacities, although the M34 and Road to Access intersection needs to be signalised. Please refer to the traffic impact study, attached as ***Annexure R***:

7. POLICIES

7.1 National Development Guidelines

7.1.1 Spatial Planning and Land Use Management Act, 2013 (Act 16 of 2013)

Section 7 of the Spatial Planning and Land Use Management Act, 2013 (Act 16 of 2013) confirms that the following principles apply to spatial planning, land development and land use management:

7(a) The principle of spatial justice, whereby-:

(i) Past spatial and other development imbalances must be redressed through improved access to and use of land.

It is our opinion that the greater community of this area will benefit from the development proposal through various new housing and employment opportunities.

The development will enhance the urban environment through the strengthening of economic growth and strategic densification of future development zones, as required in terms of the RSDF.

(ii) Spatial development frameworks and policies at all spheres of government must address the inclusion of persons and areas that were previously excluded, with an emphasis on informal settlements, former homeland areas and areas characterised by widespread poverty and deprivation.

(iii) Spatial planning mechanism, including land use schemes, must incorporate provisions that enable redress in access to land by disadvantaged communities and persons.

(iv) Land use management system must include all areas of a municipality and specifically include provisions that are flexible and appropriate for the management of disadvantaged areas, informal settlements and former homeland areas.

(v) Land development procedures must include provisions that accommodate access to secure tenure and incremental upgrading of informal areas.

(vi) A Municipal Planning Tribunal considering an application before it, may not be implemented or restricted in the exercise of its discretion solely on the ground that the value of land or property is affected by the outcome of the application.

Principles (7)(a) (ii) to (vi) relates to obligations imposed on local government, and in this regard the legislation is clear in respect of the procedures to facilitate the development to the property.

7(b) The principle of spatial sustainability, whereby spatial planning and land use management systems must-:

(i) Promote land development that is within the fiscal, institutional and administrative means of the Republic.

The proposed development, as motivated, complies with the fiscal, institutional and administrative means of the Republic as well as the Local Authority.

Development Policies (RSDF for Region 4), related administration and laws and the National Environmental Management Act, 1998, do allow for the application, as submitted, to be entertained.

(ii) Ensure that special consideration is given to the protection of prime and unique agricultural land.

In terms of Municipal policy, the property is earmarked for future urban land uses, not agricultural use. The Municipal policy is also due for review in the near future, which is to include the property and surroundings in the development zone.

(iii) Uphold consistency of land use measures in accordance with environmental management instruments.

This principle relates to obligations imposed on local government, and in this regard the legislation is clear in respect of the procedures to facilitate the development to the property.

(iv) Promote and stimulate the effective and equitable functioning of land markets.

This principle relates to obligations imposed on local government, and in this regard the legislation is clear in respect of the procedures to facilitate the development to the property.

(v) Consider all current and future cost to all parties for the provision of infrastructure and social services in land developments.

This principle relates to obligations imposed on local government, and in this regard the legislation is clear in respect of the procedures to facilitate the development to the property.

(vi) Promote land development in locations that are sustainable and limit urban sprawl.

The subject properties border onto the urban edge of the City of Tshwane and will not contribute to urban sprawl, as it entails a brownfield development. Other similar developments in the area has recently been approved by Council and a services masterplan will be done in the near future to service the area.

According to relevant policy guidelines of the Municipality (i.e. the Regional Spatial Development Framework for Region 4, 2013), the subject properties are earmarked for purposes of future urban development. Development pressure and the availability of developable land is channelling development opportunities into the area.

(vii) Result in communities that are viable.

The proposed development is in close proximity to residential, commercial, lifestyle and educational opportunities and will therefore ensure that there are sufficient residents in the general area to make full use of such facilities. As mentioned above, the site is located in a future development zone, which has been activated by other similar

developments and applications being approved by Council in the area.

7(c) The principle of efficiency, whereby-:

(i) Land development optimises the use of existing resources and infrastructure.

The proposed development will promote efficient land development, as it entails the establishment of a place of work in close proximity to place of residence. A mixture of land-uses will result in a better functioning urban environment. The proposed development will fit into the planned redevelopment of the area and create much needed housing opportunities within the municipality.

The subject properties are strategically situated in relation to transportation routes, e.g. the M34 Road, R511, Ruimte Road and the N14 freeway. These routes connect the application site to the surrounding areas and municipalities on a provincial scale.

The availability of services, capacity of said services, and upgrades required will be determined and confirmed in the relevant Engineering Service Reports, as per the documentation included hereto as part of the application documentation.

(ii) Decision-making procedures are designed to minimise negative financial, social, economic or environmental impacts.

This principle relates to obligations imposed on local government, and in this regard the legislation is clear in respect of the procedures to facilitate the development to the properties.

(iii) Development application procedures are efficient and streamlined and timeframes are adhered to by all parties.

This principle relates to obligations imposed on local government, and in this regard the legislation is clear in respect of the procedures to facilitate the development to the properties.

7(d) Principal of spatial resilience *whereby flexibility in spatial plans, policies and land use management systems are accommodated to ensure sustainable livelihoods in communities most likely to suffer the impacts of economic and environmental shocks.*

This principle relates to obligations imposed on local government, and in this regard the legislation is clear in respect of the procedures to facilitate the development to the property.

7(e) The principle of good administration, whereby-:

(i) All spheres of government ensure an integrated approach to land use and land development that is guided by the spatial planning and land use management systems as embodied in this Act.

This principle relates to obligations imposed on local government. The application will be circulated to relevant internal municipal departments for their comments.

(ii) All government departments must provide their sector inputs and comply with any other prescribed requirements during the preparation or amendment of spatial planning frameworks.

This principle relates to obligations imposed on local government.

(iii) The requirements of any law relating to land development and land use are met timeously.

This principle relates to obligations imposed on local government.

(iv) The preparation and amendment of spatial plans, policies, land use schemes as well as procedures for development applications, include transparent processes of public participation that afford all parties the opportunity to provide inputs on matters affecting them.

This principle relates to obligations imposed on local government. It is also confirmed that the application will be advertised by the applicant in the prescribed manner.

(v) Policies, legislation and procedures must be clearly set in order to inform and empower members of the public.

This principle relates to obligations imposed on local government.

7.1.2 National Development Plan - 2030

The National Development Plan identifies five principles for spatial development: spatial justice, spatial sustainability, spatial resilience, spatial quality and special efficiency.

It confirms that South African cities are highly fragmented, as little has been achieved in reversing apartheid geography. The Plan proposes that the situation be addressed by establishing new norms and standards: amongst others by densifying cities, improving transport and locating jobs where people live.

The containment of urban sprawl is particularly highlighted in the Plan, confirming that sprawl be contained and reversed (if possible), *"… as denser forms of development are more efficient in terms of land usage, infrastructure cost and environmental protection."*

The proposed development aligns with the vision of the National Development Plan, as it will promote compaction of the city and limiting urban sprawl (by means of infill development), as well as by establishing a place of work in close proximity to residential opportunities, which will result in reduced travel times. More housing opportunities will be provided within the municipal area, which will include low to medium density housing opportunities.

7.2 Provincial Development Guidelines

7.2.1 Gauteng Spatial Development Framework, 2011

The Gauteng Spatial Development Framework (SDF), 2011, was, amongst others, compiled to specify a clear set of spatial objectives for municipalities to achieve in order to ensure realisation of the future provincial spatial infrastructure; and to enable and direct growth.

The SDF aims to articulate the spatial objectives of the Gauteng region to assist the alignment of neighbouring municipalities' spatial plans. It is proposed that key principles in local municipality SDFs should include (applicable to this application):

- Promotion of densification in specific areas to utilise resources more efficiently;
- Establishment of a hierarchy of nodes and supporting existing development nodes.

The SDF confirms on page 128 that *"it remains the intension to limit urban sprawl as a fundamental tenet or urban growth policy and to promote the intentions of intensification and densification, together*

with a transformed urban structure that de-emphasises the need for outward expansion of the urban system".

The SDF furthermore identified four critical factors for development in the province, relevant to this development:

- **Contained urban growth:**

  To contain urban growth, an Urban Edge was identified to curb urban sprawl. The idea behind the urban edge is to limit development within certain areas of a city. Only certain types of developments are allowed on the outside of the urban edge. The goal is to curb urban sprawl and thereby protecting the natural environment. One way to do this is to increase the densities of the built environment within the urban edge.

  This edge is however not set in stone and can be amended if development pressure in an area requires the alteration of this "line" or edge. Normally, areas identified for future development or as future development nodes are not included within the urban edge of a municipality. Amendments to the relevant spatial legislation and frameworks of the municipality usually later include these areas within the edge, so the development potential can be unlocked. Approval of net land-use rights and applications in an area indicates that the characteristics of the area have changed over the ears.

- **Resourced based economic development:**

  Resource based economic development should result in identification of the economic core. Development should be encouraged in close proximity to existing resources, which includes infrastructure such as roads, water and electricity.

  The proposed development is situated near existing and adjacent to approved proposed developments and infrastructure networks. Recent similar approved township establishment applications indicate that there is a growing economic base in the area.

- **Re-direction of urban growth:**

  Developments in economically non-viable areas should be limited and thereby achieving growth within the economic growth sphere. The western Tshwane area is a fast growing development area in Tshwane, and growth should be encouraged in the precinct. Several new township applications have been approved in close proximity and adjacent to the application site, indicating the growth trend towards this region. Further development pressure is also mounting.

- **Increased access and mobility:**

  New land development areas should be planned/design to increase access and mobility of these developments. The proposed land development area could be regarded as accessible due to its strategic locally in close proximity to the M34, R511 and N14 Highway.

7.3 Local Development Guidelines

7.3.1 Integrated Development Plan (IDP), 2011-2016

The City of Tshwane has adopted an Integrated Development Plan (IDP) for 2011-2016 in terms of Section 25 of the Local Government, Municipal Systems Act, 2000 (Act 32 of 2000), which plan integrates and coordinates plans and aligns the resources and capacity of the Municipality to implement these plans. The compilation of Spatial Development Frameworks forms part of the IDP.

Strategic Objective 2 of the IDP (economic growth and development and job creation) and Strategic Objective 3 (sustainable communities) is particularly relevant to the proposed development.

The City of Tshwane further more seeks to focus its efforts to complement National and Provincial Government to accomplish the following strategic objectives:

- Provide quality basic services and infrastructure;
- Facilitate higher and shared economic growth and development;
- To fight poverty, build clean, healthy, safe and sustainable communities;
- Foster participatory democracy through a caring, accessible and accountable service;
- To ensure good governance, financial viability and optimal institutional transformation with capacity to execute its mandate.

The Strategic Levers emanating from the city's macro and long-term strategy, including the medium-term plan reflect Tshwane's attempts in actively working towards achieving the targets set out at national and provincial level. This is to ensure that the CoT succeeds in achieving its vision of the leading international African Capital City of excellence that empowers the community to prosper in a safe and healthy environment. Throughout the IDP, the Tshwane Municipality is focused to ensure:

- Encourage economic growth within the city, making it more competitive in global markets;
- Manage physical integration and compaction of the city and improve the quality and liveability within;
- Ensure the communities well-being by making services more available to all, enhancing these services and making them more affordable.

The proposed development will encourage economic growth, lead to compaction of the city through infill development, and ensure the well-being of the community by providing a much needed services and making it more available. It will also optimise the use of the existing municipal services network. It is in-line with the directives of the current planning policy and principles. The proposed development will enable job creation during both the construction and operational phases, and will promote the sustainable use of land resources, land ownership and housing opportunities.

7.3.2 Metropolitan Spatial Development Framework (MSDF), 2012

The MSDF was compiled to realise the vision of the City of Tshwane through spatial restructuring and to integrate all aspects of spatial planning. The "Smart Growth" approach to growth management entails the management of the physical growth of cities and is central to the implementation of the MSDF, and favours brownfield development and promotion of the mixing of compatible land uses (*"doing the right thing in the right place in the right way at the right time"*).

The MSDF also encourages infill development and the consolidation of secondary or emerging nodes to create primary nodes as opposed to leapfrog development. The MSDF describes various strategies which guide the development of retail facilities, i.e. renewal strategy, maintenance strategy, expansion strategy, new growth areas strategy, nodal strategy and nodal interchange strategy. In terms of these parameters, the proposed development can be described as an Expansion Strategy.

These overall objectives are supported by specific objectives:

- To stimulate economic growth;
- Utilise possible future growth and new developments to restructure and improve the urban form;
- Promote the availability of public transport; and
- Create healthy, comfortable and safe living and working environments for all.

Urban densification is seen as an important part of the spatial restructuring of the Tshwane Metropolitan area. This concept relates to: (1) An increase in the levels of access to goods, employment opportunities and public transport systems; (2) Viability of public transport systems; and (3) Optimal usage of land as a scarce resource.

The context of the application site is such that it is located adjacent to the build-up area of Copperleaf Golf Estate as well as to the Diepsloot area. Recent applications for township establishment were also approved by Council (Peach Tree X15 and X16) just to the south-east of the application site. Vacant land is a scarce resource, thus the developer seized the opportunity to develop the vacant property. As a result, the proposed development is in line with the principles dealing with containment of growth and compaction of urban development.

The proposed development stimulates economic growth by providing taxable residential, commercial, and industrial property, thereby creating additional revenue for the CoT and adding buying power to the local economy. The proposed development will enhance the image of the area by developing vacant land which has been neglected.

7.3.3 Regional Spatial Development Framework: Region 4, 2013

The Regional Spatial Development Framework (RSDF) (2013) for Region 4 earmarks the subject properties for purposes of future urban development. The properties are situated outside the demarcated urban edge of 2013. In terms of RSDF's Density Map, the properties fall in a low density residential area.

The RSDF concedes that the future urban development area *"represents a natural direction for growth of the metropolitan area and region",* subject to the provision of essential services and the LSDF for the area (i.e. Monavoni and Western Farms Development Framework, 2008).

The following development guidelines are proposed in the future urban area:

- Development that is in line with the Monavoni and Western Farms Development Framework;
- Contribution towards the goals of the City Strategy and MSDF;
- Availability of bulk engineering services;
- Protection of environmental sensitivity of the area;
- Proximity to other existing supporting social facilities, economic opportunities, retail and recreation;
- Physical features that may define the development (e.g. railway lines, watersheds, provincial roads, environmental areas);
- Provision of community facilities (e.g. schools, medical facilities, police stations).

The spatial development framework for the region is based on an integrated urban lattice on which densification and intensification of systems can take place in an integrated manner. A set of linear systems form the framework of the urban development lattice and relays urban energy from the traversing highways to lower order roads where it can be converted into physical development and economic growth. Existing and future mass transport routes are and should be integrated into the urban system.

The application site is located adjacent to the R511, N14-Highway and the M34, which has been identified by the RSDF as part of the **east-west** development mobility spines in the area which is defined as an arterial along which traffic flows with minimum interruption. In essence, the proposed township establishment is thus in line with the proposals of the RSDF.

7.3.4 Monavoni and Western Farms Development Framework, 2008

In terms of the Monavoni and Western Farms Development Framework (2008), the subject properties is situated within Zone 9: Agricultural Zone, while approved townships Peach Tree Extensions 15 and 16, situated to the south of the subject properties, is situated in Zone 2: Low Density Residential Zone (maximum nett density: 25 dwelling units per hectare).

The Proposed Development Edge also runs between the subject properties and nigh approved townships Peach Tree Extensions 15 and 16, situated to the south of the subject properties. The Framework confirms that geotechnical conditions on the subject properties are "intermediate", which also applies to nearby approved townships Peach Tree Extensions 15 and 16, situated to the south of the subject properties.

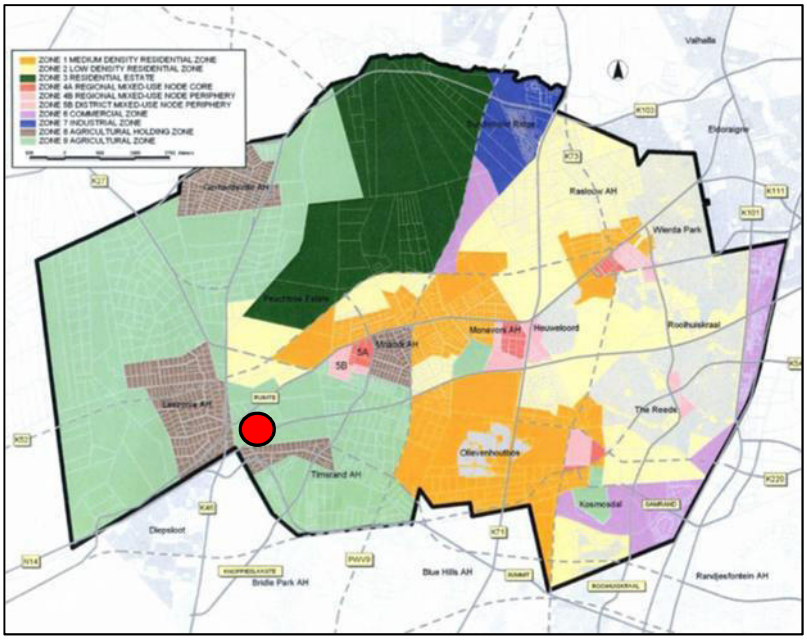

Figure 4: Monavoni & Western Farms Spatial Framework

The Framework also indicates that both the subject properties and adjacent approved townships Peach Tree Extensions 15 and 16, situated to the south of the subject properties, have low agricultural potential and medium development suitability.

8. MOTIVATION AND BURDEN OF PROOF

8.1 Need

8.1.1 A part of Portion 109 and a part of the Remainder of Portion 331 of the farm Knopjeslaagte 385-JR is located in an area where several new residential and mixed use developments and townships have been developed in recent years or are planned in the near future. This is mainly due to the high demand in developable land in close proximity to built-up areas and access routes. These townships are located all around the application site. It is necessary to accommodate and consider the land uses of the surrounding existing and proposed uses as well as residential townships in the area in the layout of the proposed township establishment.

8.1.2 The locality of the application site adjacent to the existing urban edge and in a future development zone and also major through routes and highways, are vitally important. The accessibility of the site is one of its major advantages. Access to the proposed township will be from the M34 (R114), which links with the R511 and also the N14-Highway.The site of application's close proximity to Copperleaf Golf Estate, Diepsloot-West, Laezonia AH, Gerhardsville and Mnandi AH.

8.1.3 Open and vacant, unutilized land within a build-up or developing area can be perceived as a weakness due to the security threat that vacant land imposes, as well as the negative influence it has on the image of a neighbourhood. Unused agricultural land or vacant land, which implies lower densities, makes the provision of essential municipal services less viable and more expensive to provide. By developing the existing land, the development of urban fibre can be stimulated through the strengthening of the future development node and region. The proposed land use rights of the erven accommodated in the township, Peach Tree Ext 23, are in accordance with the proposals of the Integrated Development Plan (IDP), as the IDP earmarks this area for mixed uses.

8.1.4 The proposed development will positively influence the income base of the Municipality. The income generated by rates is a function of land value, which is in turn a function of the land use. The establishment of the township broadens the economic base of the area. The development will also ensure the following:

- Infill development – The application site is a vacant portion of land situated adjacent to an existing and future residential townships, within the Municipality.
- New work opportunities in close proximity to place of residence – as a large labour force (skilled, semi-skilled and unskilled) is available in close proximity to the proposed development.
- Optimal use of existing infrastructure.

8.1.5 It is important to mention the issue of sustainability in terms of motivating the need for the development. According to the definition of Social Sustainability, the following themes are relevant (own extract):

- Basic needs (which includes Housing and Employment)
- Identity, sense of place and culture
- Social mixing and cohesion
- Well-being, happiness and quality of life

The social sustainability of the development can be derived from the fact that it will fulfil in the basic needs of the future inhabitants of the development. This will contribute to the well-being and quality of life of these people.

A large infrastructure enhancement exercise, in order to service the proposed development, will have a positive influence on the surrounding properties and members of the local community. The demand for investment in infrastructure to eradicate backlog and create a platform for economic growth within South African and especially in this part of the City of Tshwane is much needed. Due to the current demand, the government and development finance institutions can only provide a portion of this development's housing requirements and it is therefore crucial that private sector investors and the public cooperate in funding efforts. The capital cost for the development will be essentially borne by the developer, while new housing opportunities are provided, additional civil services are provided and job creation is ensured, while economic growth is taking place.

One of the most positive influences of this development will be the number of employment opportunities that it will create. The construction phase will create temporary employment, while the operational phase of the residential-, retail-, security-, and municipal uses will create numerous permanent job opportunities.

8.1.6 The need for the proposed development is also recognised by the Municipality's approval of similar land use applications in the immediate vicinity. The proposed development is also consistent with approved land use policies (e.g. the RSDF, MSDF and IDP). The need for the proposed development is substantiated by the principles of the IDP, i.e. the infill of vacant land and the optimal use of existing infrastructure, as well as from current market forces.

8.2 Desirability

8.2.1 The development can be regarded as being desirable and will have several beneficial social and economic impacts on the area, which can be summarised as follow:

- Optimum utilisation of services and infrastructure.
- Increase in property values of surrounding properties.
- Increased security.
- Compatibility with surrounding land uses.
- Increased housing opportunities

The proposed mixed land use development will act as a catalyst for the sustainable development of the larger precinct, as identified in the RSDF for the region. Even though other developments are taking place in the area, this development will help the remaining inherent potential of the surrounding land to be unlocked.

8.2.2 The proposed development will contribute to the overall efficiency, sustainability and improved quality and liveability of the greater Tshwane metropolitan area, especially in the south western part. The following factors are important:

- Urban Form: Several areas around the application site are in the process of being developed. Other similar land-use applications are currently underway.

- Character of the Environment: The area in question is characterized by vacant and unused agricultural land in close vicinity to the application site. The agricultural use of the land in the area has diminished of the years as infrastructure, urban development and other factors such as crime changed the makeup of the area. Land-uses currently being considered by Council are mainly residential of nature. The proposed township to be known as Peach Tree Extension 23 will positively contribute to the existing character of the area.

- Influence to the Area: The proposed development will fit in with the existing and developing urban form and character of the area. It will uplift the area aesthetically and economically and might attract other potential developers to the area as well. Thus, in effect, in might have a very positive financial influence to the precinct. Furthermore, the proposed development is adjacent of other already developed and planned residential townships within the area. It will thus eliminate urban sprawling to some extent as well.

8.2.3 The application site can furthermore be regarded as strategically located due to its close proximity to existing residential (formal and informal) townships and it can therefore be argued that it addresses the spatial inequalities of the past through the provision of employment opportunities in close proximity to residences, with a variety of public transport systems being available to the public. The township will ensure employment opportunities for skilled, semi-skilled and unskilled employees during the construction and the operational phases, as discussed above.

The proposed development will have several beneficial social, economic and ecological impacts once the construction thereof is finalised, which can be summarised as follow:

- Reduce the potential dumping areas and informal settlements;
- Optimum utilisation of services and infrastructure;
- Expansion of municipal infrastructure and services;
- Increase in property values of surrounding properties;
- Increased security;
- Eradication of invasive species;
- Compatibility with surrounding land uses; and
- Landscaping could improve fauna numbers and species.

As mentioned above, the proposed development will include transportation facilities and will be easily accessible through public transport. The need for social and economic facilities in this area is identified in various planning policies and policy frameworks of the Municipality. The development will provide much needed residential and retail facilities as well as light industrial components for the area, and thus make a positive contribution with regards to social welfare.

8.2.4 Taking into account the characteristics of the area and the accessibility of the site, the proposed township could be regarded as desirable and strategically situated within a developing residential area. The proposed development will contribute positively to the improvement of the character of the area. As mentioned above, the accessibility of the proposed township from the R511, M34 (R114) and also the N14 Highway furthermore contributes to the development potential of the application site and surroundings.

8.2.5 The development proposal is also consistent with, and will promote, the land use policy guidelines of the Municipality.

8.3 Compliance with SPLUMA principles

8.3.1 With reference to Section 7.1.1 of this Memorandum, it is confirmed that the development proposal complies with the principles of the Spatial Planning and Land Use Management Act, 2013 (Act 16 of 2013).

8.4 Public interest in terms of Section 47(2) of the Spatial Planning and Land Use Management Act, 2013 (Act 16 of 2013)

8.4.1 The proposed development is in the public interest, as the land use rights is consistent with approved policy guidelines on national, provincial and local level.

8.4.2 The proposed development will provide a greater choice in retail and residential opportunities to the public.

8.5 Facts and circumstances of application in terms of Section 42 of the Spatial Planning and Land Use Management Act, 2013 (Act 16 of 2013)

8.5.1 Application is made in terms of Section 16(4) of the City of Tshwane Land Use Management By-Law (2016) for the establishment of a township on Portion 109 and Rem/331 of the farm Knopjeslaagte 385 JR, to be known as Peach Tree Extension 23.

8.5.2 The township will comprise of seven (7) erven zoned as follows:

- Seven (7) erven zoned "Industrial 2" for the main purposes of "Commercial Use" and "Light Industry", subject to certain conditions;

8.5.3 The proposed land use rights align with approved policy guidelines on national, provincial and local level.

8.6 Rights and obligations of affected parties in terms of Section 42 of the Spatial Planning and Land Use Management Act, 2013 (Act 16 of 2013)

8.6.1 The rights and obligations of affected parties will be taken into account in the following manner:

- The application will be advertised in the prescribed manner by the publications of notices in the Gauteng Provincial Gazette, Beeld and Citizen, by the simultaneous display of a notice on site and notification to adjacent property owners.

- The City Planning Department will circulate the application for comments from internal departments of the Municipality. Any concerns raised will have to be dealt with to the satisfaction of the relevant department.

- The applicant will circulate the application to relevant external departments/institutions for comment.

8.7 Impact on engineering services, social infrastructure and open space in terms of Sections 42 and 49 of the Spatial Planning and Land Use Management Act, 2013 (Act 16 of 2013)

8.7.1 The impact of the proposed development will be confirmed by the client's consulting engineers, the internal departments of the Municipality and relevant external departments/institutions who will be afforded an opportunity to comment on the application.

8.7.2 Any adverse impacts will be mitigated and addressed by suitable solutions, which may include service agreements and payment of bulk contributions to upgrade existing services infrastructure.

8.7.3 Engineering services have also been discussed in Section 5 and 6 of this memorandum. More detailed information is available in the relevant Annexures attached hereto.

8.8 Reply to objections

8.8.1 The applicant will reply to any valid objections to the application.

8.8.2 The advertisements will comply with the requirements of the relevant provincial legislation and as well as those in terms of the City of Tshwane Land Use Management By-Law (2016).

The rights of potential objectors and or interested parties will be brought to the attention of probable objectors and or interested parties in terms of the requirements of the City of Tshwane Land Use Management By-Law (2016).

9. CONCLUSION

9.1 Application is made in terms of Section 16(4) of the City of Tshwane Land Use Management By-Law (2016) for the establishment of a township on a part of Portion 109 and a part of the Remainder of Portion 331 of the farm Knopjeslaagte 385-JR, to be known as Peach Tree Extension 23.

9.3 Taking into account the contextual characteristics of the area, the accessibility of the application site and its location within close proximity to various public amenities, the proposed township for which there is a proven need could be regarded as strategically situated within a developing and sought-after area.

9.4 The application clearly indicates the land- use rights, scheme documents, diagrams, layout plans, need and desirability, co-ordinated harmonious development and all other relevant requirements in terms of provincial legislation.

9.5 We trust that Council will evaluate and consider the application on its merit.

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0105

LIST OF ANNEXURES

Appendix G2

Fauna and Flora Habitat Assessment

FAUNA HABITAT ASSESSMENT FOR PORTION 331, 109, 105 OF THE FARM KNOPJESLAAGTE 385-JR, CENTURION

Report Authors: CW Vermeulen; SE van Rooyen

Compiled by: Corné Niemandt

Reviewed: Reinier F. Terblanche (Pr.Sci.Nat, Reg. No. 400244/05)

April 2016

Landscape Architects &
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Review of

FAUNA HABITAT ASSESSMENT FOR PORTION 331, 109, 105 OF THE FARM KNOPJESLAAGTE 385-JR, CENTURION

Review: July 2016

Reviewer: Reinier F. Terblanche

(M.Sc, *Cum Laude*; Pr.Sci.Nat, Reg. No. 400244/05)

APPROACH OF REVIEWER TO ECOLOGICAL REVIEWS

Ecological studies and applied ecology comprise the consideration of a diversity of factors, even more so in South Africa with its exceptional high floral and faunal diversities, various soil types, geological formations and diversity of habitats in all its biomes. Therefore it would be easy to add onto or show gaps in any ecological impact assessment, rehabilitation actions or management plans stemming from ecological assessments. The approach followed here is to review the ecological study in a reasonable context and focus on the successful fulfilment of the aims of the study within the limits of cost and time.

ECOLOGICAL REVIEW: FAUNA HABITAT ASSESSMENT FOR PORTION 331, 109, 105 OF THE FARM KNOPJESLAAGTE 385-JR, CENTURION, APRIL 2016

Findings of the review

- The report contains details of the expertise of the persons who prepared the report and a declaration that the person who prepared the report is acting independently.
- The aims of the report are clear.
- The report provides references and descriptions of the principles and guidelines to be taken into account for fauna habitat assessment.
- Acceptable methods and limitations have been given in detail to reach the goal of the assessment.
- Relevant laws and guidelines have been mentioned and integrated.
- The report gives a clear assessment of the status fauna at the site and also added an extensive literature survey and existing knowledge survey.
- The recommendations and the conclusion are consistent with the aims of the report.
- It is to be commended that the report is economical and practical so that it adds value to the team effort of addressing the management and future of the habitats at the site.

Overall the report appears to be relevant, detailed enough for the purposes of this study and complete and finally addressing the key issues at stake.

Reinier F. Terblanche M.Sc. Ecology; Pr.Sci.Nat, Reg. No. 400244/05

Specialists

Specialist investigators: Mr. S.E. van Rooyen (M.Sc. Restoration Ecology and Botany candidate); CW Vermeulen (B.Sc. Biological and Environmental Sciences); Mr. Corné Niemandt (M.Sc. Plant Science; B.Sc. Honours Zoology)

Declaration of independence:

The specialist investigators responsible for conducting this particular specialist vegetation study declare that:

• We consider ourselves bound to the rules and ethics of the South African Council for Natural Scientific Professions (SACNASP);

• At the time of conducting the study and compiling this report we did not have any interest, hidden or otherwise, in the proposed development, except for financial compensation for work done in a professional capacity;

• Work performed for this study was done in an objective manner. Even if this study results in views and findings that are not favourable to the client/applicant, we will not be affected in any manner by the outcome of any environmental process of which this report may form a part;

• We declare that there are no circumstances that may compromise our objectivity in performing this specialist investigation. We do not necessarily object to or endorse the proposed development, but aim to present facts, findings and recommendations based on relevant professional experience and scientific data;

• We do not have any influence over decisions made by the governing authorities;

• We have the necessary qualifications and guidance from professional experts (registered Pr. Nat. Sci.) in conducting specialist reports relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;

• This document and all information contained herein is and will remain the intellectual property of Bokamoso Environmental: Specialist Division. This document, in its entirety or any portion thereof, may not be altered in any manner or form, for any purpose without the specific and written consent of the specialist investigators.

• We will comply with the Act, regulations and all other applicable legislation;

S.E. van Rooyen

CW Vermeulen

Corné Niemandt

Table of Contents

FIGURES:

1. INTRODUCTION

Bokamoso Environmental Consultants CC; Specialist Division was appointed to conduct a Basic Faunal Habitat Assessment for the proposed mixed use development on Portion 331, 109, 105 of the farm Knopjeslaagte 385-JR, Centurion, also known as Peach Tree Extensions.

This report is based on the faunal species present on the study area as well as species that could potentially occur. The report acts as an overview of the probable and/or known occurrence of following faunal groups; Mammals, Reptiles, Amphibians, Birds and Invertebrates.

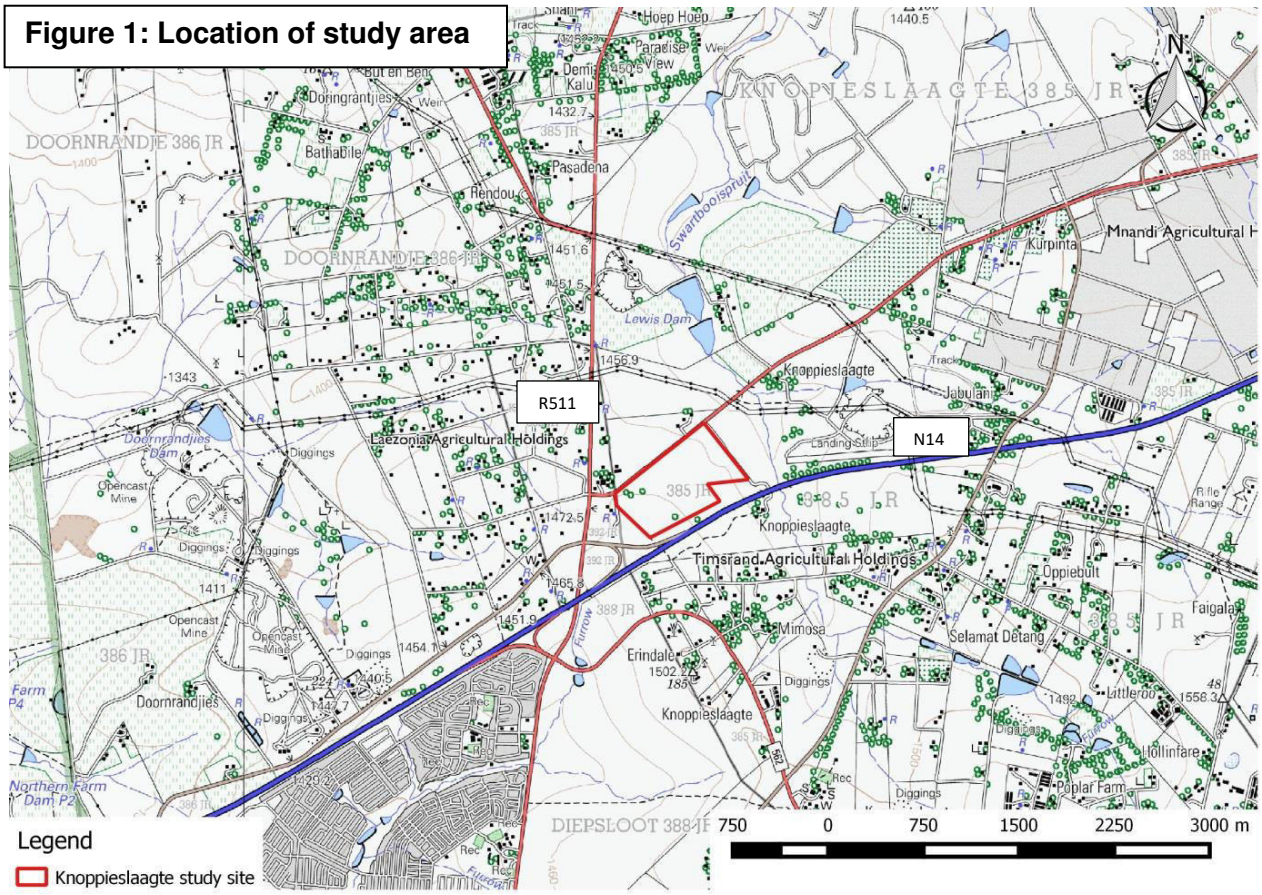
2. SCOPE AND OBJECTIVE OF ASSESSMENT

- To qualitatively and quantitatively assess the significance of the habitat components and current general conservation status of the property
- Comment on ecological sensitive areas within the study area
- Comment on connectivity with natural vegetation and homogeneous habitats surrounding the study area
- To provide a list of faunal species which occur or might occur, and to identify species of conservation importance
- To highlight potential impacts of the proposed development on the fauna judge to be present on the study site, and
- To provide management recommendations to mitigate negative and enhance positive impacts should the proposed development be approved.

3. STUDY AREA

The study area is situated in Centurion, Gauteng, on portion 331, 109, 105 of the farm Knopjeslaagte 385-JR. The study area is situated east of the R115 Road and north of the N14, adjacent to the Centurion Flight Academy (Pty) Ltd (**Figure 1**). The study site is about 45 ha in size, is located 1469 meters above sea level and is located in the quarter degree square (QDS) 2528CC. The study area is homogenous with regards to vegetation and falls in the Egoli Granite Grassland, declared as Endangered (Government Gazette no. 34809, 2011).

Figure 1: Location of study area



4. METHODS

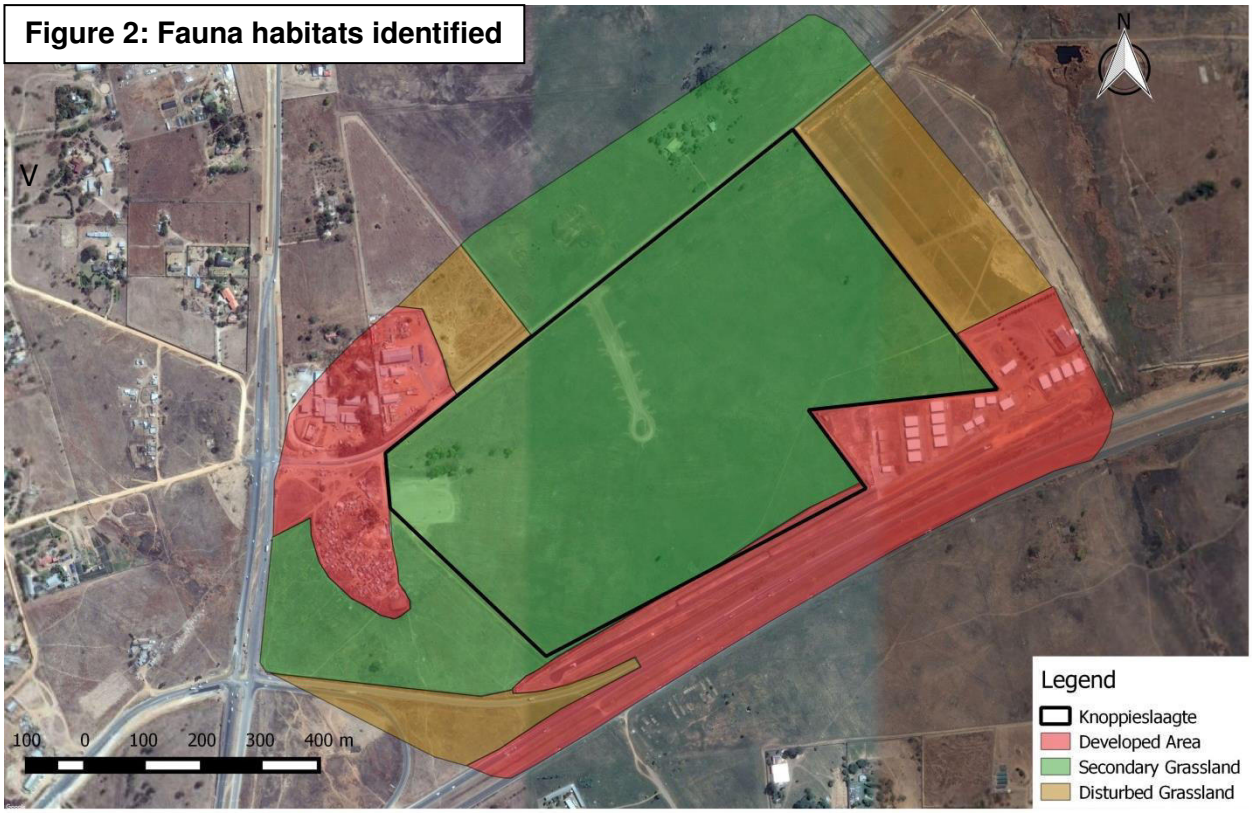
Before conducting a field survey a desktop assessment was conducted to note the prevalent faunal species occurring on or near the study area. A list of expected species was compiled and used as a reference during the field survey to ensure that faunal species that should theoretically occur were not overlooked. All distinct faunal habitats were identified on site, after which each habitat was assessed to record the associated faunal species for each of the

respective faunal group (Mammals, Herpetofauna, Invertebrates and Avifauna) present in that specific habitat.

5. RESULTS

One faunal habitat type was identified in the study area, namely a Secondary Grassland (**Figure 2**).

Figure 2: Fauna habitats identified



5.1 Secondary Grassland

This study unit contains various anthropogenic disturbances in the form of footpaths, littering, mowing of grass and alien vegetation encroachment in the eastern corner. Adjacent to the study site is an Airport, which creates noise disturbances. The majority of the study area is dominated by graminoid species such as *Eragrostis* spp., *Schizachyrium sanguineum*, *Heteropogon contortus, Andropogon* spp., *Aristida* spp. and *Hyparrhenia hirta.* Encroachment of *Seriphium plumosum* is also observed. Fairly high floristic species richness appears to remain which apparently enhances the favourability of this habitat for several fauna species (**Figure 3**).

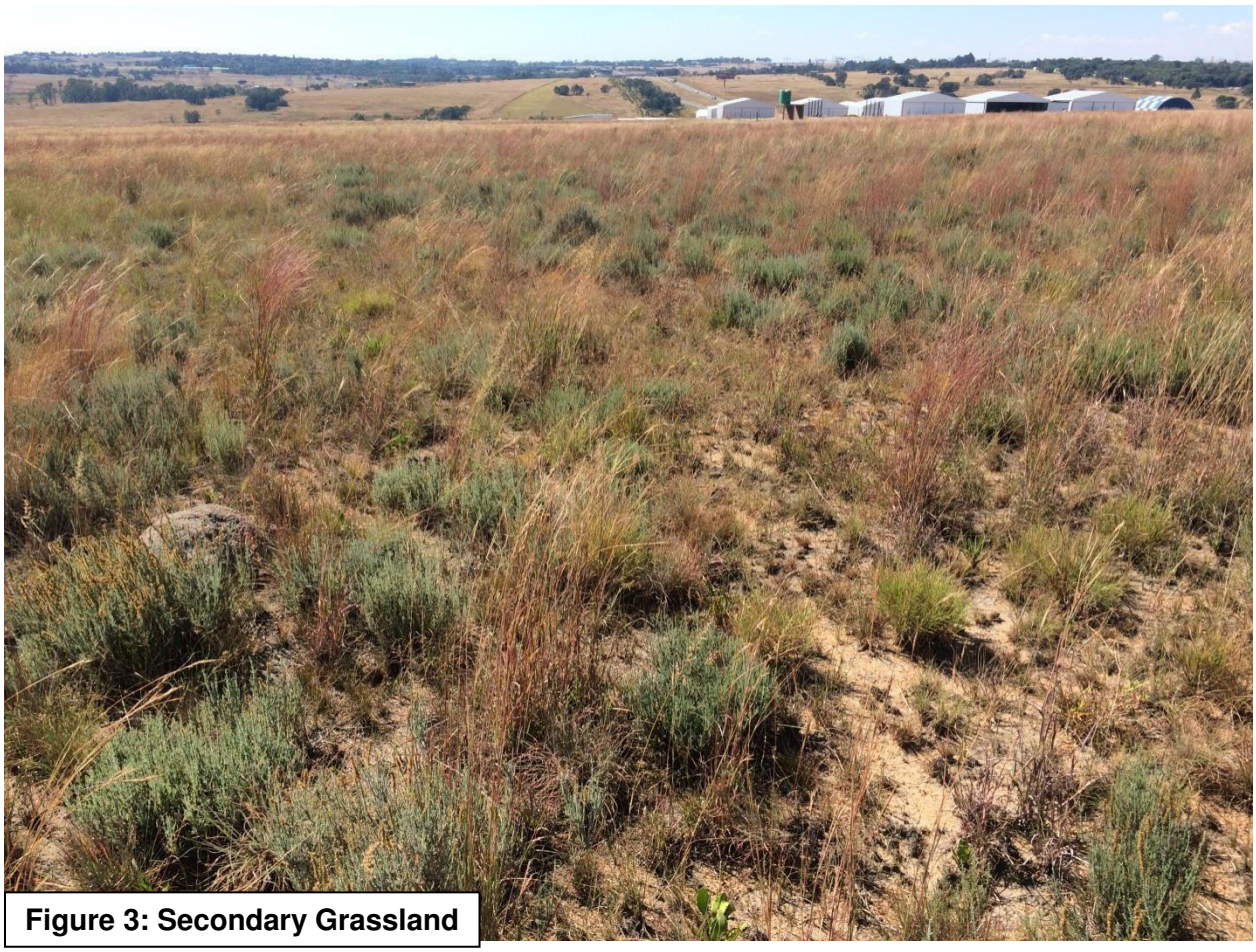


Figure 3: Secondary Grassland

6. MAMMAL HABITAT ASSESSMENT

This part of the report focuses on the probable and/or known occurrence of Threatened and Near Threatened mammal species as well as mammal species with conservation concern based on the habitats present on the study area.

Special attention was paid to the evaluation of the quantitative and qualitative habitat conditions of Threatened and near Threatened mammal species judged to have a probable occurrence in the study area. Mitigation measures to lesser the impacts and effects of the proposed development were suggested where applicable. The secondary objective of this investigation was to gauge which mammals might still reside in the study area and to compile a complete list of mammal diversity.

6.1 Methods

A three hour field survey was conducted on the 20th of April 2016, during which all observed mammal species as well as all the potential mammal habitats on the study area was identified. Following the field survey a desktop assessment was conducted to add additional mammal species expected to occur in the study area on account of their individual habitat preferences in accordance with the habitats identified on the study area. Mammal occurrence probability can be attributed to the well recorded and known distributions of South African mammals as well as the quantitative and qualitative nature of the habitats present on site. Moreover the 500 meters surrounding the study area was scanned for any additional mammal habitats.

Field Survey

Before the commencement of the field survey a list of expected mammal species was compiled to use as a reference in the field. All the Threatened and Near Threatened mammals with distribution ranges overlapping the study area were included in the aforementioned reference list. These species were prioritized and special attention was paid in terms of identifying their associated habitat preferences and noting signs of their occurrence. The field survey was conducted by means of random transect walks in each habitat. During the field survey mammal species were identified in accordance with individual habitat preferences as well as actual observations and signs such as spoor, droppings, burrows and roosting sites indicating their presence (Stuart & Stuart, 2011).

Desktop Survey

On account of the fact that the majority of mammals are nocturnal, hibernating, secretive and/or seasonal it is increasingly difficult to confirm their presence or absence by means of actual observations alone. Therefore a number of authoritative tomes such as field guides, databases and scientific literature were utilized to deduce the probable occurrence of mammal species. The Animal Demography Unit: Virtual Museum (http://vmus.adu.org.za/) was consulted to verify the records and occurrence of recorded mammal species in the 2528CCQDS. The Gauteng Conservation Plan (C-plan v3.3) was consulted to evaluate ecologically sensitive areas associated with mammals. A comprehensive list of probable mammalian occurrence with reference to the study area was compiled on account of the well-known and documented distributions of mammals in South Africa, especially in the Gauteng province.

The occurrence probability of mammal species was deduced in accordance with a species' distribution and habitat preferences. Where a species' distribution range was found to overlap with the study area and its preferred habitat was present, the applicable species was deemed to have a high occurrence probability on or near the study area.

In the case were the preferred habitat of a species' were found to be suboptimal on the study area, however its distribution range still overlapped the study area, the applicable species' occurrence probability was deemed to be medium.

When the habitat preferences of a species were absent from the site, the applicable species was deemed to have a low occurrence probability regardless of its distribution range.

6.2 Specific Requirements

During the field survey attention was paid to note any signs of potential occurrence of Threatened and/or Near Threatened species.

These species include:

Southern African hedgehog (*Atelerix frontalis*), Woodland Dormouse (*Graphiurus murinus*), White-tailed rat (*Mystromys albicaudatus*), and several bat species including Blasius's/Peak-Saddle Horseshoe Bat (*Rhinolophus blasii*), Darling's Horseshoe Bat (*Rhinolophus darlingi*), Geffroy's Horseshoe Bat (*Rhinolophus clivosus*), Hildebrandt's Horseshoe Bat (*Rhinolophus*

hildebrandtii), Scheiber's Long-Fingered Bat (*Miniopterus schreibersii*) and Temminck's Hairy Bat (*Myotis tricolo*).

Mammal species listed according to IUCN as Near Threatened: Southern African Hedgehog (*Atelerix frontalis*), Schreiber's Long-Fingered Bat (*Miniopterus schreibersii*), Temminck's Hairy Bat (*Myotis tricolor*), Horseshoe Bat (*Rhinolophus clivosus*), Darling's Horseshoe Bat (*Rhinolophus darling*) and Hildebrandt's Horseshoe Bat (*Rhinolophus hildebrandtii*).

6.3 Results

6.3.1 Mammal habitats identified

During the habitat assessment only one distinct mammalian habitat was identified in the study area, namely Secondary Grassland (**Figure 2**).

The Secondary Grassland provides excellent habitat for smaller rodents and insectivorous mammals such as shrews, Slender Mongoose (*Galerella sanguineus),* Marsh Mongoose (*Atilax paludinosus),* Scrub Hare (*Lepus saxatilis),* Four-striped grass mouse (*Rhabdomys pumilio)* and house cats and dogs. The Grassland habitat is degraded as it regularly experience disturbances such as grass cutting and trampling and illegal dumping. The isolated nature of this habitat decreases the occurrence probability of locating robust terrestrial mammals such as Common Duiker (*Sylvicapra grimmia)* or Steenbok (*Raphicerus campestris).* The occurrence probability of nomadic mammal species such as the African Hedgehog is highly unlikely on account of the degraded and isolated status of this Grassland habitat.

On account of the current status of both the habitats identified in the study area, the ecological status is deemed to be low sensitive (**Figure 5**).

6.3.2 Expected and observed Mammal species

Table 1: Mammal species observed or expected to occur.

	Scientific Name	**Common Name**	**Red List Category**	**Occurrence Probability**
1.	*Aethomys*	Veld rats	Not listed	4
2.	*Atelerix frontalis*	Southern African Hedgehog	Near Threatened	1
3.	*Canis mesomelas*	Black-backed Jackal	Least Concern	3

4.	*Crocidura hirta*	Lesser Red Musk Shrew	Data Deficient	3
5.	*Crocidura silacea*	Lesser Gray-brown Musk Shrew	Data Deficient	3
6.	*Cryptomys hottentotus*	Southern African Mole-rat	Least Concern	3
7.	*Cynictis*	Yellow Mongoose	Not listed	4
8.	*Dendromus mystacalis*	Chestnut African Climbing Mouse	Least Concern	3
9.	*Epomophorus wahlbergi*	Epomophorus wahlbergi	Least Concern	1
10.	*Felis catus*	Domestic Cat	Introduced	4
11.	*Genetta maculata*	Common Large-spotted Genet (Rusty-spotted Genet)	Least Concern	3
12.	*Genetta genetta*	Common Genet	Least Concern	3
13.	*Genetta tigrina*	Cape Genet	Least Concern	3
14.	*Graphiurus murinus*	Forest African Dormouse	Least Concern	3
15.	*Hystrix africaeaustralis*	Cape Porcupine	Least Concern	2
16.	*Leptailurus serval*	Serval	Near Threatened	3
17.	*Lepus saxatilis*	Scrub Hare	Least Concern	5
18.	*Mastomys coucha*	Southern African Mastomys	Least Concern	4
19.	*Neoromicia capensis*	Cape Serotine	Least Concern	3
20.	*Rattus*	Genus Rattus	Not listed	5
21.	*Rattus rattus*	Roof Rat	Least Concern	4
22.	*Rhabdomys pumilio*	Xeric Four-striped Grass Rat	Least Concern	5
23.	*Scotophilus dinganii*	Yellow-bellied House Bat	Least Concern	4
24.	*Tatera*		Not listed	2

*The occurrence probability of the mammal species listed below are indicated as follows:
Not likely to occur - 1, Low occurrence probability - 2, Medium occurrence probability - 3, High occurrence probability – 4, Confirmed occurrence – 5.
Red Data species ranked as defined in Friedmann and Daly's S.A. Red Data Book of the mammals of South Africa.

6. 3.3 Threatened and Red Listed Mammal species

The listed shrews (**Table 1**) are not necessarily threatened; they are listed as a precautionary measure as a result of their unknown status. Musk shrews are widespread and commonly found in residential gardens throughout Gauteng, as such they are generally assumed to be abundant. The conservation status of musk shrews are however still to be determined and as such they are listed as Data Deficient.

Suitable habitat for the Serval (*Leptailurus serval*) was observed in the Secondary Grassland, as this habitat is approx. 500m away from a dam, connected to a water course. This particular species prefer wetlands and grasslands close to water. The Secondary Grassland habitat is

also favourable habitat for the Southern African hedgehog (*Atelerix frontalis*), as it prefer grassland areas. The probability for these species occurring there is unlikely, on account of the continuous human disturbances affecting this habitat. The habitat units discussed in this report is also subjected to isolation from nearby natural habitat units, which limits movement for any fauna species listed in **Table 1**.

6.4 Findings

The terrestrial habitat on the study area experience anthropogenic disturbances, which decreases the probability occurrence of both the Serval (*Leptailurus serval*) and Southern African hedgehog (*Atelerix frontalis*). It is therefore not expected that any threatened mammal species occur in the study area. Furthermore, isolation from similar natural habitats could influence the small mammals likely to occur in the study area, as genetic variation amongst species could be reduced. Based on the findings of this report the study area is deemed to have a moderate ecological sensitivity from a mammalian point of view.

7. HERPETOFAUNA HABITAT ASESSMENT

7.1 Methods

Habitat types identified in the study area was recorded, and a combined species list was compiled for the possible presence of herpetofauna species, considering the knowledge of their preferred habitats. Field guides such as those of du Preez & Carruthers (2009), Marais (2004), and (Alexander & Marais 2007) were used for identification and habitat description of herpetofauna species.

A desktop study was conducted to identify suitable habitats for the threatened herpetofauna species known to occur in the QDS 2528CC. The Animal Demography Unit: Virtual Museum (http://vmus.adu.org.za/) was consulted to verify the occurrence of herpetofauna species previously recorded within the QDS 2528CC. The Gauteng Conservation Plan (C-plan v3.3) was consulted to evaluate ecologically sensitive areas.

The majority of herpetofauna species are nocturnal, poikilothermic secretive and seasonal, which makes it difficult to observe them during field surveys. In this case the presence of

herpetofauna species was examined on habitat preferred by selected species and respective documented ranges.

7.2 Specific Requirements

Adequate amount of random transect walks in the study site was attempted to identify herpetofauna and invertebrate species. Emphasis on specific Red List species that might occur on the study site:

- Striped Harlequin Snake (*Homoroselaps dorsalis*)

7.3 Results

7.3.1 Herpetofauna habitats identified

The Secondary Grassland provides no conspicuous standing or flowing water bodies in the study area which decreases the niche preference for amphibian species (Du preez & Carruthers, 2009). Also, no medium or large sized rocks were observed which decreases the probability of finding reptile species in this habitat (**Table 2 and 3**). Termite mounds are absent from study area, which lessens the probability of finding reptiles, particularly the Striped Harlequin Snake (*Homoroselaps dorsalis*). The Secondary Grassland habitat does however provide a suitable habitat for some *Agama* species as well as nomadic reptile species.

7.3.2 Expected and observed Herpetofauna species

No amphibians or reptiles were observed during the survey. Five amphibian species and 30 reptile species have been recorded and are expected to occur in the QDS 2528CC (**Tables 2 & 3**).

Table 2: **Amphibian** species deducted to occur.

	Scientific Name	**Common Name**	**Red List Category**	**Occurrence Probability**
1.	*Schismaderma carens*	Red Toad	Least Concern	4
2.	*Sclerophrys capensis*	Raucous Toad	Least Concern	3
3	*Sclerophrys gutturalis*	Guttural Toad	Least Concern	4
4.	*Tomopterna cryptotis*	Tremelo Sand Frog	Least Concern	2
5.	*Tomopterna natalensis*	Natal Sand Frog	Least Concern	2

*The occurrence probability of the amphibian species listed below are indicated as follows:
Not likely to occur - 1, Low occurrence probability - 2, Medium occurrence probability - 3, High occurrence probability – 4, Confirmed occurrence – 5.

Table 3: **Reptile** species observed and/or deducted to occur.

#	***Scientific Name***	**Common Name**	**Red List Category**	**Occurrence Probability**
1.	*Agama aculeata distanti*	Distant's Ground Agama	Least Concern	3
2.	*Afrotyphlops bibronii*	Bibron's Blind Snake	Least Concern	2
3.	*Agama atra*	Southern Rock Agama	Least Concern	1
4.	*Aparallactus capensis*	Black-headed Centipede-eater	Least Concern	2
5.	*Atractaspis bibronii*	Bibron's Stiletto Snake	Least Concern	1
6.	*Boaedon capensis*	Brown House Snake	Least Concern	4
7.	*Causus rhombeatus*	Rhombic Night Adder	Least Concern	4
8.	*Cordylus vittifer*	Common Girdled Lizard	Least Concern	2
9.	*Crotaphopeltis hotamboeia*	Red-lipped Snake	Least Concern	4
10.	*Dasypeltis scabra*	Rhombic Egg-eater	Least Concern	4
11.	*Gerrhosaurus flavigularis*	Yellow-throated Plated Lizard	Least Concern	3
12.	*Hemachatus haemachatus*	Rinkhals	Least Concern	4
13.	*Hemidactylus mabouia*	Common Tropical House Gecko	Least Concern	2
14.	*Homoroselaps dorsalis*	Striped Harlequin Snake	Near Threatened	1
15.	*Homoroselaps lacteus*	Spotted Harlequin Snake	Least Concern	1
16.	*Lamprophis aurora*	Aurora House Snake	Least Concern	4
17.	*Leptotyphlops scutifrons conjunctus*	Eastern Thread Snake	Not listed	1
18.	*Lycodonomorphus inornatus*	Olive House Snake	Least Concern	2
19.	*Lycophidion capense capense*	Cape Wolf Snake	Least Concern	1
20.	*Lygodactylus capensis capensis*	Common Dwarf Gecko	Least Concern	4
21.	*Naja annulifera*	Snouted Cobra	Least Concern	2
22.	*Pachydactylus affinis*	Transvaal Gecko	Least Concern	4
23.	*Pachydactylus capensis*	Cape Gecko	Least Concern	3
24.	*Panaspis wahlbergii*	Wahlberg's Snake-eyed Skink	Least Concern	1
25.	*Prosymna sundevallii*	Sundevall's Shovel-snout	Least Concern	1
26.	*Psammophis brevirostris*	Short-snouted Grass Snake	Least Concern	3
27.	*Psammophylax rhombeatus rhombeatus*	Spotted Grass Snake	Least Concern	4
28.	*Pseudaspis cana*	Mole Snake	Least Concern	4

29.	*Rhinotyphlops lalandei*	Delalande's Beaked Blind Snake	Least Concern	3
30.	*Trachylepis capensis*	Cape Skink	Least Concern	3

*The occurrence probability of the reptile species listed below are indicated as follows:
Not likely to occur - 1, Low occurrence probability - 2, Medium occurrence probability - 3, High occurrence probability – 4, Confirmed occurrence – 5.

7.3.3 Threatened and Red Listed Herpetofauna species

No threatened species are expected to occur in the study area. No suitable habitat for the Striped Harlequin Snake (*Homoroselaps dorsalis*) was found to be present in the study area. It is highly unlikely for this particular species to occur in or around the study area as multiple disturbances and sub-optimal habitat was observed.

7.4 Findings

It seems that the largest part of the grassland habitat on the study area was utilized for agricultural activities in the form of agricultural lands in the past. Other disturbances, mostly anthropogenic, within the secondary grassland include vegetation harvesting, illegal dumping, and spreading of alien invasive species. Consequently, owing to the disturbed nature of the habitat it seems unlikely to be suitable for threatened and near threatened herpetofauna, including the Striped Harlequin Snake (*Homoroselaps dorsalis*) was observed during the field survey.

8. AVIFAUNA HABITAT ASSESSMENT

8.1 Methods

A field survey was conducted on the 20th of April 2016. A total of 3 hours was spent on the study area whilst conducting the field survey. Before conducting the field survey, a desktop assessment was conducted to document the prevalent avifaunal species occurring on or near the study area. A list of expected species was compiled and used as a reference guide during the field survey to ensure that bird species that should theoretically occur within the study area were not overlooked. All discrete avifaunal habitats were identified on site, after which each habitat was assessed to document the associated avifaunal composition by means of random

transect walks. Species were identified by actual sightings, calls as well as signs of presence in the form of eggshells, nests, droppings and feathers (Stuart & Stuart, 2000). Where necessary, species were verified using Sasol Birds of Southern Africa (Sinclair *et al.*, 2011).

By consulting the Southern Africa Bird Atlas Project 1 and 2 (SABAP2), a comprehensive species list could be compiled for the 2528CC QDS and the 2550_2800 pentad. SABAP2 is the follow-up project to the Southern African Bird Atlas Project (referred to as SABAP1). SABAP1 took place from 1987-1991. The second bird atlas project started on 1 July 2007 and plans to run indefinitely. The project aims to map the distribution and relative abundance of birds in Southern Africa. The field work for this project is done by more than one thousand nine hundred volunteers, known as citizen scientists. The unit of data collection is the pentad, five minutes of latitude by five minutes of longitude, squares with sides of roughly 9 km (SABAP2).

The species list for the QDS can however not be used as an accurate list in terms of the species actually occurring within the study area since it covers a larger area, as well as a larger variety of habitat types. In order to compile an accurate species list for the study area, all the species previously recorded in the 2528CC QDS were considered, and added or eliminated based on the habitat types present on the study area as well as the habitat preferences of individual species.

8.2 Specific Requirements in terms of Red Data Avifaunal species

According to the Gauteng Department of Agriculture and Rural Development's (GDARD) requirements for Biodiversity Assessments, Version 3.3 (March 2014), as well as for any other Red Data species: Eleven threatened and near threatened bird species were prioritized for inclusion into the Gauteng C-Plan based on:

1. Threat status (2 Endangered **(EN),** 5 Vulnerable (**VU**) and 4 Near Threatened (**NT**)).
2. Whether the species was actually present, on a frequent basis, in the province. Vagrants, erratic visitors or erratic migrants to the province (Tarboton *et al.*, 1987) have been excluded from the conservation plan.
3. Whether the threat was due to issues related to land use planning. Species which are impacted on mostly by threats such as poisoning were excluded.

Important Threatened and Near Threatened Bird species regional conservation status (only those favoring grassland habitats) (Taylor *et al.*, 2015):

- Blue Crane (*Anthropoides paradiseus*) **NT**
- African Marsh-Harrier (*Circus ranivorus*) **EN**
- White-bellied Korhaan (*Eupodotis senegalensis)* **VU**
- Secretarybird (*Sagittarius serpentarius*) **VU**
- African Grass-Owl (*Tyto capensis*) **VU**
- Abdims Stork (*Ciconia abdimii)* **NT**
- Verreauxs Eagle (*Aquila verreauxii)* **VU**

8.3 Avifaunal Habitats identified

One avifaunal habitat namely Secondary Grassland was identified within the study area. The Secondary Grassland habitat contains mostly grass and forb vegetation and is dominated by *Eragrostis* spp. *and Hyparrhenia hirta*. Secondary Grassland habitat generally has a low to medium avifaunal species richness as a result of the highly specialised environment. A number of widespread bird species such as Bishops and Widowbirds (*Euplectes* sp.), Sparrows (*Passer* sp.), Doves (*Steptopelia* sp.*),* Lapwings (*Vanellus* sp.*),* Swallows (Hirundo sp.) and Cisticolas (*Cisticola* sp.) were present within the grassland habitat. Connectivity with surrounding homogenous habitats was found to be low as a result of various developments, including residential, agricultural and industrial, in the surrounding area. A number of disturbances such as grass harvesting, unpaved roads and tracks, trampling, illegal rubble dumping and alien vegetation encroachment were also noted within this habitat unit. The study area is situated directly adjacent to an airfield to the east and a provincial road to the south. Both the road and the airfield is a source of noise pollution which negatively impacts avifauna within and around the study area.

Due to the on-going disturbances within the secondary grassland habitat unit and because the habitat is isolated from homogeneous grasslands, the sustainability in terms of the continual well-being and persistence of this grassland habitat is unlikely. On account of the aforementioned low connectivity and other disturbances including noise pollution from the adjacent airfield and provincial road, the study area provides sub-optimal habitat for threatened and near threatened bird species and was identified with a moderate avifaunal sensitivity.

Table 3: Bird species recorded during the field survey:

	Common English name	Taxonomic name
1.	Bishop, Southern Red	*Euplectes orix*
2.	Canary, Black-throated	*Crithagra atrogularis*
3.	Cisticola, Desert	*Cisticola aridulus*
4.	Cisticola, Zitting	*Cisticola juncidis*
5.	Crow, Pied	*Corvus albus*
6.	Dove, Laughing	*Streptopelia senegalensis*
7.	Dove, Red-eyed	*Streptopelia semitorquata*
8.	Egret, Western Cattle	*Bubulcus ibis*
9.	Fiscal, Southern	*Lanius collaris*
10.	Francolin, Orange River	*Scleroptila levaillantoides*
11.	Guineafowl, Helmeted	*Numida meleagris*
12.	Ibis, African Sacred	*Threskiornis aethiopicus*
13.	Ibis, Hadida	*Bostrychia hagedash*
14.	Kite, Black-shouldered	*Elanus caeruleus*
15.	Lark, Rufous-naped	*Mirafra africana*
16.	Longclaw, Cape	*Macronyx capensis*
17.	Masked-weaver, Southern	*Ploceus velatus*
18.	Myna, Common	*Acridotheres tristis*
19.	Palm-swift, African	*Cypsiurus parvus*
20.	Pipit, African	*Anthus cinnamomeus*
21.	Prinia, Tawny-flanked	*Prinia subflava*
22.	Quail, Common	*Coturnix coturnix*
23.	Quailfinch, African	*Ortygospiza atricollis*
24.	Stonechat, African	*Saxicola torquatus*
25.	Swallow, Greater-striped	*Hirundo cucullata*
26.	Swift, Little	*Apus affinis*
27.	Swift, White-rumped	*Apus caffer*
28.	Turtle-dove, Cape	*Streptopelia capicola*
29.	Waxbill, common	*Estrilda astrild*
30.	Whydah, Pin-tailed	*Vidua macroura*
31.	Widowbird, Long-tailed	*Euplectes progne*

The study area was found to hold a low avifaunal species richness and density. The various disturbances identified within the grassland habitat as well as its close proximity to the provincial road and airfield can be held accountable for the low avifaunal species richness and species density.

8.3.1 Threatened and Near Threatened bird species:

Table 4: Threatened and near threatened bird species previously recorded within the 2528CC QDS.

	Species name	Latest Date Record (Year)	Red Data: (Regional; Global)	Taxonomic name	Rep Rate (%)	Occurrence Probability
1.	Crane, Blue	**Prior to 2007**	**NT, VU**	*Anthropoides paradiseus*	1.6	0
2.	Duck, Maccoa	**Prior to 2007**	**NT, NT**	*Oxyura maccoa*	0.06	0
3.	Eagle, Martial	**Prior to 2007**	**EN, VU**	*Polemaetus bellicosus*	0.16	0
4.	Eagle, Verreauxs'	**Prior to 2007**	**VU, LC**	*Aquila verreauxii*	1.275	0
5.	Falcon, Lanner	**2010**	**VU, LC**	*Falco biarmicus*	2.44	0
6.	Falcon, Red-footed	**Prior to 2007**	**NT, NT**	*Falco vespertinus*	0.08	0
7.	Finfoot, African	**Prior to 2007**	**VU, LC**	*Podica senegalensis*	0.08	0
8.	Grass-owl, African	**2012**	**VU, LC**	*Tyto capensis*	2.06	0
9.	Kingfisher, Half-collared	**Prior to 2007**	**NT, LC**	*Alcedo semitorquata*	0.32	0
10.	Korhaan, White-bellied	**2016**	**VU, LC**	*Eupodotis senegalensis*	1.97	2
11.	Marsh-harrier, African	**Prior to 2007**	**EN, LC**	*Circus ranivorus*	0.16	0
12.	Roller, European	**2012**	**NT, LC**	*Coracias garrulus*	1.11	0
13.	Stork, Abdim's	**2012**	**NT, LC**	*Ciconia abdimii*	3.58	0
14.	Stork, Black	**Prior to 2007**	**VU, LC**	*Ciconia nigra*	0.16	0
15.	Stork, Yellow-billed	**Prior to 2007**	**EN, LC**	*Leptoptilos crumeniferus*	0.08	0
16.	Vulture, Cape	**Prior to 2007**	**EN, EN**	*Gyps coprotheres*	0.16	0

A total of 16 threatened and near threatened bird species have previously been recorded within the 2528CC QDS (**Table 4**). Eleven (11) of which have not yet been recorded within the 2550_2800 pentad since the commencement of the second South African Bird Atlas Project (SABAP2) in 2007. Therefore these species are highly unlikely to recur as they have not been recorded in the pentad in the past 9 years. Three of the above listed species have been recorded within the pentad within the past 4 years. They are: African Grass-owl, European Roller, Abdims Stork and White-bellied Korhaan. Only one of these species has been recorded within the pentad during 2016, namely the White-bellied Korhaan. With the exception of White-bellied Korhaan, all the species listed in Table 2 are highly unlikely to be resident on or near the study area since they are predominantly recorded as vagrants and/or occasional visitors. In addition, most of these species were recorded in habitats not present within the study area, although present within the larger quarter degree square. On account of the habitats present

within the study area, none of the species listed above, with the exception of White-bellied Korhaan are likely to occur or be resident within the study area.

White-bellied Korhaan (*Eupodotis senegalensis)* Occurrence Probability:

The secondary grassland habitat unit was found to hold suitable foraging and breeding habitat for the regionally Vulnerable White-bellied Korhaan (*Eupodotis senegalensis*). As a result of this observation a thorough habitat assessment was conducted with the aim of mapping out optimal breeding and foraging habitat for this species in and around the study area to determine if the study area could sufficiently support a breeding pair of White-bellied Korkaan in the long term.

Firstly the optimal breeding habitat for White-bellied Korhaan was identified and mapped. Thereafter all suitable foraging habitat on and around the study area was identified and mapped. The surface areas for each of the abovementioned areas were calculated with the purpose of determining the total surface area accounting for suitable and sustainable breeding and foraging habitat as required by the White-bellied Korhaan within and around the study area (**Figure 4**).

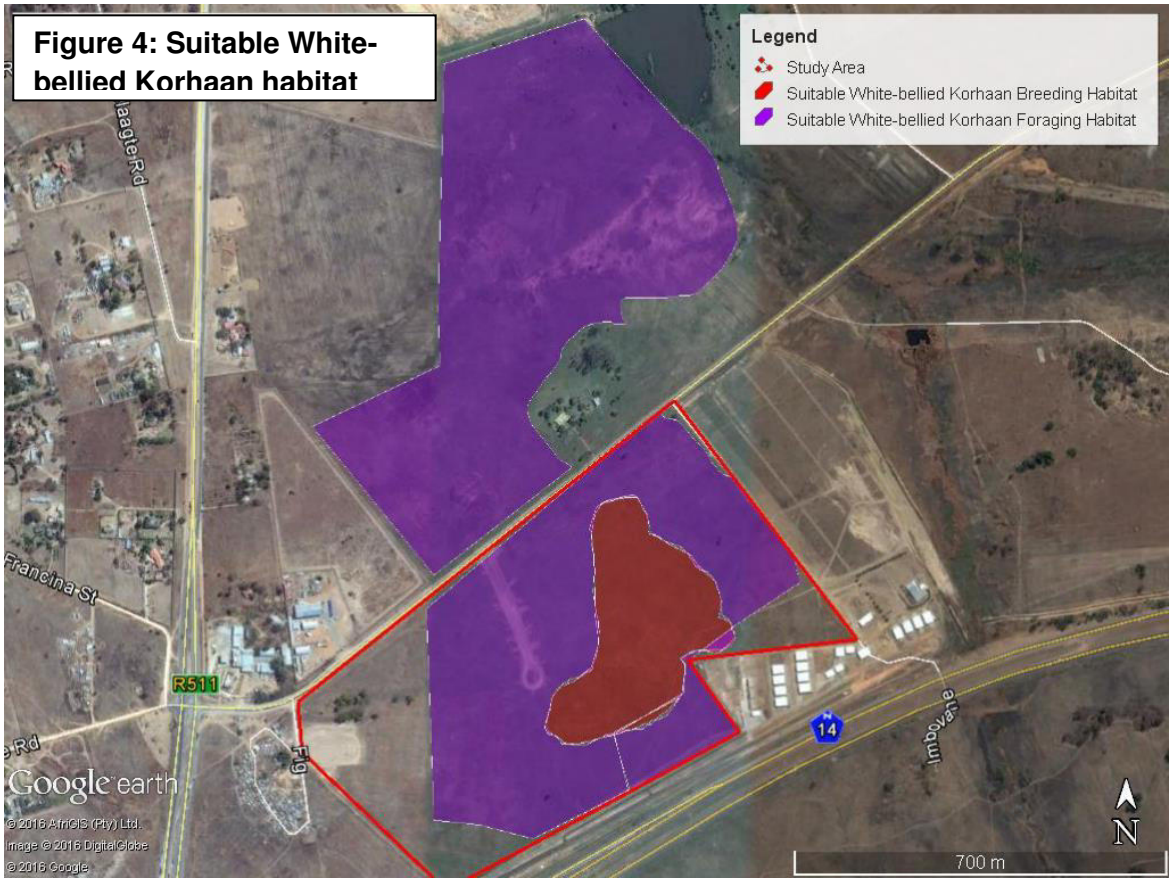


Figure 4: Suitable White-bellied Korhaan habitat

As per the Gauteng Conservation Plan Version 3.3 (GDARD, 2014) the following habitat requirements were set out for the White-bellied Korhaan (*Eupodotis senegalensis*):

This species is internationally listed as Least Concern and is locally seen to be Vulnerable (Ekstrom & Butchart, 2004; Barnes, 2000). The White-bellied Korhaan occurs in grassland and open woodland (Tarboton et al., 1987). Habitat was modelled as un-fragmented suitable habitat associated with clusters of confirmed White-bellied Korhaan records. All unsuitable habitat including agricultural holdings, actively cultivated fields, and fragments of suitable habitat <100 ha were excluded. For Vulnerable species listed under the IUCN Red List Criteria of B, C or D; Pfab and colleagues (2011) recommend that all populations must be conserved *in situ*. Gauteng's proportional contribution to the national target would be 120 breeding pairs. Estimates based on species forage requirements and densities suggest a requirement of 120 ha per pair.

Table 5. The surface areas of the White-bellied Korhaan habitat survey are as follows:

White-bellied Korhaan (*Eupodotis senegalensis*) habitat survey	
Identified Area	**Surface Area (hectares)**
Suitable breeding habitat	8.56 ha
Suitable foraging habitat	80 ha
Total suitable Grass-owl habitat	88.56 ha
Suitable habitat required as per Gauteng C-Plan V 3.3	120 ha

The result of the White-bellied Korhaan habitat survey indicates that the surface area of available suitable habitat within and directly surrounding the study area does not meet the requirements as set out in the Gauteng Conservation plan V3.3. As such it is not feasible to conserve this area since it is not viable as a sustainable White-bellied Korhaan habitat in the long-term without active management. Consequentially, the secondary grassland within the study area was deemed to have a moderate avifaunal sensitivity.

8.4 Findings and Conclusion

The secondary grassland habitat identified within the study area contained a low avifaunal diversity and density. The majority of the species observed during the field survey are grassland associated species as well as widespread species adapted to a transformed and/ or urban environment. However, suitable breeding and foraging habitat for the regionally Vulnerable White-bellied Korhaan was confirmed to be present within the study area. The surface area of

the aforementioned habitat did however not meet the requirements for the specific species as set out in the Gauteng Conservation plan V3.3 (2014). None of the other threatened and/or near threatened bird species previously recorded within the larger QDS are expected to be resident or rely on the study area for survival. As such it is not feasible to conserve this area since it is not viable as a sustainable habitat for bird species with conservation concerns in the long-term. The surrounding land use and disturbance in the form of roads, urbanization, illegal dumping, alien vegetation encroachment, trampling, habitat transformation and limited connectivity significantly reduces the probable occurrence of any additional terrestrial threatened and near threatened bird species. The close proximity of the Airfield and provincial road further reduces the occurrence possibility of bird species with conservation concerns, since most of these species are highly specialised and extremely sensitive to transformation and disturbances within their preferred habitat.

9. INVERTEBRATE HABITAT ASSESSMENT

9.1 Methods

A field survey was conducted on the 20th of April 2016. The survey consisted of two random walked transects. The dominant invertebrate species and possible suitable habitats for Red List invertebrate species were noted and sampled if necessary. Habitat characteristics for species present were derived from a survey and descriptions given in the field guide by Picker *et al.* (2004). Red Listed Species were consulted online for conservation status of Red List species (IUCN 2015; GDARD 2014). All insects were identified by using the field guide by Picker *et al.* (2004). Red Listed Butterflies were identified according to Henning *et al.* (2009).

A desktop study was done to identify suitable habitats for the Red List invertebrate species known to occur in the QDS 2528CC. The Animal Demography Unit: Virtual Museum (http://vmus.adu.org.za/) was consulted to verify the record of occurrence of invertebrate species recorded within the QDS 2528CC.

The majority of invertebrate species are nocturnal, poikilothermic secretive and seasonal, which makes it difficult to observe them during field surveys. In this case the presence of invertebrate species was examined on habitat preferred by selected species and respective documented ranges.

9.2 Specific Requirements

During the desktop study and field survey attention was given to note any signs of potential occurrence of Threatened species.

According to the GDARD C-Plan (2014), these species include the:

Roodepoort Copper Butterfly (*Aloeides dentatis* subsp. *dentatis*), Highveld Golden Opal (*Chrysoritis aureus*), Stobbia's Fruit Chafer Beetle (*Ichnestoma stobbiai*) and Highveld Blue Butterfly (*Lepidochrysops praeterita*), which are all regarded as Vulnerable (regionally and/or nationally).

Roodepoort Copper Butterfly (*Aloeides dentatis* subsp. *dentatis*):

This butterfly is proposed for Endangered (Henning *et al*., 2009) and Mecenero *et al.* (2013), based on its limited distribution and possible decline in quality and extent of remaining habitats. Suitable habitat around known localities was mapped off satellite imagery. A 100 % target was set for these areas, though it is worth noting that the entire area is within existing Protected Areas, and hence does not influence the outcome of the Gauteng C-Plan v3.3.

This species is typically found in Carletonville Dolomite Grassland at an elevation of 1 500 to 1 900 m. The species is only known from Ruimsig (Roodepoort), Heidelberg (Suikerbosrand – from two localities) and Klipriviersberg (west of Suikerbosrand). The species has a range of approx. 70 km^2. All known localities of this species occur in reserves; however the threat of habitat modification due to environmental changes remains (Henning *et al*., 2009).

The larval food plant of this species at Ruimsig Reserve is *Hermannia depressa* and at Suikerbosrand *Lotononis eriantha*. The presence of the food plant alone will not ensure the presence of the butterfly (Henning *et al*., 2009). Population control of this butterfly species probably takes place owing to finite facilities in *Lepisiota* ant nests. Males are strongly territorial and need open patches as territorial sites (Henning *et al*., 2009).

Highveld Golden Opal (*Chrysoritis aureus*) (= Heidelberg Copper):

This butterfly is proposed to be listed as Vulnerable by (Henning *et al*., 2009) and being upgraded to Endangered by Mecenero *et al.* (2013). Highveld Golden Opal is host plant (*Clutia pulchella*) and host ant (*Crematogaster* species) specific, and known from a handful of localities

on the Heidelberg-Balfour-Greylingstad ridge system (Terblanche & van Hamburg, 2003; Henning *et al*., 2009). The habitat structure of these localities is similar as a tree stratum is absent. It is currently protected in the Alice Glockner Nature Reserve, the Suikerbosrand Nature Reserve and in National Heritage Site No. 14 (Terblanche & van Hamburg, 2003; Henning *et al*., 2009).

The habitat preference of this species is on south-facing, well-drained slopes with shallow humus in the two vegetation types Andersite Mountain Bushveld and Gold Reef Mountain Bushveld, belonging to the Central Bushveld Bioregion of the Savanna Biome (Mucina & Rutherford, 2006). Frost and fire may both therefore be important ecological factors that sustain a suitable habitat for *Chrysoritis aureus* (Terblanche *et al*., 2003).
It is possible that the species is under-recorded. Known localities were buffered by 500m and the full extent of this area was included as a target. Modelling for the species was based on SABCA atlas and data from site visits, and this resulted in the development of a model which reflected the high altitude ridge systems which host the species.

Stobbia's Fruit Chafer Beetle (*Ichnestoma stobbiai*):

Although not listed, it appears that this species of beetle would qualify as Vulnerable under the IUCN Red List criteria. An expert driven mapping approach was used for the species to map the area likely to be occupied by the beetle at known localities. All suitable, untransformed habitat in the vicinity of known records were mapped as suitable, occupied habitat for the species. No attempt was made to predict the occurrence of additional populations in other areas. A 100% of the confirmed habitat and the extended mapped suitable habitat were targeted.

This species in particular only occur in small fragments in pristine grassland along the Transvaal Magaliesberg system. This rare Fruit Chafer Beetle is mostly endemic to Gauteng Province, with a single population occurring in the adjacent parts of North West Province (Kruger& Scholtz, 2008).

Highveld Blue Butterfly (*Lepidochrysops praeterita*):

Although the species is classified as Vulnerable, it is proposed for Endangered (Henning *et al*., 2009), based on a limited distribution and the extent of mining and agricultural activities within its range. It is largely endemic to Gauteng, specifically in the Carletonville area, but extends into the Potchefstroom area in the North West and Sasolburg in the Free State. No conservation

measures are in place (Henning *et al*., 2009). The species is found on a few koppies and rocky hillsides between Potchefstroom area in the North West and Sasolburg in the Free State.

Known localities were buffered by 500m and the full extent of this area was included as a target. Modelling for the species was based on South African Butterfly Conservation Assessment (SABCA) atlas and data from site visits. The model refined the basic distribution by incorporating slope and aspect, and removed unsuitable land cover classes and areas smaller than the smallest known patch of habitat occupied by the species.

The vegetation types where this species have been recorded are the Soweto Highveld Grassland and Rand Highveld Grassland in the Mesic Highveld Grassland Bioregion of the Grassland Biome (described in Mucina & Rutherford, 2006). The larval food plant of this species is *Ocimum obovatum.*

9.3 Results

9.3.1 Invertebrate habitats identified

The Secondary Grassland is the only habitat on site. Invertebrates occur in a wide variety of habitats in various environmental and disturbed conditions. The presence of common species such as grasshoppers (Order: *Orthoptera*), grassland adapted mantids (Order: *Mantoidea*) and stick insects (Order: *Phasmatoidea*) are expected.

9.3.2 Expected and observed Invertebrate species

Table 4: Invertebrate species deducted to occur.

	Scientific Name	**Common name**	**Red List Category**	***Occurrence Probability**
1.	*Aloeides dentatis* subsp. *dentatis*	Roodepoort Copper Butterfly	Endangered	2
2.	*Chrysoritis aureus*	Heidelberg Copper Butterfly	Endangered	1
3.	*Ichnestoma stobbiai*	Stobbia's Fruit Chafer Beetle	Vulnerable	1
4.	*Lepidochrysops praeterita*	Highveld Blue Butterfly	Endangered	1

*The occurrence probability of the invertebrates species listed below is indicated as follows:
Not likely to occur - 1, Low occurrence probability - 2, Medium occurrence probability - 3, High occurrence probability – 4, Confirmed occurrence – 5.

8.3.3 Threatened and Red Listed Invertebrate species

No Red List species are recorded or expected to occur in the study area due to unsuitable habitat requirements.

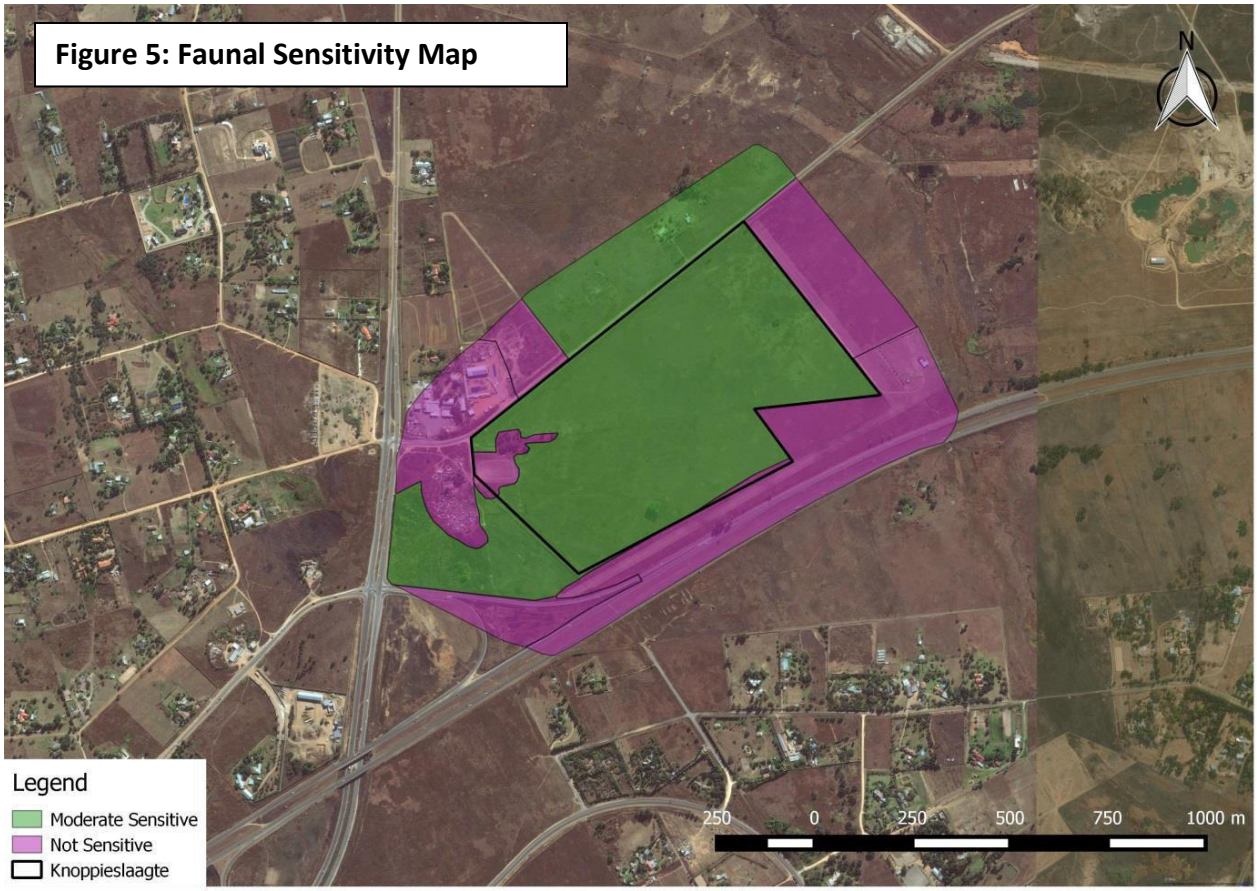
9.4 Findings

The Secondary Grassland is not particularly suitable for any of the mentioned threatened species listed in the GDARD C-plan v3.3. For example, the Roodepoort Copper Butterfly (Aloeides dentatis subsp. dentatis) prefers a predictable Grassland habitat where specific ant species are present. The probability of locating this species is unlikely as disturbances decrease the favourability of this specific habitat.

No other Threatened or Near Threatened invertebrate species are expected to occur in this particular disturbed Grassland habitat on account of minimal optimal habitat and various anthropogenic disturbances within the habitat units.

10. OVERALL FINDINGS AND IMPLICATIONS

The study area consists of only the secondary grassland habitat. This habitat generally supports common fauna species and is not particularly suitable to support any Threatened or Near Threatened fauna species. Thus, the habitat identified on study area was considered to be moderately ecological sensitive from a faunal perspective (**Figure 5**).



11. LIMITATIONS

Even though considerable care is taken to ensure accuracy and professionalism of this fauna report, environmental assessment studies are limited in scope, time and budget. Several years are needed to derive a 100% accurate report based on intensive field collecting and observations where all seasons are considered to account for fluctuating environmental conditions and migrations. Since environmental impact studies deal with dynamic natural systems additional information may come to light at a later stage.

The desktop study made up the largest part of the data used to conclude the distribution of Red Data species which were sourced by making use of the Animal Demography Unit: Virtual

Museum data basis. Any limitations in the above mentioned data basis will in effect have implications on the findings and conclusion of this assessment.

Therefore, Bokamoso Environmental: Specialist Division cannot accept responsibilities for conclusions and mitigation measures made in good faith with the limited available information at the time of the directive. This report should be viewed and acted upon considering these limitations.

12. RECOMMENDATIONS

If the proposed industrial township development is approved:

- An appropriate management authority that must be contractually bound to implement the Environmental Management Programme/Plan (EMPr) and Record of Decision (RoD) by the competent authority during the constructional and operational phase of the development should be identified and informed of their responsibilities with regards to this.
- Induction should be done for all civil contractors and for each building contractor prior to them commencing on site to discuss the EMPr and RoD.
- Prior to any activities commencing on site, all construction staff should be briefed in an environmental induction regarding the environmental status and requirements of the site. This should include providing general guidelines for minimizing environmental damage during construction, as well as education with regards to basic environmental ethics, such as the prevention of littering, lighting of fires, etc.
- Construction should be restricted to areas deemed to have a low ecological sensitivity (Refer to **Figure 5**).
- It is recommended that prior to the commencement of construction activities' initial clearing of all alien vegetation should take place.
- The contractor must ensure that no faunal species are trapped, killed or in any way disturbed during the constructional phase.
- It is recommended that all concrete and cement works be restricted to areas of low ecological sensitivity and defined on site and clearly demarcated. Cement powder has a high alkalinity pH rating, which can contaminate and affect both soil and water pH dramatically. A shift in the pH can have serious consequences on the functioning of soil, vegetation and fauna.

- To ensure minimal disturbance of faunal habitat it is recommended that construction should take place during winter, outside the reproductive season of the species present on site.
- Construction, vegetation clearing and top soil clearing should commence from a predetermined location and gradually commence to ensure that fauna present on the site have enough time to relocate.
- When construction is completed, disturbed areas should be rehabilitated using vegetation cleared prior to construction to ensure that the habitat stays intact and that faunal species present on the site before construction took place, return to the area.
- Outside lighting should be designed to minimize impacts on fauna. All outside lighting should be directed away from sensitive areas. Fluorescent and mercury vapour lighting should be avoided and sodium vapour (yellow) lights should be used wherever possible.
- Forage and host plants required by pollinators should also be planted in landscaped areas.
- Where possible, indigenous trees naturally growing on the site should be retained as part of the landscaping. Measures to ensure that these trees survive the physical disturbance from the development should be implemented. A tree surgeon should be consulted in this regard.
- In order to minimize artificially generated surface storm water runoff, total sealing of paved areas such as parking lots, driveways, pavements and walkways should be avoided. Permeable material should rather be utilized for these purposes.

13. CONCLUSION

The recommendations and mitigation measures above should be followed and correctly implemented to ensure the ecological environment is not negatively affected. The study area is not regarded as ecologically sensitive (Figure 5) from a faunal perspective, thus the proposed construction of the industrial township will have no detrimental influence on the faunal species in the study area.

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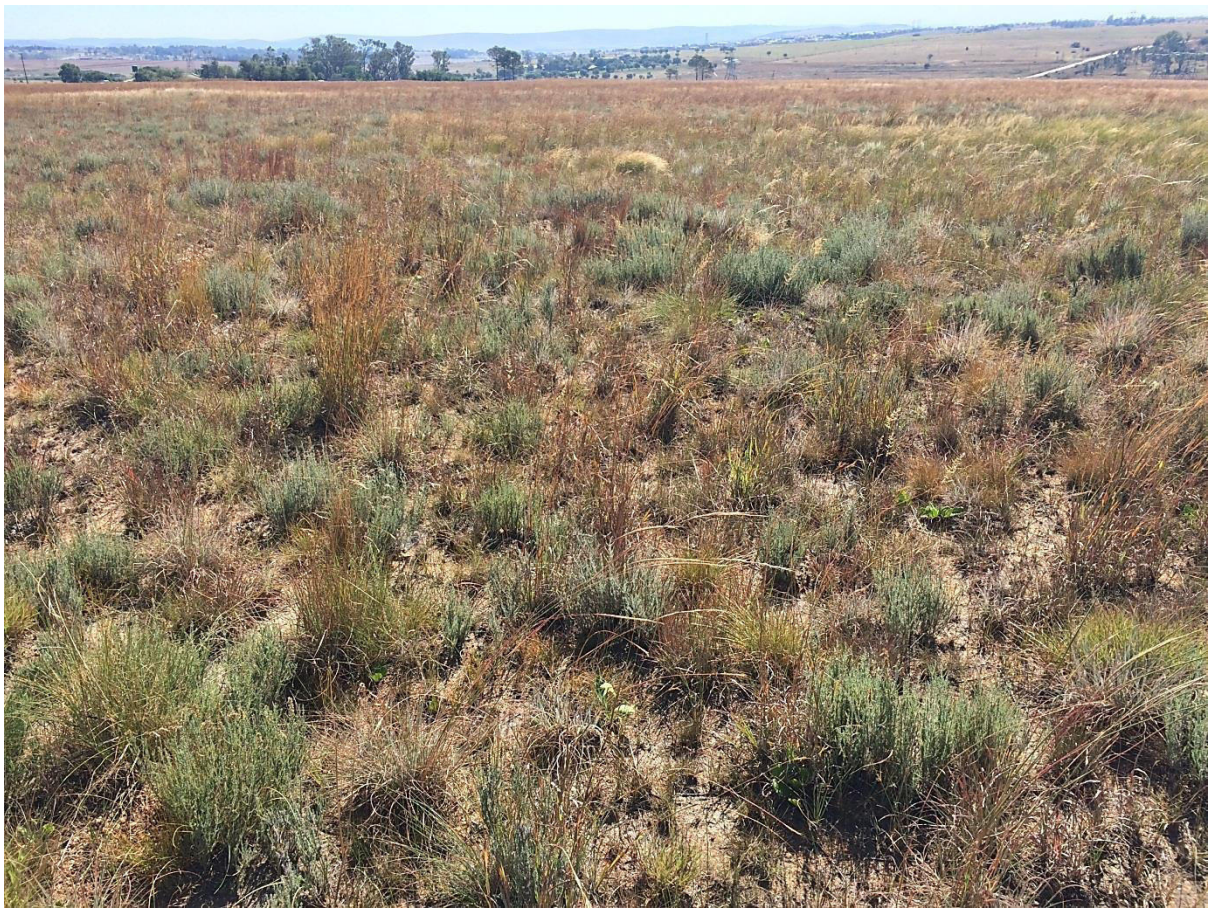
Flora Assessment for Portion 331, 109, and 105 of the Farm Knopjeslaagte 385-JR, Centurion



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April 2016

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Specialist investigators: Mr. S.E. van Rooyen (M.Sc. Restoration Ecology and Botany candidate)

Declaration of independence:

The specialist investigators responsible for conducting this particular specialist vegetation study declare that:

• I consider myself bound to the rules and ethics of the South African Council for Natural Scientific Professions (SACNASP);

• At the time of conducting the study and compiling this report we did not have any interest, hidden or otherwise, in the proposed development, except for financial compensation for work done in a professional capacity;

• Work performed for this study was done in an objective manner. Even if this study results in views and findings that are not favourable to the client/applicant, we will not be affected in any manner by the outcome of any environmental process of which this report may form a part;

• I declare that there are no circumstances that may compromise our objectivity in performing this specialist investigation. We do not necessarily object to or endorse the proposed development, but aim to present facts, findings and recommendations based on relevant professional experience and scientific data;

• I do not have any influence over decisions made by the governing authorities;

• I have the necessary qualifications and guidance from professional experts (registered Pr. Nat. Sci.) in conducting specialist reports relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;

• This document and all information contained herein is and will remain the intellectual property of Bokamoso Environmental: Specialist Division. This document, in its entirety or any portion thereof, may not be altered in any manner or form, for any purpose without the specific and written consent of the specialist investigators.

• I will comply with the Act, regulations and all other applicable legislation;

S.E. van Rooyen

VERIFICATION STATEMENT

This communication serves to verify that the flora report compiled by S. E. van Rooyen has been prepared under my supervision, and I have verified the contents thereof.

Declaration of independence: I, Dr. J.V. van Greuning (Pr. Sci. Nat. reg. no. 400168/08) declare that I:

- am committed to biodiversity conservation but concomitantly recognise the need for economic development. Whereas I appreciate the opportunity to also learn through the processes of constructive criticism and debate, I reserve the right to form and hold my own opinions and therefore will not willingly submit to the interests of other parties or change my statements to appease them.
- abide by the Code of Ethics of the S.A. Council of Natural Scientific Professions
- act as an independent specialist consultant in the field of Botany
- am subcontracted as specialist consultant by Bokamoso Environmental Consultants for the proposed Mixed Use development on Portion 331, 105, 109 of the farm Knoppieslaagte 385-JR described in this report.
- have no financial interest in the proposed development other than remuneration for work performed
- have or will not have any vested or conflicting interests in the proposed development
- undertake to disclose to Bokamoso Environmental Consultants and its client as well as the competent authority any material information that have or may have the potential to influence the decision of the competent authority required in terms of the Environmental Impact Assessment Regulations, 2014.

Dr. J. V. van Greuning

Table of Contents

1. INTRODUCTION

Bokamoso Environmental: Specialist Division was commissioned to conduct a flora assessment for the proposed light industrial development on Portion 331, 105, and 109 of the Farm Knopjeslaagte 385-JR, Centurion. The objective was to conduct a floristic species survey to determine which species occur in the site of the proposed development. Special attention was given to possible habitats for Red and Orange List plant species that may occur in the area. Furthermore, the ecological integrity and sensitive habitats of the site were investigated.

2. OBJECTIVES OF THE STUDY

- To assess the habitat component and current ecological status of the area;
- To identify and list the plant species occurring on the site and indicate whether they are Red and Orange List species;
- Make recommendations if any Red and Orange List species are found;
- To indicate the sensitive habitats of the area;
- To highlight the current impacts on the flora of the site; and
- Provide recommendations to mitigate negative impacts and enhance positive impacts on the current flora should the proposed development be approved.

3. SCOPE OF STUDY

This report:

- Lists all plant species, including alien species, recorded during the flora survey;
- Provides recommendations on Red and Orange List plant species;
- Indicates medicinal plant species recorded;
- Comments on ecological sensitive areas;
- Comments on current impacts affecting the flora of the site;
- Evaluates the conservation importance and significance of the area in and adjacent to the proposed development, with special emphasis on the current status of threatened species; and
- Provides recommendations to mitigate or reduce negative impacts, should the proposed development be approved.

4. STUDY AREA

4.1 Regional vegetation

The study site lies within the Quarter Degree Square (QDS) 2528CC, which according to Mucina and Rutherford (2006) forms part of the Egoli Granite Grassland. This vegetation unit is considered Endangered according to the National list of threatened terrestrial ecosystems for South Africa, 2011 (Government Gazette no. 34809, 2011).

Less than 3 % of the targeted 24 % of the Egoli Granite Grassland is conserved in several nature reserves. The authors described the landscape of the Egoli Granite Grassland as low hills and moderately undulating plains, which support tall grass species such as *Hyparrhenia hirta,* dominating the area. Scattered rocky outcrops and rock sheets form suitable habitats for woody species (Mucina and Rutherford, 2006). This grassland is regarded as degraded as over utilisation created a species poor vegetation unit (Mucina and Rutherford, 2006).

4.2 The study site

The site for the proposed light industrial development on Portion 331, 109, and 105 of the farm Knopjeslaagte 385-JR, Centurion is situated east of the R115 Road and north of the N14, adjacent to the Centurion Flight Academy (Pty) Ltd (**Figure 1**). The study site is about 45 ha in size.

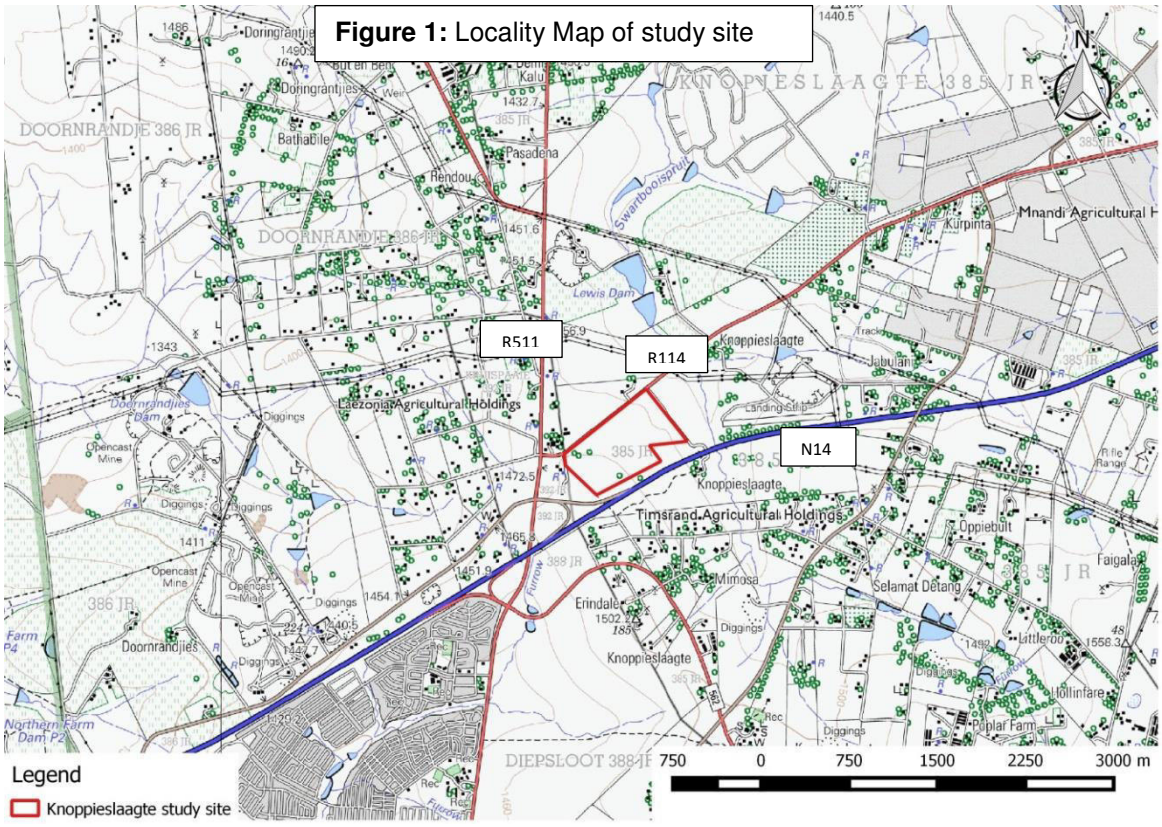

Figure 1: Locality Map of study site

5. METHODS

The study site was visited on the 20th of April 2016. For each study unit identified, a species list was compiled for all plants recorded, using the adequate number of sampling plots (100 m by 25 m). Field guides such as those by Germishuizen and Meyer (2003), Koekemoer *et al*. (2014), Pooley (1998), van Ginkel *et al.* (2011), van Oudtshoorn *et al.* (2014), van Wyk and Malan (1998) and van Wyk (2013) were used to identify the species. The herbarium of the University of Pretoria (H.G.W.J. Schweickerdt Herbarium, University of Pretoria) was also visited to confirm the correct identification of species.

The survey also included information about the occurrence of Red and Orange List plant species obtained from GDARD (Pfab, 2002; Pfab and Victor, 2002) (Annexure A). The Red List Plant Species Guidelines and Requirements for Biodiversity Assessments v3. issued by GDARD (2014) was consulted. A desktop study was done to identify suitable habitats for the Red and Orange List plant species known to occur in the QDS 2528CC. The plant species list for this QDS obtained from SANBI (Plants of Southern Africa: an online checklist) was consulted to verify the record of occurrence of the plant species recorded at the site. The Gauteng Conservation Plan (C-plan v3.3) was also consulted to evaluate ecologically sensitive areas (GDARD. 2014b).

Each study unit was further assessed for the occurrence of alien plant species (Bromilow, 2010) and any form of disturbance. Alien species are included in the species lists (indicated in bold in the relevant tables) as they suggest the particular state of each study unit. For each alien species the Category is indicated according to the Alien and Invasive species lists (2014) amended in NEMBA (National Environmental Management: Biodiversity Act (ACT NO, 10 OF 2004) (Department of environmental affairs. 2014).

For each plant species, the medicinal properties were assessed (van Wyk et al., 2013). Medicinal plants are marked with an asterisk in the respective tables (**Table 4**).

6. RESULTS

6.1 Study Units

The vegetation of the study site consists of Secondary Grassland, therefore no different study units was distinguished. (**Figure 2**):

The plant species found in the study unit is listed in **Table 4**.

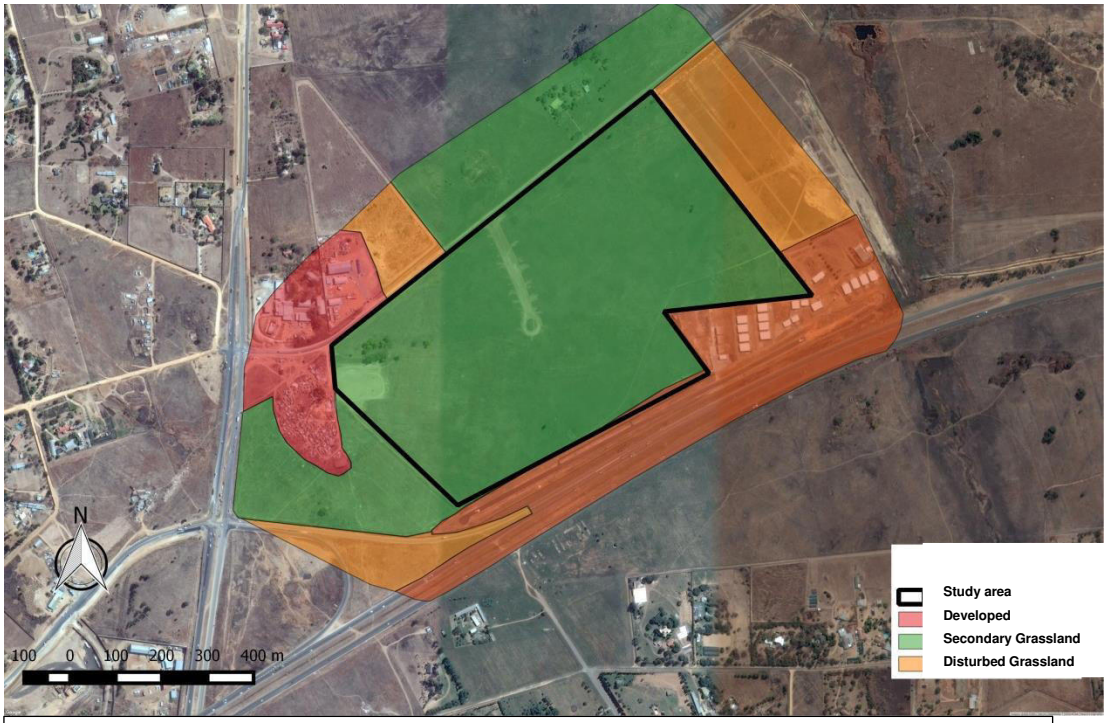

Figure 2: Vegetation map indicating different study units identified in the study site

6.2 Red and Orange List species

Twenty-two Red and Orange List species are known to occur in the QDS 2528CC (**Annexure A**), from which one Orange List plant species (*Hypoxis hemerocallidea*) was found on the study site. According to the GDARD five Red List species occur within a 5 km radius form the study site. The chance of finding these species on the study site is very low, as the study site experiences some disturbances from human activities as well as isolation from similar vegetation units.

6.3 Medicinal and Alien species

The number of medicinal plant species for each study unit is indicated in **Table 1** and in species list (**Table 4**). The species are indicated with an asterisk. Five medicinal species were listed in the study site.

Table 1 The number of plant species recorded per study unit, including the total number of medicinal and alien plant species.

Study unit	Total number of species	No. of medicinal species	No. of alien species
Secondary Grassland	65	5	11

The number of alien plant species for the study unit is indicated in **Table 1 & 2**, and in species lists (**Table 4**). The species are indicated in bold. The Secondary Grassland study unit has a low alien species richness compared to the total number of species identified (**Table 1**). These alien plant individuals are scattered over the study unit, forming no conspicuous stands dominated by alien species.

Table 2 Number of alien plant species per study unit and numbers in different categories.

Study unit	Total number of alien species	CAT 1b	CAT 2	Not declared
Secondary Grassland	11	4	1	6

Category 1b alien species are major invaders that need to be removed (Act No. 43 of 1983), as amended. These alien species must be contained, and in many cases they already fall under a government sponsored management programme such as Working for Water. Alien invasive species in this Category may not be owned, imported into South Africa, grown, moved, sold, given as a gift or dumped in a waterway.

All Category 2 declared weeds should likewise be removed (Act No. 43 of 1983), as amended, unless a permit is obtained to control it in a demarcated area or a biological control reserve.

6.4 Secondary Grassland

6.4.1 Composition & Connectivity

This study unit is dominated by the graminoid layer (**Table 3**), which include species such as *Eragrostis* spp., *Schizachyrium sanguineum*, *Heteropogon contortus, Andropogon* spp., *Aristida* spp. and *Hyparrhenia hirta* (**Figure 3**). Dominant forb species such as *Commelina africana, Dicoma anomala, Felicia muricata, Helichrysum nudifolium* var. *nudifolium* and *Wahlenbergia undulata* were also observed. One particular dwarf shrub, *Seriphium plumosum,* is encroaching in this study unit (**Figure 3**). None the less, the ecological status of this Secondary Grassland is good, with fairly high species richness.

Table 3 Number of species recorded in each growth form

GROWTH FORM	TOTAL NUMBER OF SPECIES
Shrub/Tree	5
Graminoid	30
Forb	26

Succulent	2
Geophyte	2

This Secondary Grassland is isolated from similar grassland vegetation units. It is surrounded by urban development and agricultural activities. The ecological status of this study unit will only decrease as movement of plant species is limited on account of isolation from natural vegetated areas.

6.4.2 Red and Orange List species

One Orange List species *Hypoxis hemerocallidea* was observed in abundance on the study site (**Annexure A**). This study unit also provides suitable habitat for *Boophone disticha, Brachycorythis conica* subsp. *transvaalensis, Habenaria kraenzliniana, Melolobium subspicatum* and *Pearsonia bracteata* (**Annexure A**). The probability of locating these species is unlikely on account of human disturbances and isolation from similar vegetation units.

6.4.3. Medicinal and Alien species

Eleven alien plant species occur on the study unit, of which four are category 1b invaders and should be removed from the study unit (**Table 2**). Six species remain uncategorised.

Five medicinal species were observed in this study unit (**Table 1**).

6.4.4 Sensitivity

This study unit is regarded as moderate sensitive, on account of the high number of species recorded and suitable habitat it provides for several Red List species know to occur in the QDS 2528CC. This study unit is also isolation from similar vegetation units, which limit the probability of locating any of the Red List species mentioned in **Annexure A.**

Table 4 Species list for Disturbed Grassland study unit.

Scientific name	**Invasive category**
Acacia mearnsii	**2**
Aloe cf. *zebrina*	
Andropogon eucomus	
Andropogon schirensis	
Aristida congesta subsp. *congesta*	
Aristida stipitata	
Babiana hypogae	
Barleria sp.	
Bidens pilosa	

Brachiaria nigropedata	
Bulbostylis hispidula subsp. *pyriformis*	
Chamaecrista mimosoides	
Chlorophytum cf. *transvaalense*	
Cleome maculata	
Commelina africana	
Commelina erecta	
Cymbopogon caesius	
Cynodon dactylon	
Cyperus sp.	
Datura ferox	**1b**
Dichrostachys cinerea subsp. *africana**	
Dicoma anomala	
Diheteropogon amplectens	
Eleusine coracana	
Eragrostis chloromelas	
Eragrostis curvula	
Eragrostis gummiflua	
Eragrostis nindensis	
Eragrostis superba	
Eucalyptus camaldulensis	**1b**
Felicia muricata	
Gnaphalium luteo-album	
Haplocarpha scaposa	
Helichrysum nudifolium var. *nudifolium* *	
Heteropogon contortus	
*Hilliardiella oligocephala**	
Hyparrhenia hirta	
*Hypoxis hemerocallidea**	
Hypoxis iridifolia	
Indigofera sp.	
Lactuca inermis	
Ledebouria revoluta	
Melia azedarach	**1b**
Melinis repens	
Monsonia angustifolia	
Panicum natalense	
Paspalum dilatatum	
Perotis patens	
Persicaria lapathifolia	
***Pinus* sp.**	
Pogonarthria squarrosa	
Polygala hottentotta	
*Scabiosa columbaria**	
Schizachyrium sanguineum	
Schoenoplectus sp.	
Seriphium plumosum	
Sporobolus africanus	
Striga elegans	
Tagetes minuta	
Themeda triandra	

Trachypogon spicatus	
Trichoneura grandiglumis	
Urelytrum agropyroides	
Urochloa panicoides	
Verbena bonariensis	**1b**
Wahlenbergia undulata	

Alien species indicated in bold; Medicinal species indicated with (*)

Figure 3: Secondary Grassland dominated by *Hyparrhenia hirta* and *Schizachyrium sanguineum*

7. FINDINGS AND POTENTIAL IMPLICATIONS

The study site consists of one study unit, dominated by the graminoid vegetation layer. Although one Orange List species was observed, the study site cannot be deemed ecologically high sensitive due to anthropogenic influences such as urban development threatening this ecosystem (**Figure 4**). These factors also isolate this study unit, which will ultimately result in the distinction of important individual plant species located in this Secondary Grassland. It is strongly advised that the Orange List species *Hypoxis hemerocallidea* be relocated from the site prior to construction.

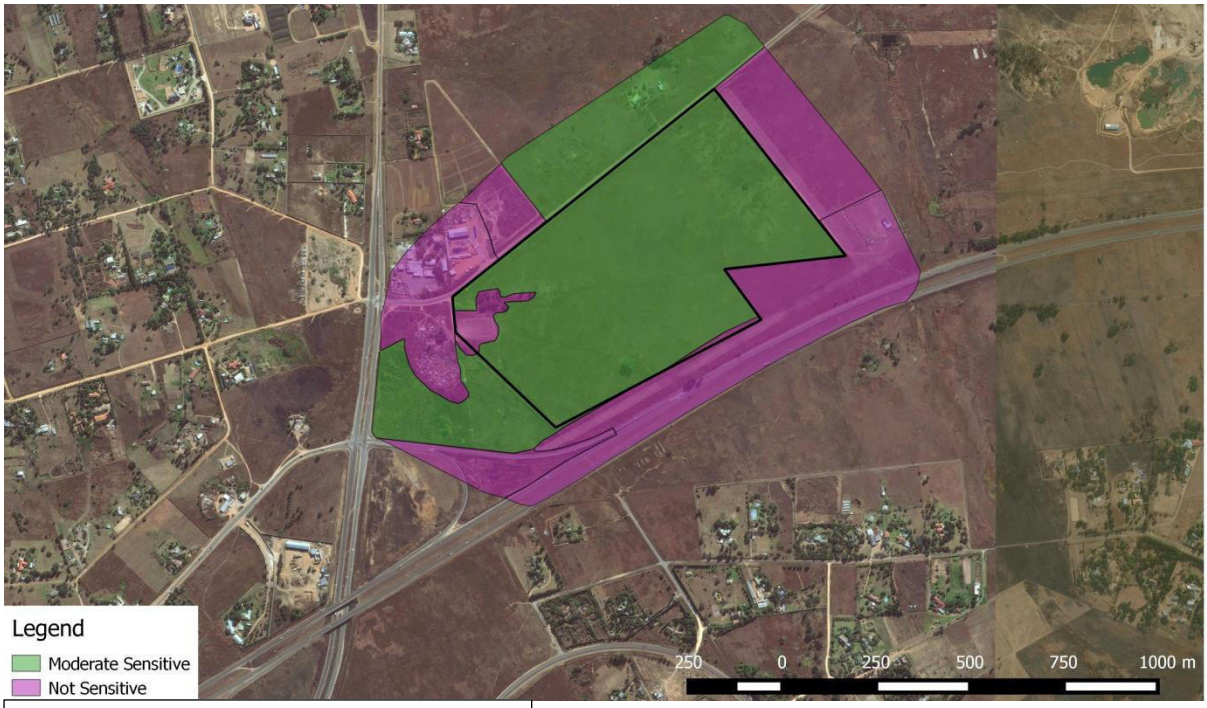

Figure 4: Sensitivity map of study site

8. DISCUSSION, RECOMMENDATIONS AND MITIGATION MEASURES

Competent and appropriate management authority should be appointed to implement the Ecological Management Plan (EMP) and Environmental Impact Assessment (EIA) conditions throughout all phases of development, including the operational phase. The EMP should comply with the *Minimum Requirements for Ecological Management Plans* according to GDARD. The EMP and EIA should take into account all recommendations and mitigation measures as outlined by all Flora assessments conducted for the EIA process. The following recommendations and mitigation measures are proposed:

- The attached sensitivity map should be used as a decision tool to guide the layout design (**Figure 4**).
- A pre- and post-construction alien invasive control, monitoring and eradication programme must be implemented along with an on-going programme to ensure persistence of indigenous species. A qualified botanist/ecologist should compile and supervise the implementation of this programme.
- Rehabilitation of natural vegetation should proceed in accordance with a rehabilitation plan compiled by a specialist registered in terms of the Natural Scientific Professions Act (No. 27 of 2003) in the field of Ecological Science.

- Where active rehabilitation or restoration is mandatory, it should make use of indigenous plant species native to the study area. The species selected should strive to represent habitat types typical of the ecological landscape prior to construction. As far as possible, indigenous plants naturally growing within the vicinity of the study area, but would otherwise be destroyed during construction, should be used for re-vegetation/landscaping purposes.
- Only plant species that are indigenous to the natural vegetation of the study site should be used for landscaping in communal areas. As far as possible, plants naturally growing on the development site, but would otherwise be destroyed during clearing for development purposes, should be incorporated into landscaped areas. Forage and host plants required by pollinators should also be planted in landscaped areas.
- In order to minimize artificially generated surface storm-water runoff, total sealing of paved areas such as parking lots, driveways, pavements and walkways should be avoided. Permeable material should rather be utilized for these purposes.
- A rescue plan for the Orange List species, *Hypoxis hemerocallidea* needs to be incorporated into the EMP prior to construction.

9. CONCLUSIONS

The removal and relocating of the Orange List species *Hypoxis hemerocallidea* prior to construction is mandatory. All alien species in the study site, especially Category 1b must be eradicated as a matter of urgency, to preclude their spreading during the construction phase.

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Annexure A: Red Data Flora (confidential)

The following Red Data floral species are listed for the QDC 2528CC. An indication is also provided if the species was recorded on site.

SPECIES	FLOWERING SEASON	SUITABLE HABITAT	CRITERIA	CATAGORY ([1]global; [2]national)	OBSERVED
Adromischus umbraticola subsp. *umbraticola*	September-January	Rock crevices on rocky ridges, usually south-facing, or in shallow gravel on top of rocks, but often in shade of other vegetation.	A2	Near Threatened[1]	Not observed No Suitable habitat
Boophone disticha	October-January	Dry grassland and rocky areas.	N/A	Declining[2]	Not observed Suitable habitat
Bowiea volubilis subsp. *volubilis*	September-April	Shady places, steep rocky slopes and in open woodland, under large boulders in bush or low forest.	B	Vulnerable[2]	Not observed No suitable habitat
Brachycorythis conica subsp. *transvaalensis*	January-March	Short grasslands, hillsides, on sandy gravel overlying dolomite, sometimes also on quartzites; occasionally open woodland; 1000 - 1705m.	A3	Endangered[2]	Not observed Suitable habitat Recorded within 5km radius from study site

Callilepis leptophylla	August-January & May	Grassland or open woodland, often on rocky outcrops or rocky hillslopes.	N/A	Declining[2]	Not observed No suitable habitat
Ceropegia decidua subsp. *pretoriensis*	November-April	Direct sunshine or shaded situations, rocky outcrops of the quartzitic Magaliesberg mountain series, in pockets of soil among rocks, in shade of shrubs and low trees, can be seen twining around grass spikes.	A1	Vulnerable[1]	Not observed No suitable habitat
Cheilanthes deltoidea subsp. *silicicola*	November-June	Southwest-facing soil pockets and rock crevices in chert rock.	A2	Vulnerable[1]	Not observed No suitable habitat Recorded within 5km radius from study site
Cleome conrathii	March-May; December-January	Stony quartzite slopes, usually in red sandy soil, grassland or open to closed deciduous woodland, all aspects.	A3	Near Threatened[1]	Not observed No suitable habitat
Crinum macowanii	October-January	Grassland, along rivers, in gravelly soil or on sandy flats.	N/A	Declining[2]	Not observed No suitable habitat
Dicliptera magaliesbergensis	February-April	Forest, savanna (Riverine forest and bush).	A1	Vulnerable[1]	Not observed No suitable habitat Recorded within

					5km radius from study site
Drimia sanguinea	August-December	Open veld and scrubby woodland in a variety of soil types.	B	Near Threatened[2]	Not observed No suitable habitat Recorded within 5km radius from study site
Eucomis autumnalis	November-April	Damp, open grassland and sheltered places.	N/A	Declining[2]	Not observed No suitable habitat
Gunnera perpensa	October-March	In cold or cool, continually moist localities, mainly along upland streambanks.	N/A	Declining[2]	Not observed No suitable habitat
Habenaria barbertoni	February-March	In grassland on rocky hillsides.	A2	Near Threatened[1]	Not observed No suitable habitat
Habenaria kraenzliniana	February-April	Terrestrial in stony, grassy hillsides, recorded from 1000 to 1400m.	A3	Near Threatened[1]	Not observed Suitable habitat Recorded within 5km radius from study site

Habenaria mossii	March-April	Open grassland on dolomite or in black sandy soil.	A1	Endangered[1]	Not observed No suitable habitat
Holothrix randii	September-October	Grassy slopes and rock ledges, usually southern aspects.	B	*Holothrix randii*	Not observed No suitable habitat
Hypoxis hemerocallidea	September-March	Occurs in a wide range of habitats, from sandy hills on the margins of dune forests to open rocky grassland; also grows on dry, stony, grassy slopes, mountain slopes and plateaux; appears to be drought and fire tolerant.	N/A	Declining[2]	Observed
Ilex mitis var. *mitis*	October-December	Riverbanks, streambeds, evergreen forests.	N/A	Declining[2]	Not observed No suitable habitat
Lithops lesliei subsp. lesliei	March-June	Primary habitat appears to be the arid grasslands in the interior of South Africa where it usually occurs in rocky places, growing under the protection of surrounding forbs and grasses.	B	Near Threatened[2]	Not observed No suitable habitat
Melolobium subspicatum	September-May	Grassland.	A1	Vulnerable[1]	Not observed Suitable habitat Recorded within 5km radius from

					study site
Pearsonia bracteata	December-April	Plants in Gauteng and North West occur in gently sloping Highveld grassland, while those in the Wolkberg were collected from steep wooded slopes and cliffs in river valleys.	A3	Near Threatened[1]	Not observed Suitable habitat

Appendix G3

Geotechnical Report

REPORT
ON
THE ENGINEERING GEOLOGICAL INVESTIGATION
ON
THE REMAINDER OF PORTION 105
POTION 109
PORTION 111
AND
ON
THE REMAINDER OF PORTION 331
OF
THE FARM
KNOPJESLAAGTE 385 JR.

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JANUARY 2016

Client

Keymacx

REPORT ON THE ENGINEERING GEOLOGICAL INVESTIGATION ON THE REMAINDER OF PORTION 105, POTION 109, PORTION 111 AND ON THE REMAINDER OF PORTION 331 OF THE FARM KNOPJESLAAGTE 385 JR.

CONTENTS Page

REPORT ON THE ENGINEERING GEOLOGICAL INVESTIGATION ON THE REMAINDER OF PORTION 105, POTION 109, PORTION 111 AND ON THE REMAINDER OF PORTION 331 OF THE FARM KNOPJESLAAGTE 385 JR.

1. INTRODUCTION

Louis Kruger Geotechnics CC was appointed to do an engineering investigation on the Remainder of Portion 105, Potion 109, Portion 111 and on the Remainder of Portion 331 of the farm Knopjeslaagte 385 JR. The investigation was undertaken according to the normal requirements to assess the suitability of the site (SANS 634: Geotechnical Investigations For Township Development, SANS 633: Profiling, and Percussion and Core Borehole Logging In Southern Africa for Engineering Purposes, Home Building Manual Part 1 & 2", National Home Builders Registration Council, 1999) and Guidelines for Urban Engineering Geological Investigations 1997). The following aspects are addressed in this report:

- Geology and Soil profile
- Geohydrology
- Foundation conditions
- Construction material

2. TERMS OF REFERENCE

The appointment was to do an engineering investigation on the Remainder of Portion 105, Potion 109, Portion 111 and on the Remainder of Portion 331 of the farm Knopjeslaagte 385 JR. The following aspects were to be addressed:

- The geotechnical characteristics of the site
- Geotechnical constraints
- Founding conditions
- NHBRC Zoning

The locality of the site is shown on Figure 1.

3. AVAILABLE INFORMATION

The following information was available:

- 1 : 50 000 Geological Map 2528CC Lyttelton
- Cadastral map
- Colour aerial photographs, Tshwane Metropolitan Council
- Tshwane Internet Geographical information System

4. LOCALITY

The site is situated on the Remainder of Portion 105, Potion 109, Portion 111 and on the Remainder of Portion 331 of the farm Knopjeslaagte 385 JR and is bounded by the N14 Krugerdorp Highway in the south, by Fig Street in the west, by the R114 Pretoria Road in the north and by Imbovane Street in the east. The locality of the site is shown on Figure 1.

LOCALITY	FIGURE 1 NTS

5. TOPOGRAPHY AND DRAINAGE

No topographical information was available. The Tshwane Internet Geographical information System shows that the site slopes at an average of 4% towards the north-east. No drainage features are present on the site and according to the available information it is not affected by flood lines. The topography of the site is shown on Figure 2.

6. METHOD OF INVESTIGATION

Twenty-five test pits were dug on the site and the soil profiles were described according to the standard method proposed by Jennings, Brink and Williams (1973). Disturbed samples of the most prominent soil horizons were taken and submitted to a soils laboratory for foundation indicator tests. Due to the high gravel content and the consistency of the materials encountered on the site, no undisturbed samples were taken

7. GEOLOGY AND SOIL PROFILE

According to the 1: 50 000 scale geological map the site is underlain by migmatite gneiss (granite) of the Halfway House Suite. The geology of the site was confirmed during this investigation, granite bedrock was encountered in the test pits. The test pit positions are shown on Figure 2 and the soil profiles are attached as Appendix A. The following materials were encountered on the site:

7.1 Soil profile

The test pit positions are shown on Figure 3 and the soil profiles are attached as Appendix A. The following materials were encountered on the site:

7.1.1 Colluvium

Two types of colluvium were encountered on the site:

Type A: Slightly moist, dark brown, soft, shattered, silty sand with plant roots covers the eastern part of the site. This material was encountered in fourteen test pits from surface up to an average depth of 0,3 meters.

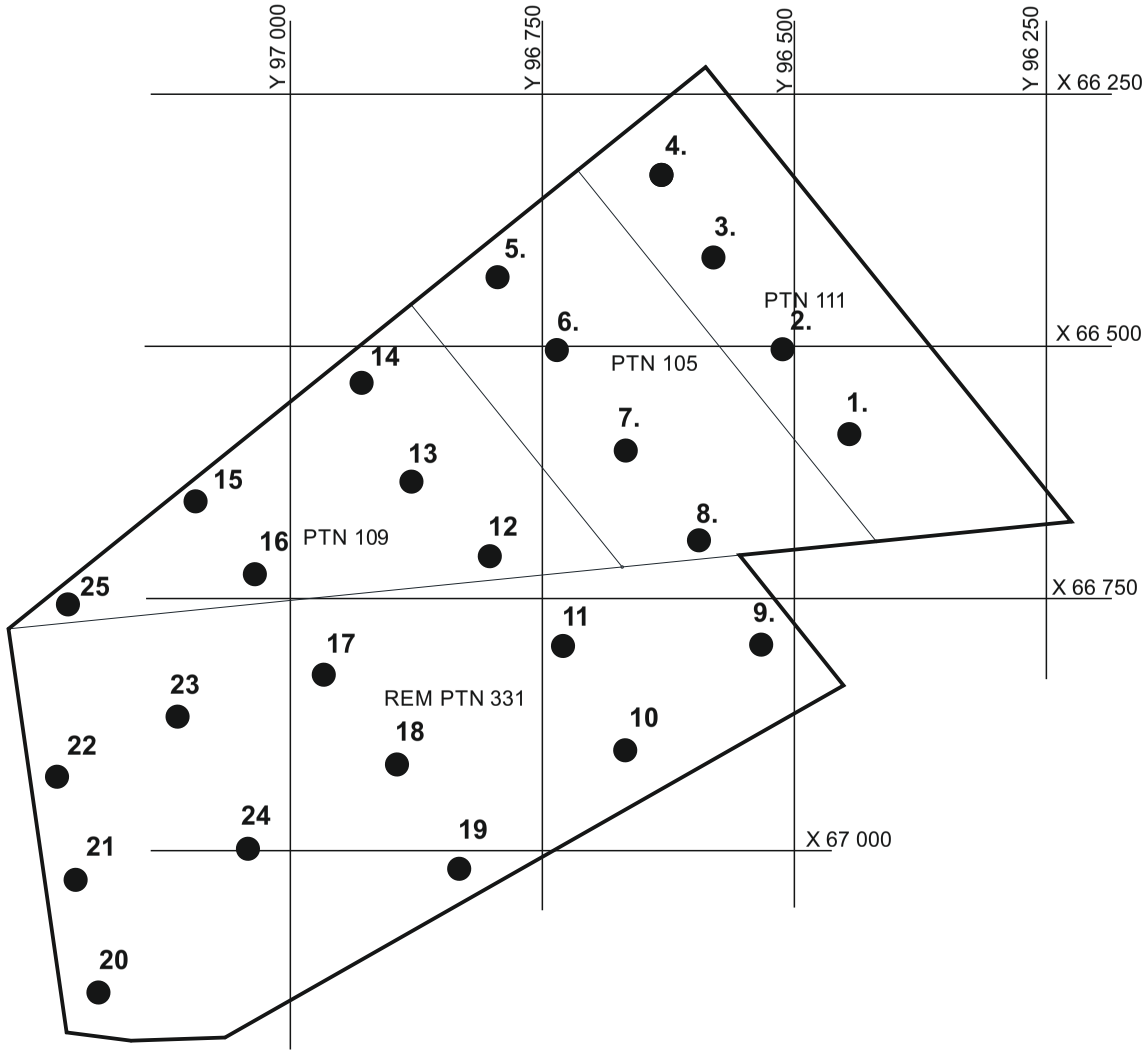
Type B: Slightly moist, brown, soft, shattered, silty, gravelly, sand with plant roots was encountered on the western part of the site. This material was encountered in eight test pits from surface up to an average depth of 0,6 meters.

7.1.2 Ferricrete

Slightly moist, dark brown becoming yellow mottled orange and black, loose, silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles was encountered in twenty-three test pits from an average depth of 0,4 meters up to an average depth of 1,0 meters. In nine test pits the back actor refused hardpan ferricrete at an average depth of 0,7 meters.

7.1.3 Granite

Residual granite consisting of slightly moist, greyish white mottled orange and black, firm, intact, clayey sand with medium and large ferricrete concretions and with patches of very soft rock granite was encountered in three test pits from an average depth 0,7 meters up to an average depth of 1,3 meters and slightly moist, greyish white mottled orange, firm, intact, silty sand with very soft rock fragments was encountered in two test pits from an average depth 1,0 meters up to an average depth of 1,6 meters. Very soft rock granite was encountered in sixteen test pits from an average depth of 1,3 meters up to an average depth of 1,7 meters. The back actor refused on soft- to medium hard rock granite in sixteen test pits at an average depth of 1,4 meters.



TEST PIT POSITIONS	SCALE 1 : 7 500	FIGURE 2

8. GEOHYDROLOGY

No ground water was encountered during the investigation. The presence of pedogenic material however indicates that a perched water table could be present during and after periods of high rainfall.

9. LABORATORY TEST RESULTS

9.1 Indicator test results

The laboratory test results are attached as Appendix B and are summarized in the following table:

MATERIAL	TP	DEPTH (m)	PI	% Clay	% Silt	% Sand	% Gravel
Colluvium Type A	1	0.2	SP	3	11	85	1
Colluvium Type A	8	0.3	NP	1	11	86	2
Colluvium Type B	17	0.3	7	6	18	56	20
Colluvium Type B	20	0.3	NP	3	21	55	21
Colluvium Type B	24	0.4	7	7	14	46	33
Nodular ferricrete	1	0.8	SP	2	10	49	39
Nodular ferricrete	15	1.0	SP	4	8	45	43
Nodular ferricrete	22	1.0	SP	1	2	47	51
Residual granite Type 1	2	0.8	NP	1	13	47	39
Residual granite Type 2	21	1.3	SP	3	10	59	28

The difference between the Type A colluvium and the Type B colluvium is reflected by the higher sand- and lower gravel content of the Type A hillwash. The difference between the nodular ferricrete and the colluvium is shown by the higher gravel content and the difference between the nodular ferricrete and the residual granite is shown by the higher silt- and lower gravel content of the residual granite. The difference between the two types of residual granite is reflected by the higher gravel- and lower sand content of the Type 1 residual granite. The variation in the composition of the materials is clearly reflected by the results.

9.2 Potential expansiveness

The potential expansiveness of the materials encountered on the site was calculated according to the method proposed by Van der Merwe (1964). The following material characteristics are considered when applying this method:

- Plasticity index
- Clay fraction (< 0,002 mm)
- Thickness of expansive material
- Thickness of non - expansive material

Assuming the laboratory test results typify the material encountered on the site, the application of the method of Van der Merwe shows that all the materials classify as “Low” and is therefore considered to be non-expansive.

9.3 Collapse potential

Due to the consistency and the gravel content of the materials, no undisturbed samples were taken.

10. ENGINEERING GEOLOGICAL ZONING

The site was divided into the following Engineering Geological Zones:

Zone 1: Colluvium, nodular ferricrete and residual granite underlain by granite bedrock

Zone 2: Colluvium and nodular ferricrete underlain by hardpan ferricrete

The engineering geological zones are shown on Figure 3. *The boundaries between the different zones are based on field observations, aerial photographic interpretation and the interpolation of information between test pits. Therefore a conservative approach to the use of the engineering geological boundaries is recommended*

11. GEOTECHNICAL CONSIDERATIONS

The following geotechnical considerations, which could influence the proposed development, were identified:

11.1 Founding of structures

11.1.1 Engineering geological zone 1: Colluvium, nodular ferricrete and residual granite underlain by granite bedrock

- The composition and consistency of the colluvium varies considerably and the overall consistency is soft, therefore, it is not considered suitable founding material for unadapted structures. If unadapted structures are founded on this material, and the moisture content should increase, unacceptable differential, vertical movements could occur, with resultant cracking of structures.

- The consistency of the nodular ferricrete with patches of honeycomb ferricrete is loose and the gravel content varies considerably, therefore, it is not considered suitable founding material for unadapted structures. If unadapted structures are founded on this material, and the moisture content should increase, unacceptable differential, vertical movements could occur, with resultant cracking of structures.

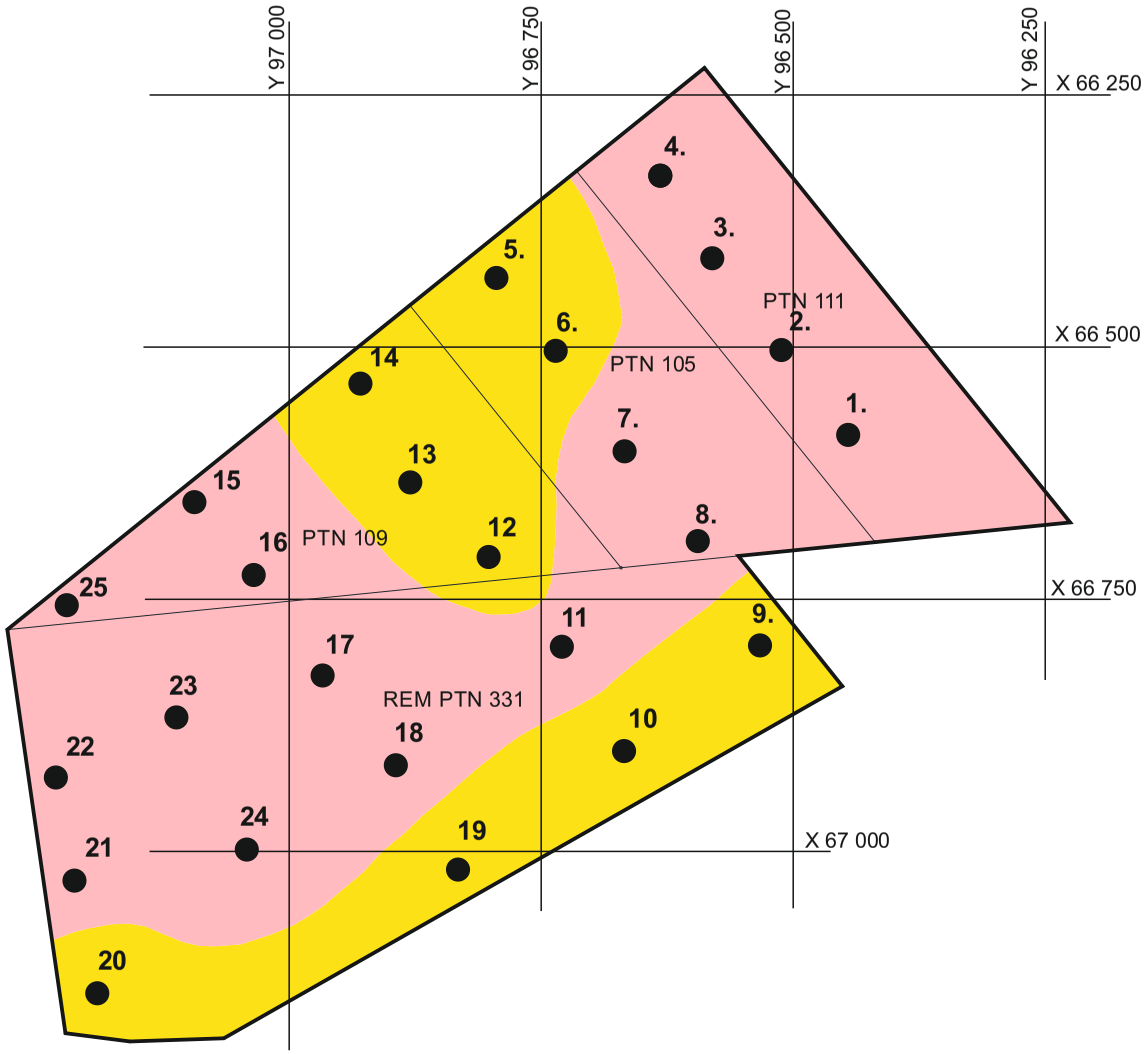
- The consistency of the nodular ferricrete with patches of honeycomb ferricrete is loose and the gravel content varies considerably, therefore, it is not considered suitable founding material for unadapted structures. If unadapted structures are founded on this material, and the moisture content should increase, unacceptable differential, vertical movements could occur, with resultant cracking of structures.

- The soft- to medium hard rock granite bedrock is considered suitable for the founding of structures.

11.1.2 Engineering geological zone 2: Colluvium and nodular ferricrete underlain by hardpan ferricrete

- The composition and consistency of the colluvium varies considerably and the overall consistency is soft, therefore, it is not considered suitable founding material for unadapted structures. If unadapted structures are founded on this material, and the moisture content should increase, unacceptable differential, vertical movements could occur, with resultant cracking of structures.

- The consistency of the nodular ferricrete with patches of honeycomb ferricrete is loose and the gravel content varies considerably, therefore, it is not considered suitable founding material for unadapted structures. If unadapted structures are founded on this material, and the moisture content should increase, unacceptable differential, vertical movements could occur, with resultant cracking of structures.



Zone 1: Colluvium, nodular ferricrete and residual granite underlain by granite bedrock.

Zone 2: Colluvium and nodular ferricrete underlain by hardpan ferricrete

The boundaries between the different zones are based on field observations, aerial photographic interpretation and the interpolation of information between test pits. Therefore a conservative approach to the use of the engineering geological boundaries is recommended

ENGINEERING GEOLOGICAL ZONING	SCALE 1 : 7 500	FIGURE 3

- The consistency of the nodular ferricrete with patches of honeycomb ferricrete is loose and the gravel content varies considerably, therefore, it is not considered suitable founding material for unadapted structures. If unadapted structures are founded on this material, and the moisture content should increase, unacceptable differential, vertical movements could occur, with resultant cracking of structures.

- Depending on the lateral and vertical continuity, the hardpan ferricrete is considered suitable for the founding of structures.

11.2 Excavatability

In engineering geological zone 1 the back actor refused at an average depth of 1,4 meters and in engineering geological zone 2 the back actor refused at an average depth of 0,7 meters.

11.3 Construction material

Both types of colluvium classify as A-2-4, the nodular ferricrete and residual granite classifies as A-1-b. The Plasticity Index and Grading Modulus were used to assess the suitability as construction material (TRH 14)

11.4 Groundwater

A perched water table, which could cause the flooding of excavations, could be present during or after periods of high rainfall. This is confirmed by the presence of pedogenic material.

11.5 Stability of excavations

Limited instability occurred in the sidewalls of the test pits.

12. GEOTECHNICAL CLASSIFICATION

The site was classified according to the Geotechnical Classification for Urban Development (after Partridge, Wood and Brink 1993). The criteria for the classification are shown in the following table:

GEOTECHNICAL CLASSIFICATION FOR URBAN DEVELOPMENT (after Partridge, Wood and Brink 1993)

CONSTRAINT		MOST FAVOURABLE (1)	INTERMEDIATE (2)	LEAST FAVOURABLE (3)
A	Collapsible soil	Any collapsible horizon or consecutive horizons totalling a depth of less than 750 mm in thickness	Any collapsible horizon or consecutive horizons totalling a depth of more than 750 mm in thickness	A least favourable situation for this constraint does not occur
B	Seepage	Permanent or perched water table more than 1,5 meters below surface	Permanent or perched water table less than 1,5 meters below surface	Swamps or marshes
C	Active soil	Low soil heave predicted	Moderate soil heave predicted	High soil heave predicted
D	Highly compressible soil	Low soil compressibility expected	Moderate soil compressibility expected	High soil compressibility expected
E	Erodibility of soil	Low	Intermediate	High
F	Difficulty of excavation to 1,5 m depth	Scattered or occasional boulders less than 10% of the total volume	Rock or hardpan pedocretes between 10 and 40% of the total volume	Rock or hardpan pedocretes more than 40% of total volume
G	Undermined ground	Undermining at a depth greater than 100 m below surface (except where total extraction mining has not occurred)	Old undermined areas to a depth of 100 m below surface where stope closure has ceased	Mining within less than 100 m of surface or where total extraction mining has taken place
H	Instability in areas of soluble rock	Possibly unstable	Probably unstable	Known sinkholes and dolines
I	Steep slopes	Between 2 and 6 degrees (all regions)	Slopes between 6 and 18 degrees and less 2 degrees (Natal and Western Cape) Slopes between 6 and 12 degrees and less 2 degrees (all other regions)	More than 18 degrees (Natal and western Cape) More than 12 degrees (all other regions)

	CONSTRAINT	MOST FAVOURABLE (1)	INTERMEDIATE (2)	LEAST FAVOURABLE (3)
J	Areas of unstable natural slopes	Low risk	Intermediate risk	High risk (especially in areas subject to seismic activity)
K	Areas subject to seismic activity	10% probability of an event less than 100 cm/s^2 within 50 years	Mining induced seismic activity more than 100 cm/s^2	Natural seismic activity more than 100 cm/s^2
L	Areas subject to flooding	A "most favourable" situation for this constraint does not occur	Areas adjacent to a known drainage channel or floodplain with slope less than 1%	Areas within a known drainage channel or floodplain

Based on the above, the site is classified as follows:

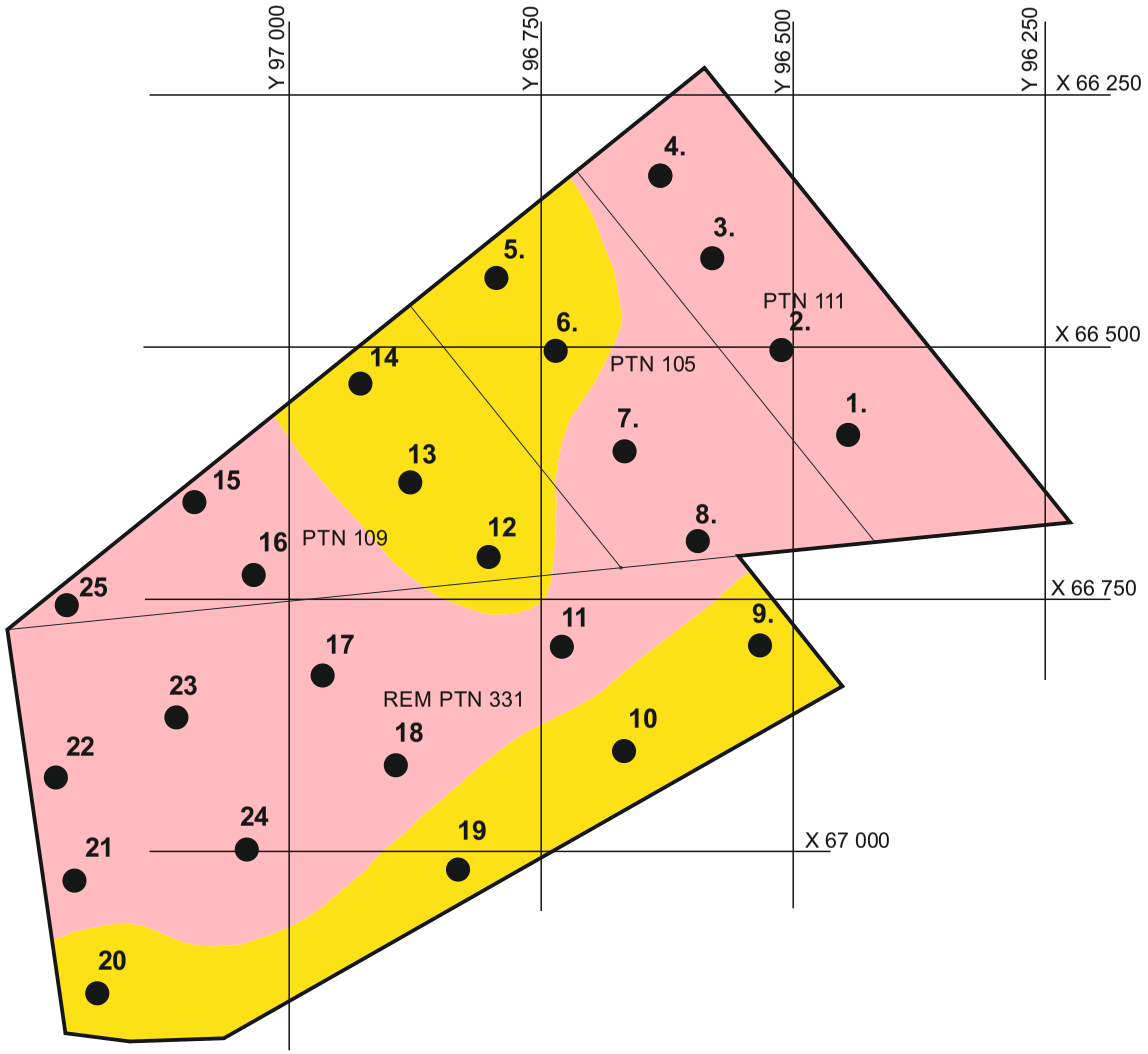
Engineering geological zone 1: 2A 1/2B 1C 2D 2E 2F 1I

Engineering geological zone 2: 1/2A 2B 1C 2D 2E 2/3F 1I

13. NHBRC CLASSIFICATION (SANS 10400-H: THE APPLICATION OF THE NATIONAL BUILDING REGULATIONS - PART H)

ZONE	NHBRC ZONE	MOTIVATION
Engineering geological zone 1 Geotechnical classification: 2A 1/2B 1C 2D 2E 2F 1I (see table)	P(Perched water table)-C1/C2-S1/S2	Due to the variation in composition, and the overall consistency, collapse is expected in the colluvium, nodular ferricrete and in the residual granite if unadapted structures are founded on it. The average thickness of the collapsible material is 1,4 meters and the thickness varies between 1,0 and 1,8 meters, therefore this part of the site is zoned as C1/C2-S1/S2. The presence of the shallow perched water table is accommodated by adding a zoning of P(Perched water table.
Engineering geological zone 2 Geotechnical classification: 1/2A 2B 1C 2D 2E 2/3F 1I (see table)	P(Perched water table)-R-C/C1-S/S1	Due to the variation in composition, and the overall consistency, collapse is expected in the colluvium and nodular ferricrete if structures are founded on it. The average thickness of the collapsible material is 0,7 meters and the thickness varies between 0,5 and 1,0 meters, therefore this part of the site is zoned as C/C1-S/S1. The presence of the shallow perched water table is accommodated by adding a zoning of P(Shallow water table),), and the presence of shallow hardpan ferricrete is accommodated by adding a zoning of R.

It is important to note that the zoning is based on the profiling of test pits and the interpolation of information between test pits; therefore it is possible that variations from the expected conditions can occur. The zoning is shown on Figure 4.



NHBRC Zone P(Perched water table)-C1/C2-S1/S2

NHBRC Zone P(Perched water table)-R-C/C1-S/S1

The boundaries between the different zones are based on field observations, aerial photographic interpretation and the interpolation of information between test pits. Therefore a conservative approach to the use of the engineering geological boundaries is recommended

NHBRC ZONING	SCALE 1 : 7 500	FIGURE 4

14. CONCLUSIONS AND RECOMMENDATIONS

It is important to note that the recommendations are based on the profiling of test pits and the interpolation of information. It is therefore possible that variations from the expected conditions can occur.

14.1 Foundations for light structures

14.1.1 NHBRC Zone P(Perched water table)-C1/C2-S1/S2

The colluvium, nodular ferricrete and the residual granite are expected to be potentially collapsible / compressible. Therefore this material is considered unsuitable in its natural state to act as a founding medium. This even applies for light structures with a foundation pressure of less than 100kPa. From the discussion foundation improvement and imparting flexibility in the brickwork are clearly required. The following alternatives are recommended:

If granite bedrock is present at shallow depth:

- *Deep strip footings:*
  Found structures below the potentially collapsible material. Structures should be provided with vertical movement joints, light reinforcement in the masonry and floor slabs should be provided with fabric reinforcement.

If the depth to granite bedrock becomes too deep to found economically:

- *Modified normal:*
  Found structures on reinforced strip footings, the foundation pressure should not exceed 50 kPa and structures should be provided with light reinforcement in the masonry and articulation joints at internal and external doors.

- *Stiffened strip footings, stiffened or cellular raft:*
  Found structures on stiffened strip footings or a stiffened or cellular raft with lightly reinforced masonry. The bearing pressure should not exceed 50 kPa and floor slabs should be reinforced.

- *Compaction of insitu soil below footings:*
  Remove unsuitable material up to a depth and width of 1,5 times the foundation width, below normal founding depth. The loose material in the bottom of excavations should be compacted, and the excavations backfilled with suitable material, compacted in 150 mm layers to at least 93% of Mod AASHTO density at -1% to +2% of optimum moisture content. Structures can be founded on normal reinforced strip footings on the backfill and should be provided with vertical movement joints, light reinforcement in the masonry and floor slabs should be provided with fabric reinforcement.

- *Soil raft:*
  Remove the collapsible material to 1,0 meters beyond the perimeter of the structure to at least a depth of 1,5 times the width of the widest foundation. The loose material in the bottom of excavations should be compacted, and the excavations backfilled with suitable material, compacted in 150 mm layers to at least 93% of Mod AASHTO density at -1% to +2% of optimum moisture content. Structures can be founded on normal reinforced strip footings on the backfill and should be provided with vertical movement joints and light reinforcement in the masonry.

- *Piled or pier foundations:*
  Found structures on piled or pier foundations with reinforced ground beams or solid slabs on piled or pier foundations

It is important though that in spite of the guidelines given above, inspection of foundation excavations and the involvement of a competent engineer familiar with structural founding are necessary. ***It is furthermore recommended that the trenches for services be profiled***

and that a construction report be compiled for the development. The purpose of the construction report is to confirm or adapt the zoning of the site, and to provide more accurate information regarding the founding conditions.

14.1.2 NHBRC Zone P(Perched water table)-R-C/C1-S/S1

The colluvium and nodular ferricrete are considered to be potentially collapsible. Therefore these materials are considered unsuitable in its natural state to act as a founding medium. This even applies for light structures with a foundation pressure of less than 100kPa. From the discussion foundation improvement and imparting flexibility in the brickwork are clearly required. The following alternatives are recommended:

If hardpan ferricrete is present at shallow depth and the lateral and vertical continuity is confirmed:

- *Deep strip footings:*
  Found structures below the potentially collapsible material. Structures should be provided with vertical movement joints, light reinforcement in the masonry and floor slabs should be provided with fabric reinforcement.

If the depth to hardpan ferricrete becomes too deep to found economically:

- *Modified normal:*
  Found structures on reinforced strip footings, the foundation pressure should not exceed 50 kPa and structures should be provided with light reinforcement in the masonry and articulation joints at internal and external doors.

- *Compaction of insitu soil below footings:*
  Remove unsuitable material up to a depth and width of 1,5 times the foundation width, below normal founding depth. The loose material in the bottom of excavations should be compacted, and the excavations backfilled with suitable material, compacted in 150 mm layers to at least 93% of Mod AASHTO density at -1% to +2% of optimum moisture content. Structures can be founded on normal reinforced strip footings on the backfill and should be provided with vertical movement joints and light reinforcement in the masonry.

- *Soil raft:*
  Remove the collapsible material to 1,0 meters beyond the perimeter of the structure to at least a depth of 1,5 times the width of the widest foundation. The loose material in the bottom of excavations should be compacted, and the excavations backfilled with suitable material, compacted in 150 mm layers to at least 93% of Mod AASHTO density at -1% to +2% of optimum moisture content. Structures can be founded on normal reinforced strip footings on the backfill and should be provided with vertical movement joints and light reinforcement in the masonry.

It is important though that in spite of the guidelines given above, inspection of foundation excavations and the involvement of a competent engineer familiar with structural founding are necessary. ***It is furthermore recommended that the trenches for services be profiled and that a construction report be compiled for the development. The purpose of the construction report is to confirm or adapt the zoning of the site, and to provide more accurate information regarding the founding conditions.***

14.1.3 Recommendations that apply to the entire site

Due to the slope of the site, it is envisaged that a level platform for the structure will be created by way of a balanced cut to fill operation. This means that on the cut end of the platform, excavations may have proceeded to the level of the hardpan ferricrete or granite bedrock, depending on the depth of cut and the thickness of the transported material at the cut end. When building platforms are constructed, the soil profile should be investigated to establish the approximate thickness of the various horizons within the platform area. The following guidelines should be followed:

- In cut sections, the alternatives listed in the previous section apply. Should the cut extend up to competent founding material, only loose material at founding level has to be removed or must be compacted

- On the fill end, the founding alternatives listed in the previous section apply. If the entire fill section is constructed by compacting a competent material, founding at shallow depth is possible.

It is important though that in spite of the guidelines given above, inspection of foundation excavations and the involvement of a competent engineer familiar with structural founding are necessary. ***It is furthermore recommended that the trenches for services be profiled and that a construction report be compiled for the development. The purpose of the construction report is to confirm or adapt the zoning of the site, and to provide more accurate information regarding the founding conditions.***

14.2 Foundations for large structures

Detailed foundation investigations should be done on the footprints of large structures.

14.3 Excavatability

The excavatability of the materials encountered on the site was evaluated according to the South African Bureau of Standards Standardized Specification for Civil Engineering Construction DB: Earthworks (Pipe Trenches. In NHBRC Zone P(Perched water table)-C1/C2-S1/S2 the excavatability is considered to classify as "soft to intermediate" up to an **average** depth of one meter. In NHBRC Zone P(Perched water table)-R-C/C1-S/S1 the excavatability is considered to classify as "soft to intermediate" up to an **average** depth of 0,5. *It is important to note that the evaluation is based primarily on the profiling of test pits and the interpolation of information between test pits. It is therefore possible that variations from the expected conditions can occur.*

14.4 Geohydrology

All excavations should be provided with adequate drainage. Structures should be provided with damp proofing and provision should be made to prevent the ingress of water into– and below foundations.

14.5 Construction material

Both types of hillwash could be suitable as fill and selected sub-grade, the nodular ferricrete and the residual granite could be suitable as fill, selected sub-grade and sub-base. *It is recommended that the suitability of material that is to be used, be confirmed by detailed laboratory testing*.

14.5 Services

Due to the expected corrosivity, it is recommended that all services be protected.

14.7 Stability of excavations

It is recommended that all excavations be cut back or shored.

14.8 General recommendations

- Water has a significant influence on the behaviour of the in-situ material. To reduce differential movements of structures it is necessary to maintain moisture equilibrium under the structures. Therefore it is recommended that the following measures regarding drainage around structures be implemented:

- No accumulation of surface water must be allowed around the perimeter of the structures and the entire development must be properly drained.

- Down pipes should discharge into a lined or precast furrow. This furrow should discharge the water 1,5 meters away from the foundation onto a paved or grassed surface sloping away from the building.

- Preferably, if no gutters or paving is to be provided around structures, a 1,5 meter wide sealed concrete apron should be cast along the perimeter of the structures the water must be channeled away from the foundation.

- Leaks in water bearing services should be attended to without undue delay.

- No large shrubs or trees should be planted closer to structures than the distances provided in the following Table:

DESCRIPTION	**MATURE HEIGHT OF TREE**		
	Up to 8m	**8m tot 15m**	**Over 15m**
Buildings other than single storey buildings of lightweight construction	-	0.5	1,2
Single storey buildings of lightweight construction (e.g. timber framed)	-	0.7	1,5
Free standing masonry walls	-	1,0[1] 0,5[2]	2,0[1] 1,0[2]
Drains and underground services • less than 1 meter deep • more than 1 meter deep	 0,5 -	 1,5 1,0	 3,0 2,0

Note:
1) These distances will generally avoid all direct damage
2) These distances assume that some movement and minor damage, which may be tolerated, might occur.

This table provides guidance on the acceptable proximity of young trees or new planting to allow for future growth. This table should not be taken to imply that construction work can occur at the specified distances from existing trees; as such work might damage the tree, or render it dangerous, but refers to the potential for future growth, either of a young tree or of planting, occurring subsequent to construction

L.J Kruger Pr. Sci. Nat.

15. REFERENCES

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- "Home Building Manual Part 1 & 2", National Home Builders Registration Council, 1999
- "Revised Guide to Soil Profiling for Civil Engineering Purposes in Southern Africa", Jennings Brink and Williams, The Civil Engineer in SA, 1973
- "The Prediction of Soil Heave from the Plasticity Index and Percentage Clay Fraction of Soils", D.H van der Merwe, The Civil Engineer in South Africa, 1964
- "A Guide to Construction on or with Materials Exhibiting Additional Settlement due to Collapse of Grain Structure", Jennings and Knight 1975
- "A Short Workshop on Suggested Interpretation Techniques of Soil Movement with Emphasis on Heave and Collapse Conditions": SAIEG, 1999
- "The Engineering Geology of Southern Africa", Volumes 1, 2 , 3 and 4, A.B.A Brink
- "Soil Survey for Engineering", Brink, Partridge & Williams
- South African Bureau of Standards Standardized Specification for Civil Engineering Construction DB: Earthworks (Pipe Trenches) SABS 1200 DB-1982
- Technical Recommendations for Highways, TRH 14 of 1985

APPENDIX A

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 1. DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,3
			Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			1,5
			Slightly moist, orange speckled white with black stained joints, very soft rock granite
			1,8
			Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 2. DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,3
			Slightly moist, greyish white mottled orange and black, firm, intact, clayey sand with medium and large ferricrete concretions and with patches of very soft rock granite - Reworked residual granite
			1,3 Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

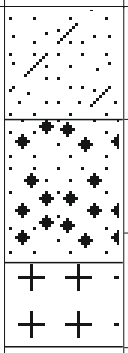
SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 3. DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,5 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			1,2 Slightly moist, orange speckled white with black stained joints, very soft rock granite
			1,5 Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

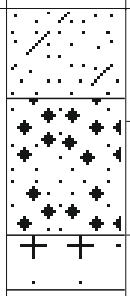
SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 4. DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium 0,4 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles 1,0 Slightly moist, orange speckled white with black stained joints, very soft rock granite 1,3 Refusal on soft rock granite No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 5. DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,3 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			0,8 Refusal on hardpan ferricrete
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 6. DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,3 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			0,5 Refusal on hardpan ferricrete
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 7 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,3 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			0,8 Slightly moist, greyish white mottled orange and black, firm, intact, clayey sand with medium and large ferricrete concretions and with patches of very soft rock granite - Reworked residual granite
			1,2 Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 8. DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
		0,5	Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
		1,0	Slightly moist, greyish white mottled orange and black, firm, intact, clayey sand with medium and large ferricrete concretions and with patches of very soft rock granite - Reworked residual granite
		1,5	Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 9 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,3 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			0,8 Refusal on hardpan ferricrete
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 10 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,4 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			0,8 Refusal on hardpan ferricrete
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 11 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,4
			Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			1,0
			Slightly moist, greyish white mottled orange, firm, intact, silty sand with very soft rock fragments - Residual granite
			1,4
			Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 12 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,2 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			0,5 Refusal on hardpan ferricrete
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

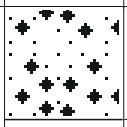
SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 13 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			0,5 Refusal on hardpan ferricrete
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

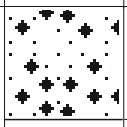
SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 14 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			0,5 Refusal on hardpan ferricrete
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 15 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,3
			Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			1,5
			Slightly moist, orange speckled white with black stained joints, very soft rock granite
			1,8
			Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 16 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,3
			Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			1,5
			Slightly moist, orange speckled white with black stained joints, very soft rock granite
			1,8
			Refusal on soft rock granite
			No ground water

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SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 17 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, brown, soft, shattered, silty, gravelly, sand with plant roots - Colluvium
			0,5 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			1,2 Slightly moist, orange speckled white with black stained joints, very soft rock granite
			1,8 Refusal on soft rock granite
			No ground water

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SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 18 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, brown, soft, shattered, silty, gravelly, sand with plant roots - Colluvium
			0,6 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			1,0 Slightly moist, orange speckled white with black stained joints, very soft rock granite
			1,5 Refusal on soft rock granite
			No ground water

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SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 19 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, brown, soft, shattered, silty, gravelly, sand with plant roots - Colluvium
			0,3 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			1,0 Refusal on hardpan ferricrete
			No ground water

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SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 20 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, brown, soft, shattered, silty, gravelly, sand with plant roots - Colluvium
			0,5 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			0,9 Refusal on hardpan ferricrete
			No ground water

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SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 21 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, brown, soft, shattered, silty, gravelly, sand with plant roots - Colluvium
			0,9
			Slightly moist, greyish white mottled orange, firm, intact, silty sand with very soft rock fragments - Residual granite
			1,8
			Refusal on soft rock granite
			No ground water

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SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 22 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, brown, soft, shattered, silty, gravelly, sand with plant roots - Colluvium
		0,5	
			Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
		1,6	Slightly moist, orange speckled white with black stained joints, very soft rock granite
		2,0	Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 23 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, brown, soft, shattered, silty, gravelly, sand with plant roots - Colluvium
			0,6
			Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			1,5
			Slightly moist, orange speckled white with black stained joints, very soft rock granite
			2,3
			Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 24 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, brown, soft, shattered, silty, gravelly, sand with plant roots - Colluvium
			0,6
			Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			1,5
			Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

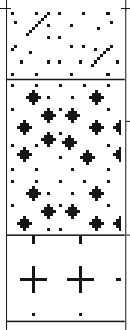
SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 25 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Fill, consisting of dark brown, soft, clayey sand with plant roots 0,3 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles 1,0 Slightly moist, orange speckled white with black stained joints, very soft rock granite 1,4 Refusal on soft rock granite No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

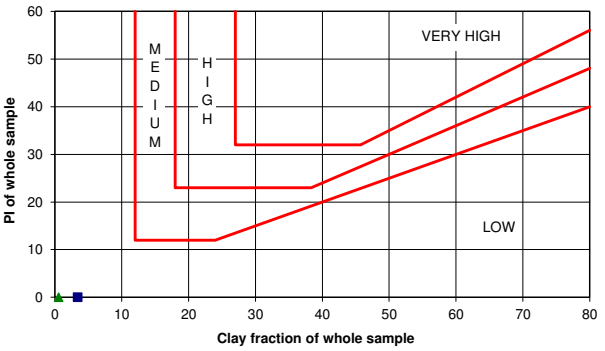
APPENDIX B

PARTICLE SIZE ANALYSIS

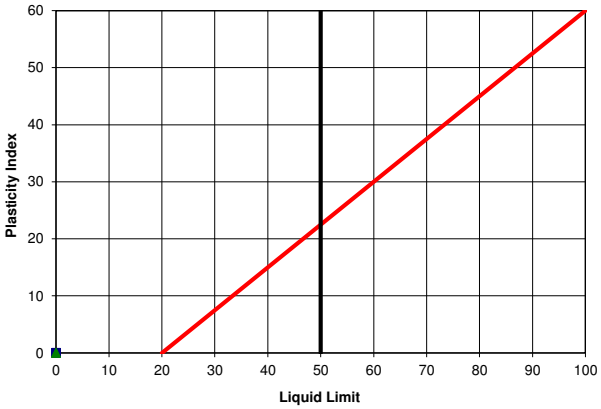
Sample No.	1	2
Soillab Sample No.	2015-S-1607-01	2015-S-1607-02
Depth (m)		
Position	SAMPLE 1	SAMPLE 2
Material Description	DARK GREY SILTY SAND	DARK GREY FERRICRETE W/ GRANITE SANDY GRAVEL
Organic Material	YES	YES
Moisture (%) / Dispersion (%)		
SCREEN ANALYSIS (% PASSING) **(TMH 1 A1(a) & A5)**		
63.0 mm	100	100
53.0 mm	100	100
37.5 mm	100	100
26.5 mm	100	100
19.0 mm	100	100
13.2 mm	100	100
4.75 mm	100	78
2.00 mm	99	49
0.425 mm	57	7
0.075 mm	16	3
HYDROMETER ANALYSIS (% PASSING) **(TMH 1 A6)**		
0.040 mm	11	2
0.027 mm	10	2
0.013 mm	7	1
0.005 mm	6	1
0.002 mm	3	1
% Clay	3	1
% Silt	11	2
% Sand	85	47
% Gravel	1	51
ATTERBERG LIMITS **(TMH 1 A2 - A4)**		
Liquid Limit		
Plasticity Index	SP	SP
Linear Shrinkage (%)	0.5	1.0
Grading Modulus	1.27	2.41
Uniformity coefficient	19	6
Coefficient of curvature	1.5	0.7
Classification	A-2-4 (0)	A-1-a (0)
Unified Classification	SM	SP
Chart Reference		

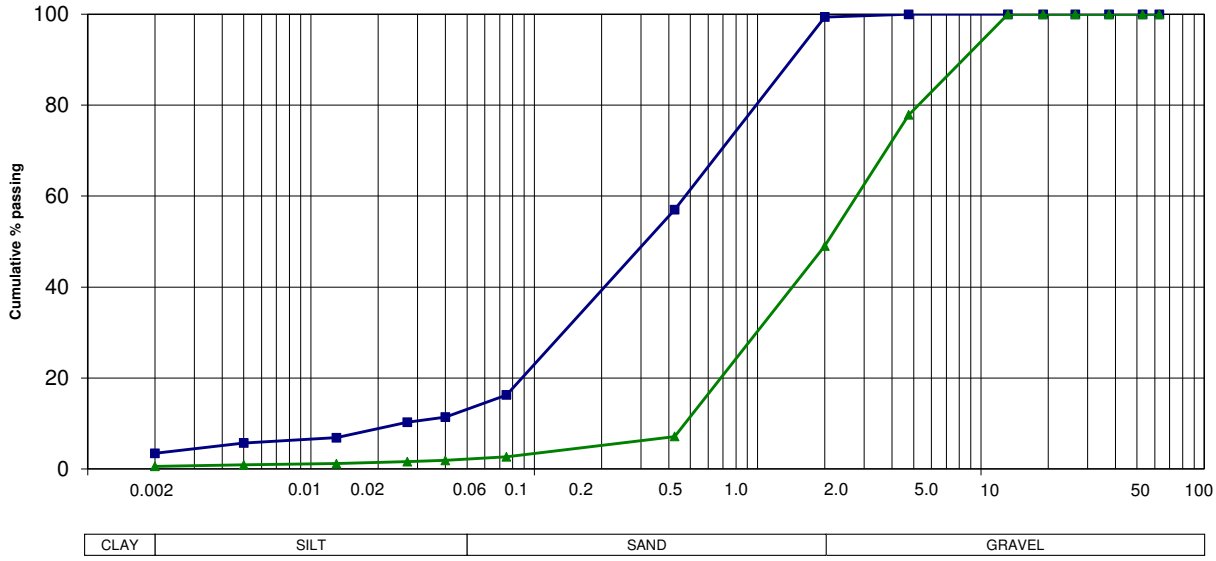
PROJECT : KNOPJESFONTEIN X2
JOB No. : 2015-S-1607
DATE : 18-11-2015

POTENTIAL EXPANSIVENESS



PLASTICITY CHART





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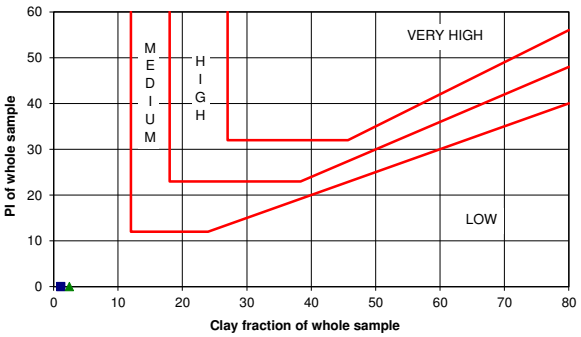
PARTICLE SIZE ANALYSIS

Sample No.	3	4
Soillab Sample No.	2015-S-1607-03	2015-S-1607-04
Depth (m)		
Position	SAMPLE 3	SAMPLE 4
Material Description	LIGHT GREY SILTY SAND	DARK GREY FERRICRETE QUARTZ GRAVELLY SAND
Organic Material	YES	YES
Moisture (%) / Dispersion (%)		
SCREEN ANALYSIS (% PASSING) **(TMH 1 A1(a) & A5)**		
63.0 mm	100	100
53.0 mm	100	100
37.5 mm	100	92
26.5 mm	100	92
19.0 mm	100	91
13.2 mm	100	89
4.75 mm	100	75
2.00 mm	98	61
0.425 mm	56	41
0.075 mm	14	14
HYDROMETER ANALYSIS (% PASSING) **(TMH 1 A6)**		
0.040 mm	9	10
0.027 mm	7	8
0.013 mm	4	6
0.005 mm	3	5
0.002 mm	1	2
% Clay	1	2
% Silt	11	10
% Sand	86	49
% Gravel	2	39
ATTERBERG LIMITS **(TMH 1 A2 - A4)**		
Liquid Limit		
Plasticity Index	NP	SP
Linear Shrinkage (%)	0.0	0.5
Grading Modulus	1.32	1.84
Uniformity coefficient	11	45
Coefficient of curvature	0.9	0.6
Classification	A-2-4 (0)	A-1-b (0)
Unified Classification	SM	SM
Chart Reference		

PROJECT : KNOPJESFONTEIN X2
JOB No. : 2015-S-1607
DATE : 18-11-2015

POTENTIAL EXPANSIVENESS



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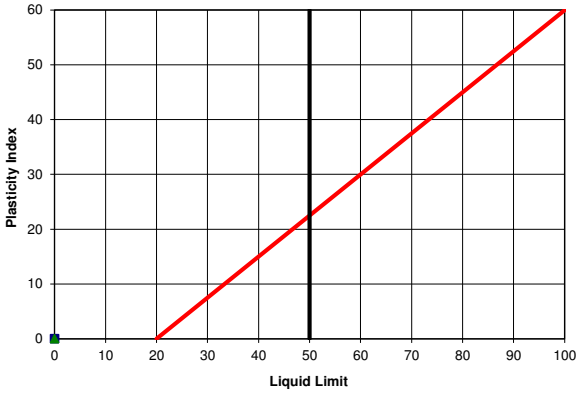

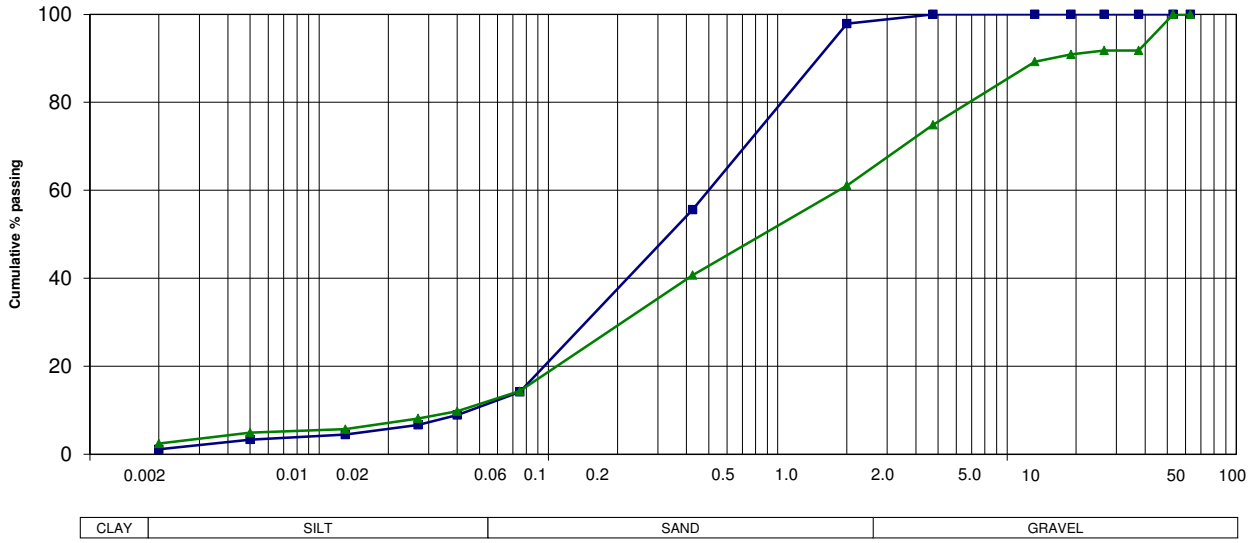

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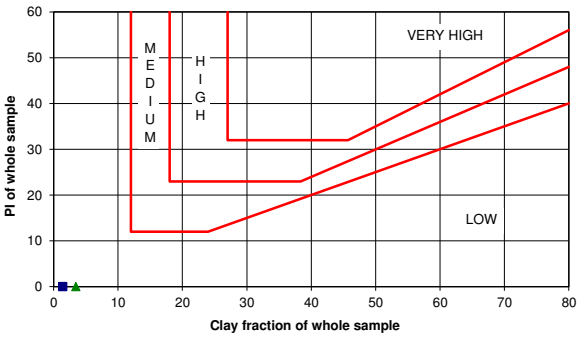
PARTICLE SIZE ANALYSIS

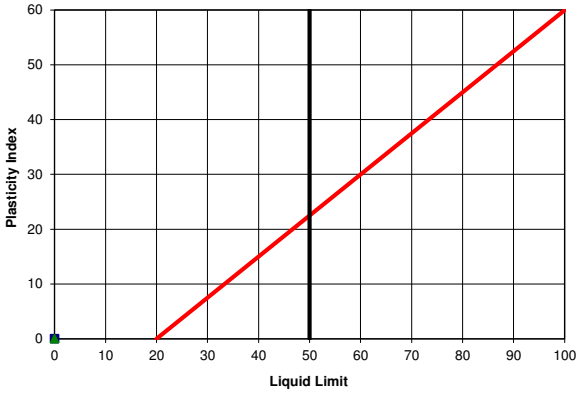
Sample No.	5	6
Soillab Sample No.	2015-S-1607-05	2015-S-1607-06
Depth (m)		
Position	SAMPLE 5	SAMPLE 6
Material Description	DARK REDDISH BROWN FERRICRETE QUARTZ GRAVELLY SAND	DARK GREY FERRICRETE QUARTZ GRAVELLY SAND
Organic Material		YES
Moisture (%) / Dispersion (%)		
SCREEN ANALYSIS (% PASSING) **(TMH 1 A1(a) & A5)**		
63.0 mm	100	100
53.0 mm	100	100
37.5 mm	100	100
26.5 mm	100	100
19.0 mm	100	100
13.2 mm	98	96
4.75 mm	74	82
2.00 mm	61	72
0.425 mm	35	43
0.075 mm	17	15
HYDROMETER ANALYSIS (% PASSING) **(TMH 1 A6)**		
0.040 mm	11	10
0.027 mm	8	9
0.013 mm	4	6
0.005 mm	3	5
0.002 mm	1	3
% Clay	1	3
% Silt	13	10
% Sand	47	59
% Gravel	39	28
ATTERBERG LIMITS **(TMH 1 A2 - A4)**		
Liquid Limit		
Plasticity Index	NP	SP
Linear Shrinkage (%)	0.0	1.0
Grading Modulus	1.87	1.69
Uniformity coefficient	50	28
Coefficient of curvature	1.0	0.9
Classification	A-1-b (0)	A-1-b (0)
Unified Classification	SM	SM
Chart Reference		

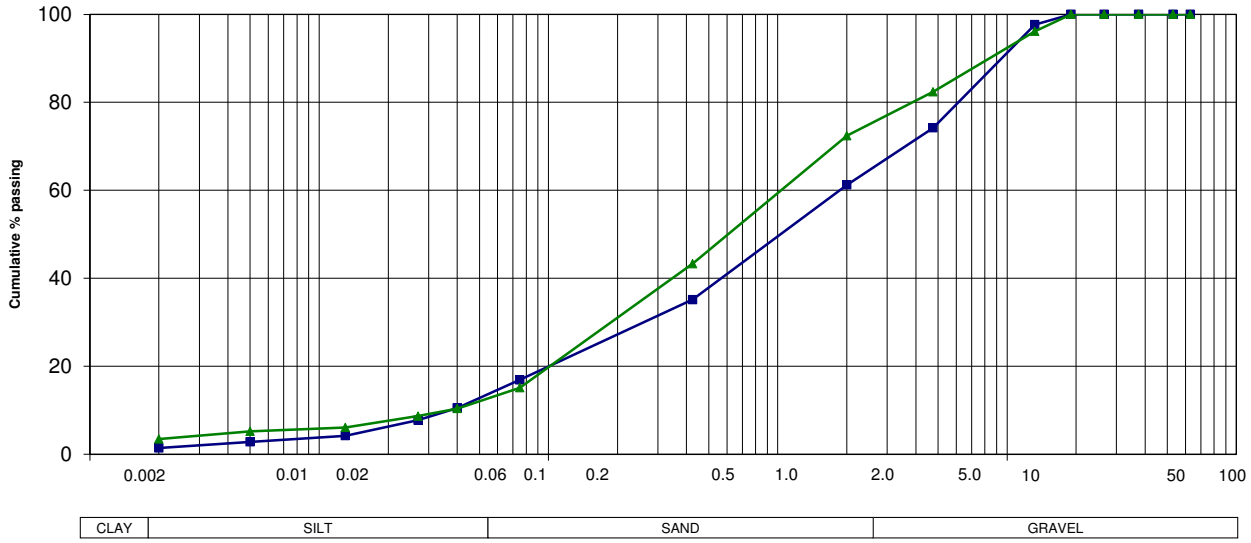
PROJECT : KNOPJESFONTEIN X2
JOB No. : 2015-S-1607
DATE : 18-11-2015

POTENTIAL EXPANSIVENESS



PLASTICITY CHART





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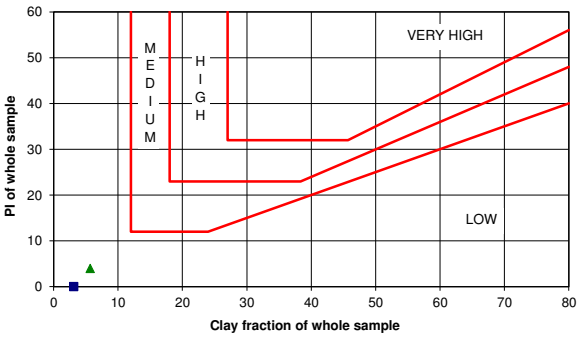
PARTICLE SIZE ANALYSIS

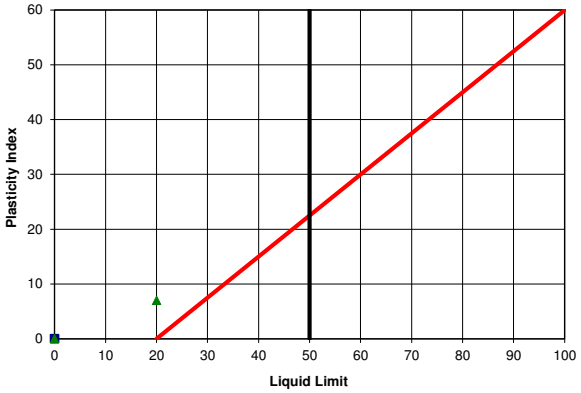
Sample No.	7	8
Soillab Sample No.	2015-S-1607-07	2015-S-1607-08
Depth (m)		
Position	SAMPLE 7	SAMPLE 8
Material Description	LIGHT BROWN FERRICRETE W/ GRANITE GRAVELLY SAND	DARK GREY FERRICRETE W/ GRANITE GRAVELLY SAND
Organic Material		YES
Moisture (%) / Dispersion (%)		
SCREEN ANALYSIS (% PASSING) **(TMH 1 A1(a) & A5)**		
63.0 mm	100	100
53.0 mm	100	100
37.5 mm	100	100
26.5 mm	100	100
19.0 mm	100	100
13.2 mm	95	98
4.75 mm	87	89
2.00 mm	79	80
0.425 mm	52	57
0.075 mm	28	28
HYDROMETER ANALYSIS (% PASSING) **(TMH 1 A6)**		
0.040 mm	18	19
0.027 mm	13	16
0.013 mm	7	11
0.005 mm	5	9
0.002 mm	3	6
% Clay	3	6
% Silt	21	18
% Sand	55	56
% Gravel	21	20
ATTERBERG LIMITS **(TMH 1 A2 - A4)**		
Liquid Limit		20
Plasticity Index	NP	7
Linear Shrinkage (%)	0.0	3.0
Grading Modulus	1.40	1.36
Uniformity coefficient	35	72
Coefficient of curvature	0.6	1.9
Classification	A-2-4 (0)	A-2-4 (0)
Unified Classification	SM	SM & SC
Chart Reference		

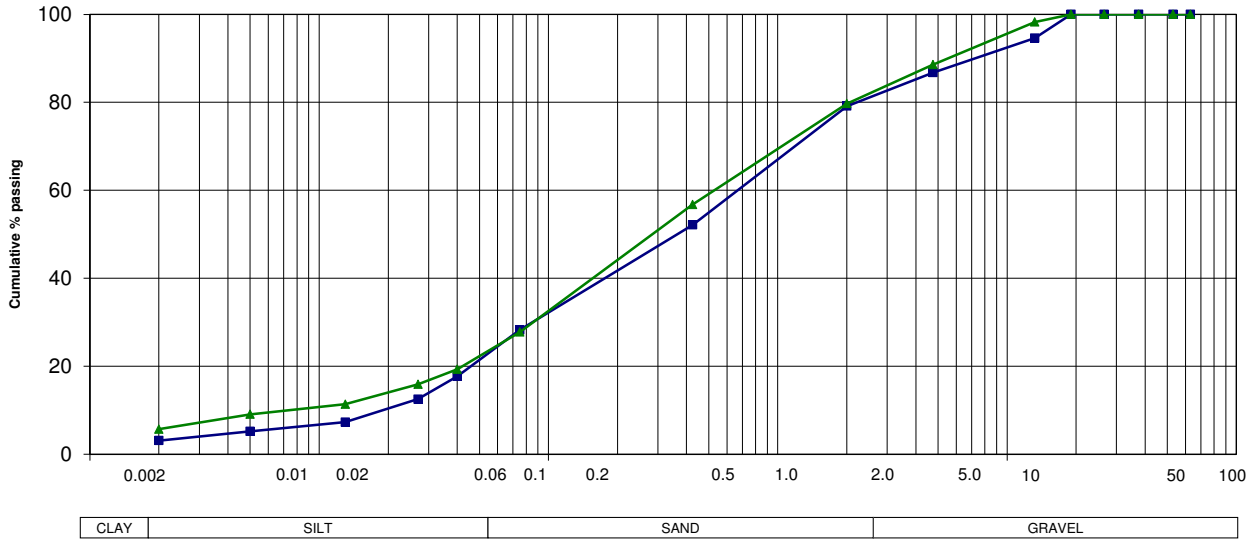
PROJECT : KNOPJESFONTEIN X2
JOB No. : 2015-S-1607
DATE : 18-11-2015

POTENTIAL EXPANSIVENESS



PLASTICITY CHART





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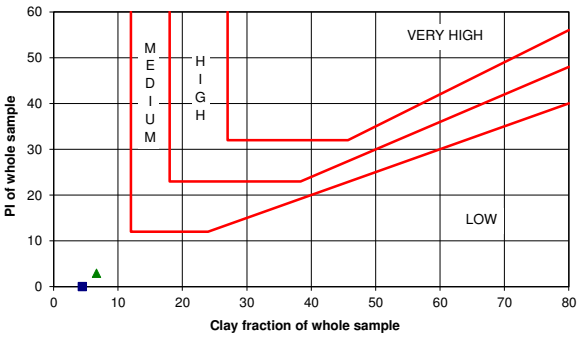
PARTICLE SIZE ANALYSIS

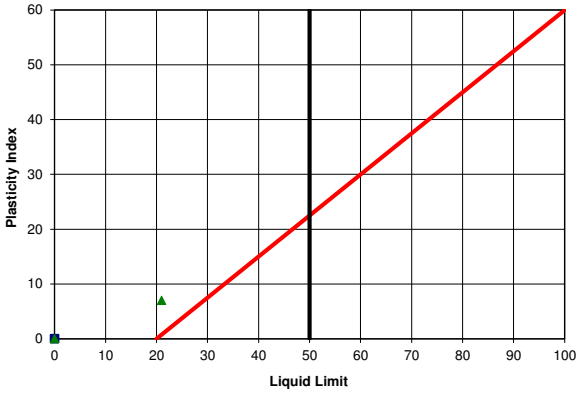
Sample No.	9	10
Soillab Sample No.	2015-S-1607-09	2015-S-1607-10
Depth (m)		
Position	SAMPLE 9	SAMPLE 10
Material Description	DARK BROWN QUARTZ FERRICRETE GRAVELLY SAND	LIGHT BROWN FERRICRETE W/ GRANITE GRAVELLY SAND
Organic Material		
Moisture (%) / Dispersion (%)		
SCREEN ANALYSIS (% PASSING) **(TMH 1 A1(a) & A5)**		
63.0 mm	100	100
53.0 mm	100	100
37.5 mm	100	100
26.5 mm	100	100
19.0 mm	100	100
13.2 mm	94	98
4.75 mm	75	90
2.00 mm	57	67
0.425 mm	37	42
0.075 mm	15	25
HYDROMETER ANALYSIS (% PASSING) **(TMH 1 A6)**		
0.040 mm	9	16
0.027 mm	8	13
0.013 mm	7	10
0.005 mm	5	7
0.002 mm	4	7
% Clay	4	7
% Silt	8	14
% Sand	45	46
% Gravel	43	33
ATTERBERG LIMITS **(TMH 1 A2 - A4)**		
Liquid Limit		21
Plasticity Index	SP	7
Linear Shrinkage (%)	1.0	3.0
Grading Modulus	1.91	1.67
Uniformity coefficient	52	99
Coefficient of curvature	0.6	1.0
Classification	A-1-b (0)	A-2-4 (0)
Unified Classification	SM	SM & SC
Chart Reference		

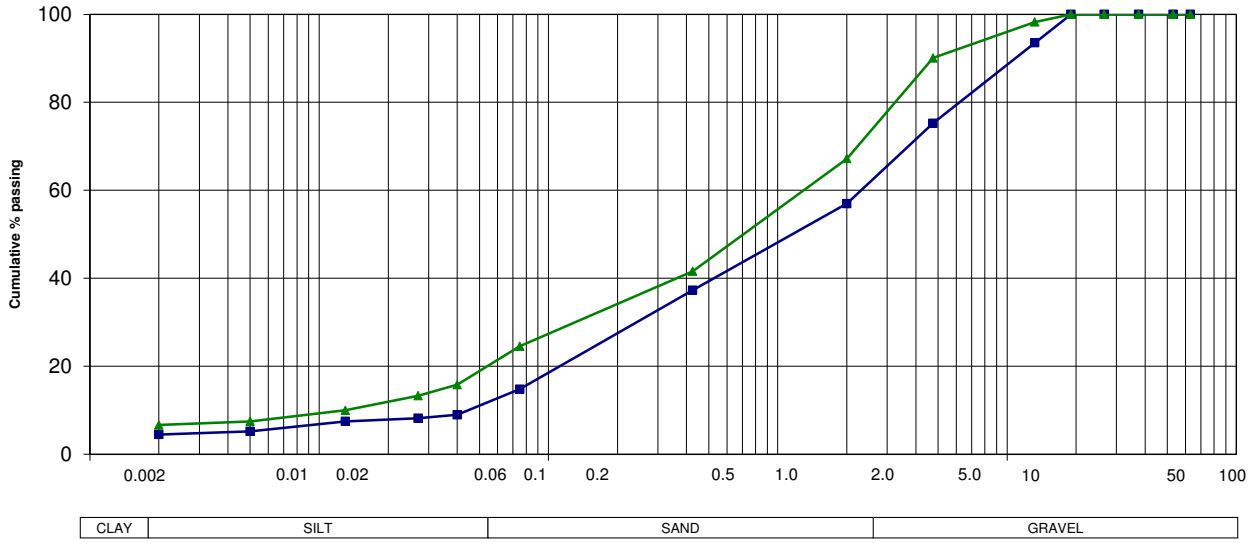
PROJECT : KNOPJESFONTEIN X2
JOB No. : 2015-S-1607
DATE : 18-11-2015

POTENTIAL EXPANSIVENESS



PLASTICITY CHART





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Appendix G4

Electrical Report

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FAX : +27 (0) 12 663 7106
e-mail : scarrack@elektroplan.co.za

YOUR REF:	OUR REF:	DATE:
	PTI/05/16	2016-07-01

Mr. E. M. Keyser
NAPAJ Property Investment & Development (Pty) Ltd.
P.O. Box 34093
ERASMIA
0023

Dear Sir,

PROPOSED PEACH TREE INDUSTRIAL TOWNSHIP : ELECTRICAL RETICULATION : REVISED PROVISIONAL BASIC SERVICES REPORT

1. BULK ELECTRICAL SERVICES

This area falls within the Eskom, and more specific, the Eskom Laezonia Substation supply area and/but also within the boundaries of the City of Tshwane Metropolitan Municipality.

Following the possible upgrade of the Laezonia substation by Eskom, the supply of bulk power (maximum demand) to this proposed development, should under normal circumstances not pose a problem. However, for the proposed development of Peach Tree Extensions 15 & 16, Eskom indicated/written to those Developers (see attached correspondence in Annexure A), that they are presently not able to supply bulk power to those developments, in the near future. Therefore, with this development, situated in the close vicinity of those developments, it is recommended that negotiations are entered into with the City of Tshwane, for the supply of bulk power to this development.

It is known to us that, the CoT : Energy & Electricity department, is in the process of establishing a new 11kV satellite substation in the close vicinity of the existing Copper Leaf Golf Estate. This substation should be completed within the next nine months.

Therefore, due to the above-mentioned and the location of this satellite substation, negotiations will be entered into with the CoT, for the supply of bulk power to this proposed development.

.....2/

Due to excessive distances, loads and particularly with regards to voltage drop constraints on the medium voltage distribution system, it is hereby recommended that this proposed township/development be divided into two or more township extensions, to enable power to the initial extension (due to estimated load requirements) from the new satellite substation situated at the Copper Leaf Golf Estate. Important, services are not taken over by the CoT in phases, only in completed Extensions.

For further extensions on this property, external feeder cables must be installed in future from the new planned Monavoni primary substation to this development to accommodate the estimated loads. It is estimated that the Monavoni primary substation will be completed in approximately 24 working months, assuming the Contract start officially in July 2016, the start of the new CoT financial year. According to information received from the CoT, tenders for the Monavoni substation are already in place and the appointment of successful contractors, is imminent.

In terms of the distance that this site will eventually be from the future Monavoni substation, there will obviously be an offset in terms of payable bulk supply contribution to the CoT, for external cables installed to/for this proposed development.

2. ESTIMATED LOAD REQUIREMENTS

This proposed development, planned in four extensions/phases, consists mainly of twenty five stands in total, planned for commercial and light industrial, one stand for Municipal & one stand for infrastructure works, purposes. This proposed development is situated on Portions 105, 109 & 331 of the farm Knopjeslaagte 385-JR, totaling approximately 41.66ha. With this taken into account, the estimated load requirements for this development, are as follows :-

TABLE 1

Estimated Load Requirements For Proposed Extension 1

Item	Description	Estimated Load
1.	Commercial & light industrial : 2 stands : 7.57ha @ 50% FSR X 4kVA/100m²	1 513.60kVA
2.	Infrastructure Works : 1 stand : 0.10ha @ 50% FSR X 4kVA/100m²	20.00kVA
3.	Total Estimated Load : Extension 1	1 533.60kVA

The total estimated load for proposed Extension 1 is approximately **1.53MVA**

...../3

TABLE 2

Estimated Load Requirements For Proposed Extension 2

Item	Description	Estimated Load
1.	Commercial & light industrial : 4 stands : 7.79ha @ 50% FSR X 4kVA/100m²	1 558.10kVA
2.	Municipal : 1 stand : 0.60ha @ 50% FSR X 4kVA/100m²	120.00kVA
3.	Total Estimated Load : Extension 2	1 678.10kVA

The total estimated load for proposed Extension 2 is approximately **1.68MVA**

TABLE 3

Estimated Load Requirements For Proposed Extension 3

Item	Description	Estimated Load
1.	Commercial & light industrial : 7 stands : 10.88ha @ 50% FSR X 4kVA/100m²	2 176.30kVA
2.	Total Estimated Load : Extension 3	2 176.30kVA

The total estimated load for proposed Extension 3 is approximately **2.18MVA**

TABLE 4

Estimated Load Requirements For Proposed Extension 4

Item	Description	Estimated Load
1.	Commercial & light industrial : 6 stands : 9.41ha @ 50% FSR X 4kVA/100m²	1 882.80kVA
2.	Total Estimated Load : Extension 4	1 882.80kVA

The total estimated load for proposed Extension 4 is approximately **1.88MVA**

Therefore, the total estimated load for the complete proposed development is approximately **7.27MVA**.

…../4


PORTION 111
KNOP JESLAAGTE 385-JR
PORTION 914
KNOP JESLAAGTE 385-JR
EXTENSION 1
EXTENSION 2
EXTENSION 3
EXTENSION 4
PROPOSED 20m STREET
PROPOSED 25m STREET
PROPOSED 20m STREET
PROPOSED 20m STREET
PORTION 105
KNOP JESLAAGTE 385-JR
PORTION 109
KNOP JESLAAGTE 385-JR
R/PORTION 331
KNOP JESLAAGTE 385-JR
K34 KRUGERSDORP PRETORIA ROAD
N14-HIGHWAY (P156/2)
ROAD PROCLAMATION NO. 1439/73
158 -ZONIA A.H.
157
N
A
B
C
D
E
F
G
H
J
1
20kVA
2
760kVA
3
752kVA
4
786,80kVA
5
365,30kVA
6
359,30kVA
7
356,50kVA
8
329,60kVA
9
423,30kVA
10
373,40kVA
11
389,70kVA
12
358,60kVA
13
226,00kVA
14
120kVA
15
273,70kVA
16
271,60kVA
17
267,60kVA
18
221,60kVA
19
215,40kVA
20
200kVA
21
200kVA
22

...../5

3. REQUIRED ELECTRICAL MATERIALS AND EQUIPMENT

3.1 11 kV (Medium Voltage) Ring Feeder Cables

The minimum requirement for this type of development is 150mm² Cu 3-core PVC SWA PVC 11/11kV, underground cables. It may be a CoT requirement to supply & install 240mm² Cu 3-core PVC SWA PVC 11/11kV cables complete with outdoor SF6 switching units for the external bulk supply to this proposed development, due to distances.

3.2 Miniature-substations

SF6 type, concrete base, pavement mounted miniature= substations must be installed to supply low voltage power to the individual stands, as per the load requirements and designs.

3.3 Main Low Voltage Feeder Cables

600/1 000 V Cu 4-core SWA main low voltage underground feeder cables, sized as per the load requirements for each individual stand, must be installed from the miniature-substations to at least 1m into each stand.

3.4 Metering/Distribution Cubicles

12 Way, 3CR12, stubby type, side walk mounted cubicles, must be installed to supply power to individual stands and allow individual metering of electrical consumption. For larger bulk type service connections, SF6 type metering units in combination with T3 ring main units, will be required.

3.5 Street-ligting

Street-light luminaires mounted on galvanized steel poles with galvanized steel luminaire outreach must be installed in accordance with CIE 140 specifications/standards for Group A or B type roads.

For Eskom, it is a requirement of Eskom that the Developer utilize energy efficient technologies and equipment in accordance with good practice in the Residential sector and the Developer must comply with the provisions of the Distribution code.

All required electrical materials and equipment for this development must be in accordance with the Eskom specifications.

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4. FINANCIAL CONTRIBUTIONS/CHARGES :

CITY OF TSHWANE : BULK SUPPLY CONTRIBUTIONS

With the City of Tshwane assumed as the supply Authority for this planned/proposed development, electrical bulk supply contributions as determined and calculated by the City of Tshwane Electrical Services Department, based on the estimated load and current Municipal tariffs (adjusted on the first day of July every new Council financial year), will be payable for these proposed developments by the Developer to the City of Tshwane. The amounts payable will be indicated in the Services Agreement between the City of Tshwane and the Developer.

The estimated bulk contribution amounts (at this stage worst case scenario), based on the City of Tshwane current financial year tariffs, are as follows :-

1. Peach Tree Industrial Extension 1 : 1 533.60kVA x R 2 445.00/kVA = **R 3 749 652.00** (Ex V.A.T.)
2. Peach Tree Industrial Extension 2 : 1 678.10kVA x R 2 445.00/kVA = **R 4 102 954.50** (Ex V.A.T.)
3. Peach Tree Industrial Extension 3 : 2 176.20kVA x R 2 445.00/kVA = **R 5 320 809.00** (Ex V.A.T.)
4. Peach Tree Industrial Extension 4 : 1 882.80kVA x R 2 445.00/kVA = **R 4 603 446.00** (Ex V.A.T.)

ESKOM CONNECTION CHARGES (IF APPLICABLE)

In addition to the Eskom standard tariff charges, connection charges are payable to Eskom to recoup the cost of providing the bulk connection.

The following short explanations for Connection Fee, Standard Connection Charge, Up-front Connection Charge and Distribution Connection Charges, are as follows :-

a. Connection Fee : It is the minimum up-front contribution towards the connection charge that is payable on the acceptance of the budget quotation.

   If acceptance of the budget quote is cancelled before actual survey or any physical construction work has been done, the Connection Fee plus quotation fee less any actual cost incurred, will be refundable. If the survey or construction has started, the full fee will be forfeited.

b. Standard Connection Charge : Is payable for cost associated with a standard connection. This Charge comprises of the Standard Connection Fee and the Standard Up-front Connection Charge.

…../7

c. Up-front Connection Charge : This charge, together with the Connection Fee, make up the Total Connection Charge.

d. Distribution Connection Charges : These Charges are raised on connection cost associated with the Distribution network.

We trust that the above meets with your requirements. Please do not hesitate to contact us for any further information.

Yours Faithfully

S CARRACK

ANNEXURE A :

COPIES OF ESKOM CORRESPONDANCE WITH PEACH TREE X 15 & 16 DEVELOPER

Stephen Carrack

From: Hylda Steenkamp <gaylin1@gmail.com>
Sent: 11 November 2014 12:20 PM
To: scarrack@elektroplan.co.za
Subject: Fwd: FW: Capacity Check

FYI
---------- Forwarded message ----------
From: **Theresa Smith**
<SmithT@eskom.co.za>
Date: Wed, Oct 15, 2014 at
8:12 AM
Subject: RE: FW: Capacity Check
To: Hylda Steenkamp <gaylin1@gmail.com>

Hi

The 1.3 mil is only for the upgrade costs project cost is additional.

The period of 2years is the **minimum** time span for mayor projects we have mayor projects that has been running for 6 years, there is no time guarantee on mayor projects.

This is an Eskom supply area but you can enquire at Tshwane if they will give you supply as I cannot say

Thank you

From: Hylda Steenkamp [mailto:gaylin1@gmail.com]
Sent: 10 October 2014 05:21 PM
To: Theresa Smith
Subject: Re: FW: Capacity Check

Hello Theresa,

Thank you for your mail.

The pole number on the property is LG60/3. I do not know if this will make a difference.

The estimate of R1.3mil, will that be the total cost of the power supply? Please clarrify.

Should we wish to continue, is there any possibilty that the period for the upgrade can be reduced as the power requirement is needed July next year.

Lastly, is it possible for us to obtain power from Tshwane if Eskom cannot meet the

required timeline?

King regards,

Tinus Steenkamp

On Fri, Oct 10, 2014 at 2:08 PM, Theresa Smith <SmithT@eskom.co.za> wrote:

Dear Customer

Please see the response from our Engineering department regarding your application for 2000kVa supply. Please note that should you wish to continue with the application the costs for the upgrade of the backbone will be for your account. The strengthening of the back bone will take a minimum of 2 years to complete as it will be registered as a mayor project.

Please notify me if we should go ahead with the application.

Thank you

From: Buhle Bujela
Sent: 10 October 2014 01:39 PM
To: Theresa Smith
Subject: RE: Capacity Check

Hi Theresa,

The 2MVA load can be added, however it collapses the voltage profile as shown below (Fig. 1) Eskom acceptable limits, to fix it we would have to upgrade the backbone conductor from Mink to Hare (about 3.5km of line) which will cost about R1.3mil.

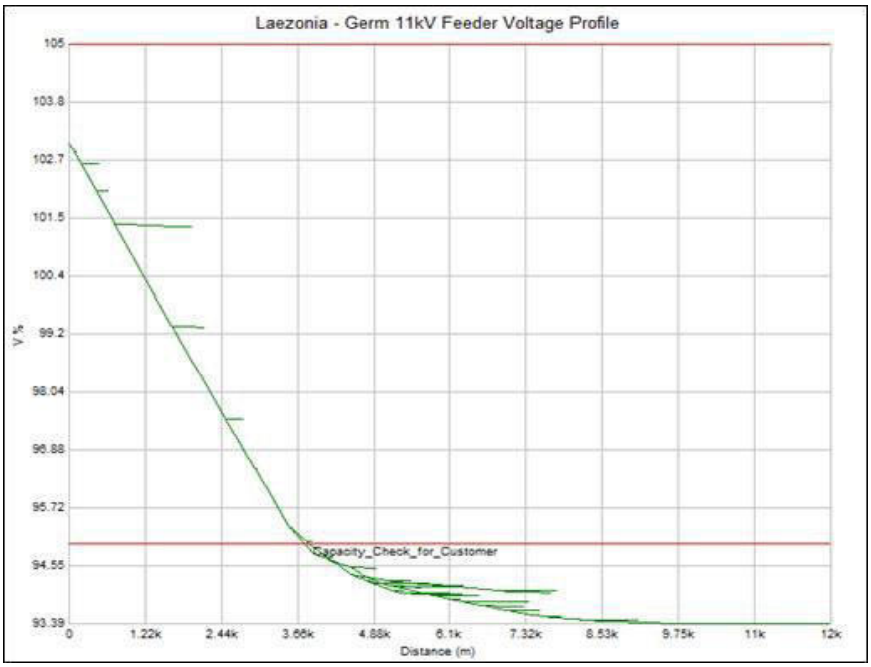


Figure 1:After adding customer on the existing line.

Kind Regards,

Buhle Bujela

From: Theresa Smith
Sent: 10 October 2014 07:53 AM
To: Buhle Bujela
Subject: Capacity Check

Hi Buhle

Can you please check if the LG54 feeder has capacity to accommodate additional 2MVA.

Thank you

I'm part of the 49Million initiative.
http://www.49Million.co.za

NB: This Email and its contents are subject to the Eskom Holdings SOC Limited EMAIL LEGAL NOTICE which can be viewed at
http://www.eskom.co.za/Pages/Email_Legal_Spam_Disclaimer.aspx

Appendix G5

Services Report

PEACH TREE EXT 21; 22; 23 & 24:

CIVIL ENGINEERING SERVICES REPORT

OCTOBER 2016

REVISION 0

Prepared for: **CITY OF TSHWANE METROPOLITAN MUNICIPALITY**

SOUTH AFRICA

CITY OF TSHWANE
IGNITING EXCELLENCE

On behalf of: **Dexalinx(Pty)Ltd**
PO Box 8446
Centurion
0048
Contact: Mr. Heinz Mulder

By: **TELAWIZE PTY LTD**

333 Emus Erasmus Street

Pretoria

Contact: Mr. Gawie Combrinck Pr Eng

Tel: 012 347 6299

TELAWIZE (PTY) LTD
ENGINEERS & PROJECT MANAGERS

SERVICES REPORT (INTERNAL & EXTERNAL):

PEACH TREE EXTENSIONS 21; 22; 23 & 24 - PROVISION OF CIVIL ENGINEERING SERVICES

1. CLIENT

Company	Dexalinx (Pty)Ltd
Contact Person	Mr. Heinz Mulder
Postal Address	P.O. Box 8446 Centurion 0046
Telephone No.	(012) 161 0000
Cell No	082 895 7869

2. COMPILED BY:

Company	Telawize Pty Ltd
Contact Person	G Combrinck Pr Eng 970122
Address	P.O. Box 11141 Erasmuskloof 0048
Telephone No.	(012) 347 6299
Fax No.	(012) 347 9767
E-mail	gawie@gfc-holdings.co.za

2. FOR SUBMISSION TO:

CITY OF TSHWANE METROPOLITAN MUNICIPALITY

Corporation	City of Tshwane
Contact Person	Chris Etsebeth - Roads and Storm water
Telephone No.	(012) 358 4993
e-mail	ChrisEt@tshwane.gov.za
Contact Person	Cynthia Ntuli - Water and Sanitation
e-mail	CinthiaN@tshwane.gov.za
Telephone No.	(012) 358 3578
Address	P O Box 1022 Pretoria 0001

4. PROFESSIONAL TEAM

Item Nr	Description	Name	Contact Person
1	Quantity Surveyor	VSB Quantity Surveyors	D van der Schyff
2	Town Planning	Urban Innovate	W. Slabbert
3	Developer	Dexalinx(Pty)Ltd	Heinz Mulder
4	Civil Engineer	Telawize Pty Ltd	G. Combrinck
5	Electrical Engineer	Electroplan	S. Carrack
6	Traffic Engineer	Route 2	J. Botha
7	Geotechnical Engineer	Louis Kruger Geotech CC	L. Kruger
8	Surveyor	Isazi Surveys	W Coetzer

Table of Contents

ADDENDUM

SERVICES REPORT:

PEACH TREE EXT 21; 22; 23 & 24: PROVISION OF CIVIL ENGINEERING SERVICES

1. INTRODUCTION

Telawize Pty Ltd was appointed by Dexalinx (Pty) Ltd as the Civil Engineering consultant to design the bulk and internal civil engineering services for the planned Commercial and Light Industrial and Fire station development on Peach Tree Ext 21; 22; 23 & 24. The construction process is estimated to be ten (10) months.

The professional team involved in this development is as follows:

Quantity Surveyor	VSB Quantity Surveyors	D van der Schyff
Town Planning	Urban Innovate	W. Slabbert
Developer	Dexalinx(Pty)Ltd	Heinz Mulder
Civil Engineer	Telawize Pty Ltd	G. Combrinck
Electrical Engineer	Electroplan	S. Carrack
Traffic Engineer	Route 2	J. Botha
Geotechnical Engineer	Louis Kruger Geotech CC	L. Kruger
Surveyor	Isazi Surveys	W Coetzer

2. LOCATION OF PLANNED DEVELOPMENT

This Commercial and Light Industrial development is situated on Portions 105, 109 & 331 of the Farm Knopjeslaagte 385 JR. The N14 is to the south and R114 (M34) to the north of the proposed development. The site follows a gradual slope of 4% towards the north east. The site covers an approximate area of 40.6806ha.

Figure 1 - Location Map

3. LAND USE

PEACH TREE EXT 21

Zoning	Erf No's	No of Erf	Areas (ha)	% of Total
Light Industrial	2-3	2	7.5600	73,18
Special		-	-	-
Infrastructure	1	1	0.1000	0.97
Roads		-	2,6700	25.85
Total		**26**	**10.3300**	**100.00**

PEACH TREE EXT 22

Zoning	Erf No's	No of Erf	Areas (ha)	% of Total
Industrial	1;3-5	4	7.7905	84.08
Special		-	-	-
Municipal	2	1	0.6000	6.48
Roads		-	-	-
Access Control	6	1	0,8748	9.44
Total		**6**	**9.2653**	**100.00**

PEACH TREE EXT 23

Zoning	Erf No's	No of Erf	Areas (ha)	% of Total
Industrial	1-7	7	10,8000	92.52
Special		-	-	-
Roads		-	-	-
Access Control	8;9	2	0.8800	7.48
Total		**9**	**11.7700**	**100.00**

PEACH TREE EXT 24

Zoning	Erf No's	No of Erf	Areas (ha)	% of Total
Industrial	1-6	6	9.4140	92.78
Special		-	-	-
Roads		-	-	-
Access Control	7	1	0.7327	7.22
Total		**7**	**10.1467**	**100.00**

4. GEOTECHNICAL INVESTIGATION

Summary

Twenty-five test pits were dug on the site and the soil profiles were described according to the standard method proposed by Jennings, Brink and Williams (1973). Disturbed samples of the most prominent soil horizons were taken and submitted to a soils laboratory for foundation indicator tests. Due to the high gravel content and the consistency of the materials encountered on the site, no undisturbed samples were taken

According to the 1: 50 000 scale geological map the site is underlain by **migmatite gneiss (granite) of the Halfway House Suite**. The geology of the site was confirmed during this investigation, granite bedrock was encountered in the test pits.

The following materials were encountered on the site:

Type A: Slightly moist, dark brown, soft, shattered, silty sand with plant roots covers the eastern part of the site. This material was encountered in fourteen test pits from surface up to an average depth of 0,3 meters.
Type B: Slightly moist, brown, soft, shattered, silty, gravelly, sand with plant roots was encountered on the western part of the site. This material was encountered in eight test pits from surface up to an average depth of 0,6 meters.

Ferricrete
Slightly moist, dark brown becoming yellow mottled orange and black, loose, silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles was encountered in twenty-three test pits from an average depth of 0,4 meters up to an average depth of 1,0 meters. In nine test pits the back actor refused hardpan ferricrete at an average depth of 0,7 meters.

Granite
Residual granite consisting of slightly moist, greyish white mottled orange and black, firm, intact, clayey sand with medium and large ferricrete concretions and with patches of very soft rock granite was encountered in three test pits from an average depth 0,7 meters up to an average depth of 1,3 meters and slightly moist, greyish white mottled orange, firm, intact, silty sand with very soft rock fragments was encountered in two test pits from an average depth 1,0 meters up to an average depth of 1,6 meters. Very soft rock granite was encountered in sixteen test pits from an average depth of 1,3 meters up to an average depth of 1,7 meters. The back actor refused on soft- to medium hard rock granite in sixteen test pits at an average depth of 1,4 meters.

The conditions encountered on site is very favourable for commercial and light industrial development. Most of the disturbed material will be re-used in the platforms that is typically associated with warehouse type structures.

Please refer to **Annexure G** for the complete Geotechnical Report.

5. CIVIL ENGINEERING SERVICES

5.1 WATER

5.1.1 Water Design Standards

The detail water reticulation analysis shall be done according to the design standards and specifications approved by the City of Tshwane Metropolitan Municipality's (CTMM) City Engineering Department. These standards and specifications are described in the "City of Tshwane Guidelines for the design and construction of water and sanitation systems". Where applicable Chapter 9 (Water Supply) of the **"Guidelines for Human Settlement Planning and Design (2000) (Red Book)"**, shall also be used as design criteria.

Design Standards for Water Supply:

Design Element	Criteria
1. Average Annual Daily Demand (AADD) for Industrial with or FSR = 0,5 (kℓ per 100m² development)	0,4kℓ
2. Gross Average Annual Daily Demand (GAADD)	Allow for 10% losses
3. Daily Peak Factor (DPF)	3.3
4. Design Peak Flow Rate (DPFR) for domestic flows	GAADD x DPF
5. Maximum static head	90 m
6. Minimum residual head under conditions of domestic peak flows	25 m
7. Maximum linear flow velocity under conditions of domestic peak flows	1,5 m/s
8. Pipe type	uPVC pressure pipes
9. Minimum pipe class	Class 12
10. Fire flow at any one hydrant under the condition of domestic peak flows (one hydrant at a time)	25ℓ/s
11. Minimum residual head (fire plus domestic peak flow)	15 m
12. Maximum linear flow velocity under conditions of fire-fighting	2,0 m/s
13. Boundary roughness (K-Value)	0,1 mm
14. Flow formulae	D'Arcy Weissbach
15. Minimum pipe diameter	110 mm

5.1.2 Planned water supply

Option A

According to the CES/GLS report, there is no connection available for this development. However, closer investigation revealed a bulk water line on the western boundary of the development, Portion

R/331 Knopjeslaagte 385 JR. We presume this line is the property of Rand Water, confirmation of ownership will be provided as soon as it is available.

This bulk water line is located within a servitude registered over portion R/331 of the farm Knopjeslaagte 385.JR on the Western side of the development.

Option B

The proposed connection option as per the GLS report is not a cost effective option for this development. The proposed route as identified by GLS in their report will result in having to cross the Swart Booi Spruit, (at an estimated cost of R 13 mil) that will require a water use license application that will impact the viability of such a connection point.

Recommendation

The proposal to supply this development with a water connection from the existing water line (Option A) located over portion R/331 is the most practical and cost effective option, as an alternative to the connection per GLS report, (Option B).

The proposed development's internal network will be supplied with an 110mmØ, 200mmØ and a 250mmØ uPVC Pipe class 12. It will connect to the existing 250mmØ Water Pipe (Option A).

Each erf will be supplied with an 110mmØ uPVC pipe connection.

Please note that Option A (Randwater) can be seen as a temporary option until such time CTMM bulk pipe is available to connect to. The developer will pay the standard bulk contributions as requested.

Refer to drawing 1632/200/01, Addendum C.

5.1.3 CES Report

The CES report was done by GLS. A summary of the proposed upgrades are listed below. These proposed upgrades (option B) are not feasible when Option A is readily available on site.

- 475 m x 600 mm Ø REPLACEMENT pipe (replacing an existing 110 mm Ø pipe)
- 460 m x 450 mm Ø main pipe
- 710 m x 450 mm Ø main pipe
- 1 045 m x 355 mm Ø main pipe
- 1 580 m x 250 mm Ø main pipe (this pipe is internal to the development)

Apart from being very expensive, these upgrades imply a water usage licence application, which will exacerbate the cost further.

Estimated Water Demands

Land use rights	Floor area (m^2)	Design Criteria ($kl/100m^2$)	FAR	Total AADD* (kl/day)	Total Demand (l/s)	Peak Factor	Peak Water Demand (l/s)
Industrial	358402	0,4	0.5	716.804	8.296	3,3	27.378
Fire Station	10028	0.6	0.5	30.084	0.348	3.3	1.149
TOTAL							**28.527**
Fire (Moderate risk)							**25.000**
TOTAL DEMAND							**53.527**

5.2 Sanitation

5.2.1 Sewer Design Standards

The detail water reticulation analysis shall be done according to the design standards and specifications approved by the City of Tshwane Metropolitan Municipality's (CTMM) City Engineering Department. These standards and specifications are described in the "City of Tshwane Guidelines for the design and construction of water and sanitation systems". Where applicable Chapter 10 (Sanitation) of the **"Guidelines for Human Settlement Planning and Design (2000) (Red Book)"**, shall also be used as design criteria.

SEWER DESIGN CRITERIA

Design Element	Criteria
1. Average Annual Daily flow for Industrial with a FSR = 0,5(kℓ per 100 m² development)	0,3 kℓ
2. Peak Factor	2,5
3. Allowance for infiltration	1,7 ℓ/s per km of pipe line 1 ℓ/s per ha on non-built-up area
4. Capacity of Sewer	Pipes may fun full at the Total Design Flow, which includes the peak and infiltration flows.
5. Sewer pipe type	Structured wall uPVC pipes SABS 1601 Class 34 up to 250 mm diameter.
6. Minimum velocity	0,6 m/s
7. Minimum pipe diameter	160 mm
8. Minimum depth of cover	1,5 m in road reserves 1,2 m in mid-blocks

5.2.2 Planned sanitation services

There are no formal sewer reticulation / bulk connection available in the vicinity of the proposed development.

Based on discussions one of the previous land owners has confirmed that a proposal made to council to allow a sewer treatment works (also know as a Package Plant) on portion 109 of the farm of Knopjeslaagte 385.JR was approved as a temporary solution. A copy of approval letter is attached under Annexure *I*.

Based on this it is also our proposal as a temporary solution to install a sewer package plant that will be designed and constructed to a specification that will be in line with council requirements and with sufficient capacity to service the proposed development until the council main sewer connection is available. This plant is constructed as a mobile unit, consisting of skid mounted containers, 2x12m containers and 1x6m container. These units will be removed once the CTMM connection is available.

All bulk contributions payable by the developer will be paid as and when required per normal with a condition that the development must connect to the council main sewer line when it becomes available in the area in the future.

The position of the proposed temporary package plant is shown on the development layout of Ext.21. Refer to Annexure D for the location of this plant as well as Annexure E for a full technical description of the proposed plant.

The internal network will be provided with a 160mmØ and 200mmØ uPVC Pipe. It will be connected to a sewer package plant that will be constructed on the north eastern side of the development. The development will connect on the municipal sewer reticulation as soon as it is available.

Refer to drawing 1632/300/01, Addendum C.

Table 4: Estimated Sewage Outflows

This table shows the total estimated outflows for extensions 21,22,23 and 24.

Land use rights	Floor area (m^2)	Design criteria ($kl/100m^2/day$)	FAR	Total PDDWF (kl/day)
Industrial	358402	0,3	0.5	537.603
Fire Station	10028	0.6	0.5	30.084
Sub Total				**567.687**
Peak Factor (PF)		**2,5**		**1419.2175**
Provision for Infiltration		**15%**		**1632.100**
DESIGN FLOW		**(In l/s):**		**18.890**

5.3 Roads

5.3.1 Standards and Specifications

All roads are designed according to the City of Tshwane Department of Transport: Standard Construction Details & Design Standards for Roads and Stormwater Drainage Infrastructure, issued by the Town Engineer's office of City of Tshwane.

5.3.2 Traffic Impact Study

The initial Traffic Impact Study was performed by Route^2 Transport Strategies on May 2016. The following is an extract of the most important issues of concern and the recommendations are:

Access Requirements

- Access to the proposed development will be from a 25m wide road linking from the R114. The access road should have two lanes in and two lanes out.
- The proposed access road will be located 600m from the R511 and R114 intersection which is in line with the Gautrans spacing requirements.

Public Transport

- The implementation of bus and minibus-taxi lay-bys on both sides of the R114 at the Access Road intersection.
- Construction of a 1,5m wide sidewalk along the Access Road from the R114.

5.3.3 CLASSIFICATION OF INTERNAL TOWNSHIP ROADS

The classifications of roads with roadway widths are as follows:

Description	Class No	Function	Reserve Width	Roadway Width
Road in 32 m Road Reserve	2	Primary Distributor	32	14.8
Road in 25 m Road Reserve	4b	District and local distributors	25 m	8.0 m
Road in 20 m Road Reserve	4b	District and local distributors	20 m	8.0 m

Table 2 – Classification of Internal Township Roads

5.3.4 GEOMETRIC DESIGN STANDARDS

The internal road will be class 4b external will be class 2. The internal roads will be 8m wide

Refer to drawing 1632/400/01, Addendum C.

5.3.5 Class 4 – District and local distributors

Design speed	50 km/h
Minimum centre line radii	50 m
Minimum gradient	0,67%
Favored maximum gradient	10%
Maximum grade/grade length	12,5% over 70m
Minimum K-value: Crest	6
Sag	6

5.3.6 PAVEMENT DESIGN

The proposed pavement design is based on anticipated traffic volumes and ground conditions. The design life of the proposed pavement is 20 years on provision that repairs to the surface will be made

where necessary in order to remain its skid resistance and impermeability during the design life of the road.

The following pavement design is proposed:

5.3.7 Road with Road Surface of 8.0 meters

Paving	:	80 mm thick interlocking block paving. 20mm river sand.
Sub base:		200 mm thick stabilized natural gravel compacted to 95% of modified AASHTO density. Minimum UCS = 1 200 kPA at 95% of modified AASHTO density – C4
Upper selected: Sub grade		150 mm thick natural gravel compacted to 93% of modified AAHSTO density. Minimum CBR – 15 at 90% of modified AASHTO density – G7 (in-situ or imported)
Lower selected: Sub grade		150 mm thick natural gravel compacted to 90% of modified AAHSTO density. Minimum CBR = 7 at 90% of modified AAHSTO density – G9 (in-situ or imported).
Fill (where required):		150 mm thick layers compacted to 90% of modified AASHTO density. Minimum CBR = 3 at 90% of modified AASHTO

5.3.8 External Road Surface with 3.7m per lane

Wearing course:	40mm Asphalt
Base	150 mm thick stabilized natural gravel compacted to 95% of modified AASHTO density- G1
Upper: Sub base:	150 mm thick stabilized natural gravel compacted to 95% of modified AASHTO density. Minimum UCS = 1 200 kPA at 95% of modified AASHTO density – C3
Lower: Sub base:	150 mm thick stabilized natural gravel compacted to 95% of modified AASHTO density. Minimum UCS = 3000 kPA at 95% of modified AASHTO density – C4
Upper selected: Sub grade	150 mm thick natural gravel compacted to 93% of modified AAHSTO density. Minimum CBR – 15 at 90% of modified AASHTO density – G7 (in-situ or imported)
Lower selected: Sub grade	150 mm thick natural gravel compacted to 90% of modified AAHSTO density. Minimum CBR – 15 at 90% of modified AASHTO density – G7 (Rip and Recompact)
Fill (where required):	150 mm thick layers compacted to 90% of modified AASHTO density. Minimum CBR = 3 at 90% of modified AASHTO

5.4 Storm water Drainage

5.4.1 Standards and Specifications

The internal storm water management system is designed according to the City of Tshwane Department of Transport: Standard Construction Details & Design Standards for Roads and Stormwater Drainage Infrastructure, issued by the Town Engineer's office of City of Tshwane.

Minimum Pipe size	:	450 mm
Pipe Material	:	Concrete
Minimum Gradient	:	1:150
Catch pit junction boxes etc	:	In accordance with the City of Tshwane Metropolitan Municipality Standard Details.

5.4.2 Design Criteria

Flood Return Period:	1:5 years for pipe systems draining
	1:20 years for the combined pipe and road systems
Design Method:	Rational method
Average yearly rainfall to be used	750mm

5.4.3 Planned Storm Water Drainage

The proposed development will generate 10,355l/s of storm water. The internal storm water network consists of ogee concrete pipes with the minimum diameter of 450mm and the maximum of 1350mm. Each erf will have its own connection to the main system.

The storm water generated on the proposed development will be discharged on Swartbooi Spruit. An outfall concrete pipe with outlet structure and energy dispensers will be constructed parallel to the R114 to the stream.

Refer to drawing 1632/500/01, Addendum C.

5.5 FLOOD LINE

In accordance with the National Water act, 1998 (act 36 of 1998) Section 144, the township is not affected by the 1: 100 year and 1: 50 year flood line.

See attached drawings.

5.6 SOLID WASTE DISPOSAL

There are numerous Solid waste removal companies operating in the area. A long term agreement will be concluded with a reputable company for the waste disposal on a regular basis. The solid waste that will be generated in the development (commercial light industrial) will be non toxic and can be disposed of at the closest public (municipal) disposal site.

6. ESTMATED PROJECT COST

A detailed Engineering design has been done. From this design a comprehensive Bill of Quantities have been compiled by both the QS and the Civil Engineers.

The estimated project cost for the provision of civil engineering services is approximately R35 million, excluding 14% vat and professional fees. A detailed breakdown of the costs is available on request.

7. BULK SERVICE CONTRIBUTIONS

7.1 Sewer and water

It will be included in this report as soon as it is available. The standard contribution will apply for both the sewerage and water reticulation.

7.2 Roads and storm water

It will be included in this report as soon as it is available. The standard contribution will apply for both Roads and Storm water.

8. SUMMARY

This development land is perfectly situated and ideal to accommodate a commercial and light industrial park.
The close proximity to the N14 and R511 main roads with free flowing access from areas such as, but not limited to, Lanseria, Diepsloot and Olivenhoutbos. This will provide a substantial number of construction and permanent job opportunities to the people residing in the adjacent areas creating an environment focused on socio-economic sustainability.

With the possibility to provision a fire station for the area as part of the development will further enhance public safety for the area.

With the thoughtful and practical application of civil engineering designs, all basic services can be provided in a sustainable manner that will ensure a long term successful development for the developer, communities in the area and Tshwane Metropolitan Municipality

Mfundo Hadebe		201570187	14/10/2016
Name	**Signature**	**Reg No**	**Date**

ADDENDUM A

LOCALITY MAP

PROPOSED TOWNSHIP: PEACH TREE EXTENSION 21/22

LOCALITY MAP 1:20 000

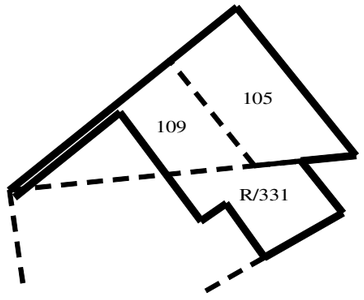
urban innovate

URBAN INNOVATE CONSULTING CC

TEL: 012 460-0670
FAX: 086 592 9974
E-MAIL: info@urbaninnovate.co.za
www.urbanonnovate.co.za

PO BOX 27011
MONUMENT PARK
0105

GEOTECHNICAL ZONES



THIS IS TO CERTIFY THAT THE TOWNSHIP LAYOUT ON THE PLAN IS IN ACCORDANCE WITH THE PROVISIONS AND RECOMMENDATIONS AS SET OUT IN THE GEOTECHNICAL INVESTIGATION FOR THE PROPOSED TOWNSHIP.

GEOTECHNICAL ZONES:

ZONE	DESCRIPTION
P-C2-S2	THE ENTIRE SITE IS ZONED - NHBRC ZONE P(FLL)-C2-S2

FLOOD LINE CERTIFICATION

1 : 50 AND 1 : 100 YEAR FLOODS

I HEREBY CERTIFY THAT IN TERMS OF SECTION 144 OF THE NATIONAL WATER ACT, ACT OF 1996, IT IS HEREBY CERTIFIED THAT THE TOWNSHIP IS NOT SUBJECT TO A FLOOD WITH AN EXPECTED FREQUENCY OF 1 : 50 YEARS AND 1 : 100 YEARS.

L.Wentzel PR. ENG. NR.950052

GENERAL NOTE:

1. CONTOURS: SUPPLIED BY ISAZI SURVEYS LAND SURVEYORS.
   1,00m INTERVALS
   DATUM: SEA LEVEL
   SYSTEM WGS
   THE CONTOURS ARE IN ACCORDANCE WITH REGULATION 18(1) OF THE TOWN-PLANNING AND TOWNSHIPS ORDINANCE,1986
2. ALL DIMENSIONS AND AREAS ARE APPROXIMATE PENDING FINAL SURVEY.
3. PROPOSED PHASES SUBJECT TO CHANGE.
4. REPRESENTS A GEOTECHNICAL ZONE LINE.
5. REPRESENTS A LINE OF NO-ACCESS.
6. REPRESENTS THE RELEVANT BUILDING LINES.

SERVITUDE NOTE:

1. EXISTING SERVITUDES TO BE INCORPORATED IN THE DESIGN OF THE TOWNSHIP.
2. PROPOSED 4m WIDE WATER ROW SERVITUDE OVER ERF 2.

PLAN No: PEACH TREE X21-22/1 **DATE:** SEPT 2016

LAND USE

USE ZONE	ERF NUMBERS	TOT. NO. OF ERVEN	MIN. ERF SIZE (m²)	AVERAGE	TOTAL AREA (Ha)	
"INDUSTRIAL 2" FOR BUSINESS BUILDINGS, COMMERCIAL USE, LIGHT INDUSTRY, CAFETERIA CAR WASH, PLACE OF REFRESHMENT, PARKING GARAGE, RETAIL INDUSTRY AND SHOPS.	2 - 6, 8	6	N/A	N/A	15,3505	78,34
"INFRUSTRUCTURE WORKS"	1	1	N/A	N/A	0,1000	0,51
"MUNICIPAL"	7	1	N/A	N/A	0,6000	3,06
"SPECIAL FOR ACCESS AND ACCESS CONTROL	9	1	N/A	N/A	0,8748	4,46
EXISTING STREETS AND WIDENING	N/A	N/A	N/A	N/A	2,6700	13,63
	TOTAL	3			19,5953	100,00

PORTION 108
KNOPJESLAAGTE 385-JR

PORTION 107
KNOPJESLAAGTE 385-JR

PORTION 106
KNOPJESLAAGTE 385-JR

PORTION 111
KNOPJESLAAGTE 385-JR

PORTION 105
KNOPJESLAAGTE 385-JR

PORTION 109
KNOPJESLAAGTE 385-JR

PORTION 914
KNOPJESLAAGTE 385-

R/PORTION 331
KNOPJESLAAGTE 385-JR

R/PORTION 331
KNOPJESLAAGTE 385-JR

REM/PTN 22

PEACH TREE X 23

PEACH TREE X 24

EXISTING ROAD (GDR)

KRUGERSDORP PRETORIA ROAD

M34 KRUGE

LAEZONIA A.H.

N14-HIGHWAY (P158/2)

PROPOSED 25m STREET

PROPOSED 20m STREET

PROPOSED 20m STREET

PROPOSED 20m STREET

PROPOSED 20m STREET

1 0,1000 Ha

2 3,8000

3 3,7600

4 3,9340

5 1,3580

6 1,3685

7 0,6000

8 1,1300

9

16m BUILDING LINE

16m BUILDING LINE

5m WIDE R.O.W SERVITUDE

5m WIDE R.O.W SERVITUDE

5m WIDE WATER PIPELINE SERVITUDES G No. 1048/2007

20m R.O.W SERVITUDE (FUTURE ROAD)

36m

30m

A B C D E F G H J K L M N O P Q R

158

SITUATED ON PART OF PORTION 105, 109 AND REM/331 OF THE FARM KNOPJESLAAGTE 385-JR.

REPRESENTED BY THE FIGURE A-B-C-D-E-F-G-H-J-K-L-M-N-O-P-Q-R-A

CITY OF TSHWANE METROPOLITAN MUNICIPALITY, GAUTENG

N

SCALE 1 : 3500

0 20 40 60 80 120m

ADDENDUM B

TOWNSHIP LAYOUT PLAN EXTENSION 21 – 24

ADDENDUM C

ENGINEERING DRAWINGS

NOTES AND SPECIFICATIONS

GENERAL

1. ALL MATERIAL AND WORKMANSHIP MUST COMPLY WITH THE REQUIREMENTS OF THE LATEST RELEVANT SABS REQUIREMENTS.
2. ALL DIMENSIONS ARE IN MILLIMETRES. (UNLESS OTHERWISE SPECIFIED).
3. DO NOT SCALE FROM THESE DRAWINGS.
4. ALL DIMENSIONS MUST BE CHECKED AND APPROVED ON SITE.
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10. FINAL POSITION OF SERVICES TO BE DETERMINED ON SITE.

LEGEND

WATER

- NEW HYDRANT
- PROPOSED / NEW PIPE
- NEW VALVE
- NEW VALVE ON EXISTING PIPE
- NEW HYDRANT ON EXISTING PIPE
- NEW END CAP
- NEW PRV
- NEW AIR VALVE
- NEW WATER METER
- EXISTING PIPE CAPPED
- EXISTING END CAP
- EXISTING NETWORK PIPE
- EXISTING BULK PIPELINE
- EXISTING HYDRANT
- NODE NUMBER (123)
- CLOSED VALVE
- EXISTING VALVE
- EXISTNG COMMUNICATION PIPES
- EXISTING AIRVALVE
- EXISTING WATER METER
- EXISTING PRV
- EXISTING PUMP
- PIPE TO BE ABANDONED (TO BE ABANDONED)
- REDUNDANT PIPE (REDUNDANT)
- EXISTING RES DISTRIBUTION ZONE
- PROPOSED RES DISTRIBUTION ZONE
- EXISTING RAND WATER PIPE
- SUBURB BOUNDARY
- SASOL GAS LINE (GAS)
- PETRONET PIPE (P_NET)
- NEW PIPE IN NEW SLEEVE (SLEEVE Ø TYPE CLASS)

SANITATION

- MANHOLE
- CE / LH
- NEW CCTV INSPECTION
- EXIST. LINE INSPECTED BY CCTV
- NEW SEWER LINE
- EXISTING SEWER LINE
- HOUSE CONNECTION

CITY OF TSHWANE
RUNNING EXCELLENCE
PO BOX 1022
PRETORIA
0001

CITY OF TSHWANE
SERVICES INFRASTRUCTURE DEPARTMENT
WATER AND SANITATION DIVISION

AMENDMENTS

NR	DATE	APPROVED	DESCRIPTION	PAR
A	AUG 2016		FOR APPROVAL	TEL

WATER AND SANITATION

FOR INTERNAL APPROVAL - RECEIVED SIGN WHEN APPLICABLE

DIRECTOR: WATER AND SANITATION - PLANNING
NAME Prof. Reg. No SIGNATURE DATE

REGIONAL DIRECTOR: (1,2,3,4,5,6 or 7)
NAME Prof. Reg. No SIGNATURE DATE

DIRECTOR: SYSTEM DEVELOPMENT
NAME Prof. Reg. No SIGNATURE DATE

DIRECTOR: BULK WATER
NAME Prof. Reg. No SIGNATURE DATE

DIRECTOR: INFRASTRUCTURE PROVISION
NAME Prof. Reg. No SIGNATURE DATE

DIRECTOR: WASTE WATER TREATMENT
NAME Prof. Reg. No SIGNATURE DATE

CONSULTANT DETAIL

TELAVIZE (PTY) LTD
ENGINEERS & PROJECT MANAGERS

P. O. BOX 11141
ERASMUSKLOOF
0048
TEL : (012) 347 6299
FAX :(012) 347 9767
CELL : 082 492 0682
gfc@gfc-holdings.co.za

I, _____ Prof Reg Nr. _____
HEREBY CERTIFY THAT THE SERVICES WILL HAVE BEEN INSTALLED ACCORDING TO NOTE 9 OF THE ABOVE NOTES AND TO THE DRAWING

SIGNATURE _____ DATE _____

CONSULTANT DRAWING NUMBER: 1632/210/01
REVISION: A

DESIGNED

NAME: M. HADEBE Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

DRAWN

NAME: M. HADEBE Prof Reg No: _____
SIGNATURE: _____ DATE: _____

CHECKED

NAME: G. COMBRINCK Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

INFORMATION OFFICE CHECKED

NAME: _____ Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

DESIGN OFFICE APPROVAL

NAME: _____ Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

CONTRACT No: 1632
PROJECT No. 1632
SHEET No. 1 OF 1
PAPER SIZE: A0
SCALE: 1:1000
DATE: AUGUST 2016

PROJECT STATUS

RECEIVED SIGN WHEN APPLICABLE

CONCEPT DRAWING | TENDER DRAWING | APPROVED CONSTRUCTION DRAWING | AS BUILT DRAWING

PROJECT ENGINEER of COT:
NAME: _____ Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

INSPECTOR OF WORKS of COT:
NAME: _____ Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

LOCATION OF PROJECT:

PEACH TREE EXT 21

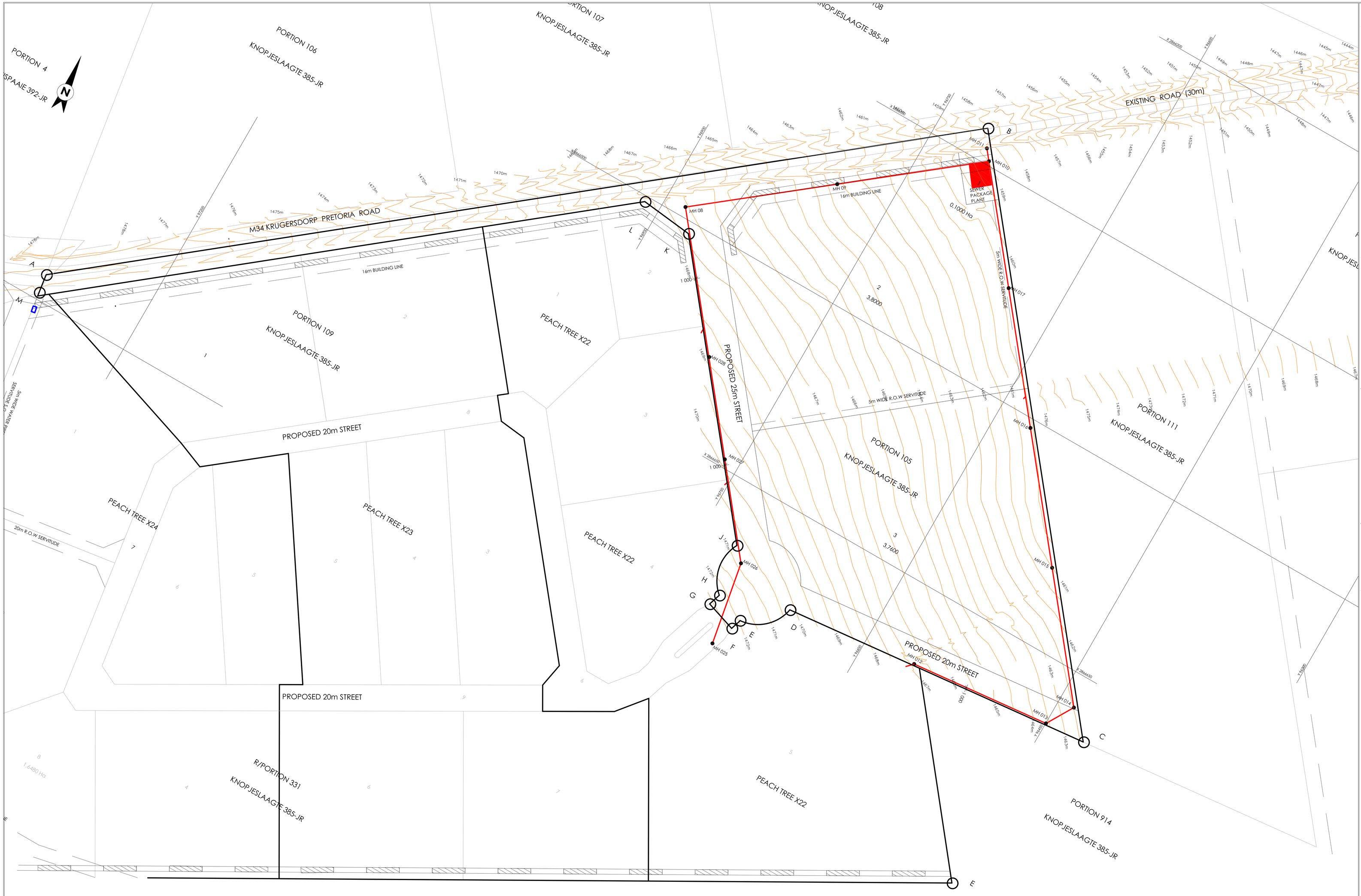
DESCRIPTION OF PROJECT:

WATER RETICULATION

GENERAL LAYOUT

WBS No. : __-_____-__-_____-__-__

COT DRAWING NUMBER: __-_____-__-_____-__-__
REVISION: 10



NOTES AND SPECIFICATIONS

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LEGEND

WATER

- NEW HYDRANT
- PROPOSED / NEW PIPE
- NEW VALVE
- NEW VALVE ON EXISTING PIPE
- NEW HYDRANT ON EXISTING PIPE
- NEW END CAP
- NEW PRV
- NEW AIR VALVE
- NEW WATER METER
- EXISTING PIPE CAPPED
- EXISTING END CAP
- EXISTING NETWORK PIPE
- EXISTING BULK PIPELINE
- EXISTING HYDRANT
- NODE NUMBER (1234)
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- EXISTING VALVE
- EXISTNG COMMUNICATION PIPES
- EXISTING AIRVALVE
- EXISTING WATER METER
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SERVICES INFRASTRUCTURE DEPARTMENT
WATER AND SANITATION DIVISION

AMENDMENTS

NR	DATE	APPROVED	DESCRIPTION	PAR
A	SEPT 2016		FOR APPROVAL	TEL

WATER AND SANITATION

FOR INTERNAL APPROVAL - RECEIVED SIGN WHEN APPLICABLE

DIRECTOR: WATER AND SANITATION - PLANNING
NAME Prof. Reg. No SIGNATURE DATE

REGIONAL DIRECTOR: (1,2,3,4,5,6 or 7)
NAME Prof. Reg. No SIGNATURE DATE

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NAME Prof. Reg. No SIGNATURE DATE

DIRECTOR: INFRASTRUCTURE PROVISION
NAME Prof. Reg. No SIGNATURE DATE

DIRECTOR: WASTE WATER TREATMENT
NAME Prof. Reg. No SIGNATURE DATE

CONSULTANT DETAIL

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SIGNATURE _____ DATE _____

CONSULTANT DRAWING NUMBER: 1632/310/01 (A REVISION)

DESIGNED
NAME: M HADEBE Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

DRAWN
NAME: M. HADEBE Prof Reg No: _____
SIGNATURE: _____ DATE: _____

CHECKED
NAME: G. COMBRINCK Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

INFORMATION OFFICE CHECKED
NAME: _____ Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

DESIGN OFFICE APPROVAL
NAME: _____ Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

CONTRACT No: 1632
PROJECT No. 1632
SHEET No. 1 OF 1
PAPER SIZE: A0
SCALE: 1:1000
DATE: AUGUST 2016

PROJECT STATUS

RECEIVED SIGN WHEN APPLICABLE

○ CONCEPT DRAWING ○ TENDER DRAWING ○ APPROVED CONSTRUCTION DRAWING ○ AS BUILT DRAWING

PROJECT ENGINEER of COT:
NAME: _____ Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

INSPECTOR OF WORKS of COT:
NAME: _____ Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

LOCATION OF PROJECT:

PEACH TREE EXT 21

DESCRIPTION OF PROJECT:

SEWER RETICULATION

GENERAL LAYOUT

WBS No. : __-_____-__-_____-__-__

COT DRAWING NUMBER: __-_____-__-_____-__-__ (10 REVISION)

NOTES AND SPECIFICATIONS

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10 FINAL POSITION OF SERVICES TO BE DETERMINED ON SITE.

ROADS:

1 KERBING TO BE AS PER STANDARD DETAIL PLANS A AND B AND SECTION 10 OF VOLUME 1 OF CONTRACT DOCUMENT.

2 TRAFFIC CONTROL MUST COMPLY WITH THE REQUIREMENTS OF THE SOUTH AFRICAN ROAD TRAFFIC SIGNS MANUAL (THIRD EDITION).

3 VERTICAL AND HORIZONTAL ALIGNMENT TO FOLLOW THE EXISTING ROAD SURFACE, WITH A MINIMUM CROSS FALL OF 2 % (IF APPLICABLE)

LEGEND:

EXISTING PAVING

NO KERBING

MOUNTABLE KERBING

SEMI VERTICAL KERBING

STORMWATER

1 MINIMUM PIPE DIAMETER TO BE 450mm.

2 MINIMUM FALL TO BE 1:150.

3 PIPE BEDDING TO BE CLASS B UNLESS OTHERWISE SPECIFIED.

4 ALL EXCAVATIONS AND BEDDING MUST BE INSPECTED AND APPROVED BY THE ENGINEER BEFORE LAYING OF ANY PIPES.

5 CLEAN EXISTING STORMWATER INLETS AND REPAIR WHERE NECESSARY.(IF APPLICABLE)

LEGEND:

PROPOSED: EXISTING:

STORMWATER LINE

MANHOLE

JUNCTION BOX

KERB INLET

CATCHPIT LENGTH

2/3/2

TRANSITION LENGHT

CATCHPIT LENGTH

TRANSITION LENGTH

SCALE 1:100

SCALE 1:250

SCALE 1:500

SCALE 1:1000

SCALE 1:2500

SCALE 1:2000

SCALE 1:1500

SCALE 1:1000

1:1000

AMENDMENTS

NRL	DATE	APPROVED	DESCRIPTION	PAR.

DESIGNED	DRAWN
M HADEBE	M HADEBE
DESIGN CHECKED BY: 1:1000	INFRASTRUCTURE TECHNICAL INFORMATION MANAGEMENT D.J. CHALMERS

PROJECT STATUS

CONCEPT DRAWING | TENDER DRAWING | APPROVED FOR CONSTRUCTION DRAWING | AS BUILT DRAWING

PROJECT ENGINEER (CONSULTANT):

INITIALS AND SURNAME | SIGNATURE AND PR. No. | DATE

INSPECTOR OF WORKS (CITY OF TSHWANE):

INITIALS AND SURNAME | SIGNATURE AND PR. No. | DATE

CONSULTANT DETAIL

TELAWIZE (PTY) LTD
ENGINEERING & PROJECT MANAGEMENT

333 EWUS ERASMUS STREET
ERASMUSRAND
0181

P. O. BOX 11141
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0048

TEL : (012) 347 6299
FAX :(012) 347 9767
CELL : 082 492 0482
e-mail : gfc@gfc-holdings.co.za

CITY OF TSHWANE

ROADS AND TRANSPORT DEPARTMENT

Mr P. I. Lefifonkane
STRATEGIC EXECUTIVE DIRECTOR
P.O. BOX 1409
PRETORIA
0001

Ms. L. V. Kegakilwe-Piki
EXECUTIVE DIRECTOR
P.O. BOX 1409
PRETORIA
0001

DRAWING APPROVED BY EXECUTIVE DIRECTOR
Ms. L. V. Kegakilwe-Piki

SIGNATURE: ..... DATE: .....

INFRASTRUCTURE DESIGN, CONSTRUCTION AND MAINTENANCE DIVISION
For Internal Approval

RECEIVED
SIGNATURE/DATE

DIRECTOR: TRANSPORT INFRASTRUCTURE PROVISION
SIGNATURE | DATE

DIRECTOR: TRANSPORT INFRASTRUCTURE CONSTRUCTION MANAGEMENT
SIGNATURE | DATE

DIRECTOR: TRANSPORT INFRASTRUCTURE ASSET MANAGEMENT
SIGNATURE | DATE

DIRECTOR: TRANSPORT INFRASTRUCTURE PLANNING
SIGNATURE | DATE

DIRECTOR: INTELLIGENT TRANSPORT SYSTEMS AND TRAFFIC ENGINEERING
SIGNATURE | DATE

DIRECTOR: INFRASTRUCTURE MAINTENANCE MANAGEMENT (NW)
SIGNATURE | DATE

DIRECTOR: INTEGRATED TRANSPORT PLANNING
SIGNATURE | DATE

LOCATION OF PROJECT:

PEACH TREE EXT 21

DESCRIPTION OF PROJECT

ROADS

CONTRACT No. :	PROJECT No. :
1632	1632
DATE : JUNE 2016	SCALE : 1:1000
ORIGINAL PAPER SIZE: A0	
DRAWING NO. 1632/410/01	SHEET NO: 1 OF 1
REVISION 0	

SCALE 1:1000

M. HADEBE

PORTION 4
AAIE 392-JR
PORTION 106
KNOP JESLAAGTE 385-JR
PORTION 107
KNOP JESLAAGTE 385-JR
PORTION 108
KNOP JESLAAGTE 385-JR
EXISTING ROAD (30m)
M34 KRUGERSDORP PRETORIA ROAD
16m BUILDING LINE
PORTION 109
KNOP JESLAAGTE 385-JR
PEACH TREE X22
STORM WATER CONNECTION POINT FROM PEACH TREE EXT 22
PROPOSED 25m STREET
5m WIDE R.O.W SERVITUDE
1050 mm
825 mm
750 mm
1350 mm
1200 mm
MH 01
MH 02
MH 03
MH 04
MH 05
MH 06
MH 07
MH 08
MH 09
MH 010
MH 011
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MH 046
MH 047
MH 048
MH 049
PROPOSED 20m STREET
PORTION 111
KNOP JESLAAGTE 385-JR
PORTION 105
KNOP JESLAAGTE 385-JR
PEACH TREE X24
PEACH TREE X23
PEACH TREE X22
20m R.O.W SERVITUDE
R/PORTION 331
KNOP JESLAAGTE 385-JR
PEACH TREE X22
PORTION 914
KNOP JESLAAGTE 385-JR
N14-HIGHWAY (P158/2)
0.1000 Ha
3,8000
3,7600
1,6480 Ha

NOTES AND SPECIFICATIONS

GENERAL

1 ALL MATERIAL AND WORKMANSHIP MUST COMPLY WITH THE REQUIREMENTS OF THE LATEST RELEVANT SABS REQUIREMENTS.
2 ALL DIMENSIONS ARE IN MILLIMETERS. (UNLESS OTHERWISE SPECIFIED)
3 DO NOT SCALE FROM THESE DRAWINGS.
4 ALL DIMENSIONS MUST BE CHECKED AND APPROVED ON SITE.
5 ALL CONSTRUCTION TO BE DONE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS FOR MUNICIPAL CIVIL ENGINEERING WORKS, THIRD EDITION 2005 AND THE STANDARD CTMM DETAIL DRAWINGS
6 THESE DRAWINGS MUST BE READ IN CONJUNCTION WITH THE ARCHITECTS DRAWINGS. (IF APPLICABLE)
7 THIS DRAWING MUST BE READ IN CONJUNCTION WITH THE STANDARD SPECIFICATIONS FOR MUNICIPAL CIVIL ENGINEERING WORKS, SERIES 4.
8 THE SIGNATURE OR INITIALS ON THIS DRAWING, OF ANY MANAGER OF THE TRANSPORT DEPARTMENT. IN NO WAY REMOVES ANY RESPONSIBILITY WHATSOEVER FROM THE CONSULTANT.
9 THE CONSULTANT REMAINS RESPONSIBLE TO ENSURE THAT ALL THE GUIDELINES, STANDARD DRAWINGS, STANDARDS AND SPECIFICATIONS OF THE TRANSPORT DEPARTMENT HAVE BEEN MET AND ARE COMPLIED WITH.
10 FINAL POSITION OF SERVICES TO BE DETERMINED ON SITE.

ROADS:

1 KERBING TO BE AS PER STANDARD DETAIL PLANS A AND B AND SECTION 10 OF VOLUME 1 OF CONTRACT DOCUMENT.
2 TRAFFIC CONTROL MUST COMPLY WITH THE REQUIREMENTS OF THE SOUTH AFRICAN ROAD TRAFFIC SIGNS MANUAL (THIRD EDITION).
3 VERTICAL AND HORIZONTAL ALIGNMENT TO FOLLOW THE EXISTING ROAD SURFACE, WITH A MINIMUM CROSS FALL OF 2 % (IF APPLICABLE)

LEGEND:
EXISTING PAVING
NO KERBING
MOUNTABLE KERBING
SEMI VERTICAL KERBING

STORMWATER

1 MINIMUM PIPE DIAMETER TO BE 450mm.
2 MINIMUM FALL TO BE 1:150.
3 PIPE BEDDING TO BE CLASS B UNLESS OTHERWISE SPECIFIED.
4 ALL EXCAVATIONS AND BEDDING MUST BE INSPECTED AND APPROVED BY THE ENGINEER BEFORE LAYING OF ANY PIPES.
5 CLEAN EXISTING STORMWATER INLETS AND REPAIR WHERE NECESSARY.(IF APPLICABLE)

LEGEND:
PROPOSED: EXISTING:
STORMWATER LINE
MANHOLE
JUNCTION BOX
KERB INLET
CATCHPIT LENGTH
2/3/2
TRANSITION LENGHT
CATCHPIT LENGTH
TRANSITION LENGTH

SCALE 1:100
SCALE 1:250
SCALE 1:500
SCALE 1:1000
SCALE 1:2500
SCALE 1:2000
SCALE 1:1500
SCALE 1:1000

AMENDMENTS

NR.	DATE	APPROVED	DESCRIPTION	PAR.

DESIGNED: M HADEBE
DRAWN: M HADEBE
DESIGN CHECKED BY: 1:1000
INFRASTRUCTURE TECHNICAL INFORMATION MANAGEMENT: D.J. CHALMERS

PROJECT STATUS

CONCEPT DRAWING | DEMOS DRAWING | APPROVED FOR CONSTRUCTION DRAWING | AS BUILT DRAWING

PROJECT ENGINEER (CONSULTANT)
INITIALS AND SURNAME SIGNATURE AND Pr. No. DATE
INSPECTOR OF WORKS (CITY OF TSHWANE)
INITIALS AND SURNAME SIGNATURE AND Pr. No. DATE

CONSULTANT DETAIL

TELAWIZE (PTY) LTD
ENGINEERS & PROJECT MANAGERS
333 EMUS ERASMUS STREET
ERASMUSRAND
0181
P. O. BOX 11141
ERASMUSKLOOF
0048
TEL : (012) 347 6299
FAX :(012) 347 9767
CELL : 082 492 0482
e-mail : gfc@gfc-holdings.co.za

CITY OF TSHWANE
ROADS AND TRANSPORT DEPARTMENT

Mr P. I. Lefonkane — STRATEGIC EXECUTIVE DIRECTOR — P.O. BOX 1409 PRETORIA 0001
Ms. L. V. Kegakilwe-Phiri — EXECUTIVE DIRECTOR — P.O. BOX 1409 PRETORIA 0001

DRAWING APPROVED BY EXECUTIVE DIRECTOR
Ms. L. V. Kegakilwe-Phiri
SIGNATURE: DATE:

LOCATION OF PROJECT:

PEACH TREE EXT 21

DESCRIPTION OF PROJECT

STORM WATER

INFRASTRUCTURE DESIGN, CONSTRUCTION AND MAINTENANCE DIVISION
For Internal Approval
REVIEWED
SIGN WHERE APPLICABLE
DIRECTOR: TRANSPORT INFRASTRUCTURE PROVISION — SIGNATURE / DATE
DIRECTOR: TRANSPORT INFRASTRUCTURE CONSTRUCTION (PROJECT) MANAGEMENT — SIGNATURE / DATE
DIRECTOR: TRANSPORT INFRASTRUCTURE ASSET MANAGEMENT — SIGNATURE / DATE
DIRECTOR: TRANSPORT INFRASTRUCTURE PLANNING — SIGNATURE / DATE
DIRECTOR: INTELLIGENT TRANSPORT SYSTEMS AND TRAFFIC ENGINEERING — SIGNATURE / DATE
DIRECTOR: INFRASTRUCTURE MAINTENANCE MANAGEMENT (IMM) — SIGNATURE / DATE
DIRECTOR: INTEGRATED TRANSPORT PLANNING — SIGNATURE / DATE

SCALE 1:1000

CONTRACT No. : 1632
PROJECT No. : 1632
DATE : JUNE 2016
SCALE : 1:1000
ORIGINAL PAPER SIZE: A0
DRAWING NO: 1632/510/01
SHEET NO: 1 OF 1
REVISION: A

M. HADEBE

PORTION 107
KNOPJESLAAGTE 385-JR

PORTION 108
KNOPJESLAAGTE 385-JR

EXISTING ROAD (30m)

PEACH TREE X22

PROPOSED 25m STREET

PROPOSED 20m STREET

5m WIDE R.O.W SERVITUDE

16m BUILDING LINE

STORM WATER CONNECTION POINT FROM PEACH TREE EXT 22

STORM WATER OUTLET STRUCTURE WITH RENO MATTRESS

1:100 YEAR FLOODLINE

1:50 YEAR FLOODLINE

PORTION 105
KNOPJESLAAGTE 385-JR

PORTION 111
KNOPJESLAAGTE 385-JR

PORTION 112
KNOPJESLAAGTE 385-JR

PORTION 113
KNOPJESLAAGTE 385-JR

PORTION 914
KNOPJESLAAGTE 385-JR

1 0,1000 Ha
2 3,8000
3 3,7600

MH 01 … MH 034, MH 040 … MH 045

825 mm · 1050 mm · 1200 mm · 1350 mm · 750 mm

A B C D E F G H J K L

WAY (P158/2)

NOTES AND SPECIFICATIONS

GENERAL

1 ALL MATERIAL AND WORKMANSHIP MUST COMPLY WITH THE REQUIREMENTS OF THE LATEST RELEVANT SABS REQUIREMENTS.

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7 THIS DRAWING MUST BE READ IN CONJUNCTION WITH THE STANDARD SPECIFICATIONS FOR MUNICIPAL CIVIL ENGINEERING WORKS, SERIES 4.

8 THE SIGNATURE OR INITIALS ON THIS DRAWING, OF ANY MANAGER OF THE TRANSPORT DEPARTMENT. IN NO WAY REMOVES ANY RESPONSIBILITY WHATSOEVER FROM THE CONSULTANT.

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10 FINAL POSITION OF SERVICES TO BE DETERMINED ON SITE.

ROADS:

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3 VERTICAL AND HORIZONTAL ALIGNMENT TO FOLLOW THE EXISTING ROAD SURFACE, WITH A MINIMUM CROSS FALL OF 2 % (IF APPLICABLE)

LEGEND:

EXISTING PAVING
NO KERBING
MOUNTABLE KERBING
SEMI VERTICAL KERBING

STORMWATER

1 MINIMUM PIPE DIAMETER TO BE 450mm.

2 MINIMUM FALL TO BE 1:150.

3 PIPE BEDDING TO BE CLASS B UNLESS OTHERWISE SPECIFIED.

4 ALL EXCAVATIONS AND BEDDING MUST BE INSPECTED AND APPROVED BY THE ENGINEER BEFORE LAYING OF ANY PIPES.

5 CLEAN EXISTING STORMWATER INLETS AND REPAIR WHERE NECESSARY.(IF APPLICABLE)

LEGEND:

PROPOSED: / EXISTING:
STORMWATER LINE
MANHOLE
JUNCTION BOX
KERB INLET
CATCHPIT LENGTH
2/3/2
TRANSITION LENGHT
CATCHPIT LENGTH
TRANSITION LENGTH

SCALE 1: 100 (0 1 2 4 6 10m)
SCALE 1: 250 (0 25 50 100 150 200m) 1:1000
SCALE 1: 500 (0 50 100 200 300 400m)
SCALE 1: 1000 (0 10 20 40 60 80m)
SCALE 1: 2500 (0 25 50 100 150 200m)
SCALE 1: 2000 (0 20 40 80 120 160m)
SCALE 1: 1500 (0 15 30 60 90 120m)
SCALE 1: 1000 (0 10 20 40 60 80m)

AMENDMENTS

NR.	DATE	APPROVED	DESCRIPTION	PAR.

DESIGNED: M HADEBE — DRAWN: M HADEBE
DESIGN CHECKED BY: 1:1000 — INFRASTRUCTURE TECHNICAL INFORMATION MANAGEMENT: D.J. CHALMERS

PROJECT STATUS

CONCEPT DRAWING · TENDER DRAWING · APPROVED FOR CONSTRUCTION DRAWING · AS BUILT DRAWING

PROJECT ENGINEER (CONSULTANT)
INITIALS AND SURNAME — SIGNATURE AND Pr. No. — DATE
INSPECTOR OF WORKS (CITY OF TSHWANE)
INITIALS AND SURNAME — SIGNATURE AND Pr. No. — DATE

CONSULTANT DETAIL

333 EMUS ERASMUS STREET
ERASMUSRAND
0181

P. O. BOX 11141
ERASMUSKLOOF
0048

TEL : (012) 347 6299
FAX :(012) 347 9767
CELL : 082 492 0682
e-mail : gfc@gfc-holdings.co.za

TELAWIZE (PTY) LTD
ENGINEERING & PROJECT MANAGEMENT

CITY OF TSHWANE
ROADS AND TRANSPORT DEPARTMENT

Mr P. I. Lefonkane
STRATEGIC EXECUTIVE DIRECTOR
P.O. BOX 1409
PRETORIA
0001

Ms. L. V. Kegakilwe-Phil
EXECUTIVE DIRECTOR
P.O. BOX 1409
PRETORIA
0001

DRAWING APPROVED BY EXECUTIVE DIRECTOR
Ms. L. V. Kegakilwe-Phil
SIGNATURE: ..... DATE: .....

INFRASTRUCTURE DESIGN, CONSTRUCTION AND MAINTENANCE DIVISION
For Internal Approval
SIGNATURE — DATE
DIRECTOR: TRANSPORT INFRASTRUCTURE PROVISION
DIRECTOR: TRANSPORT INFRASTRUCTURE CONSTRUCTION (PROJECT MANAGEMENT)
DIRECTOR: TRANSPORT INFRASTRUCTURE ASSET MANAGEMENT
DIRECTOR: TRANSPORT INFRASTRUCTURE PLANNING
DIRECTOR: INTELLIGENT TRANSPORT SYSTEMS AND TRAFFIC ENGINEERING
DIRECTOR: INFRASTRUCTURE MAINTENANCE MANAGEMENT (RAR)
DIRECTOR: INTEGRATED TRANSPORT PLANNING

LOCATION OF PROJECT:

PEACH TREE EXT 21

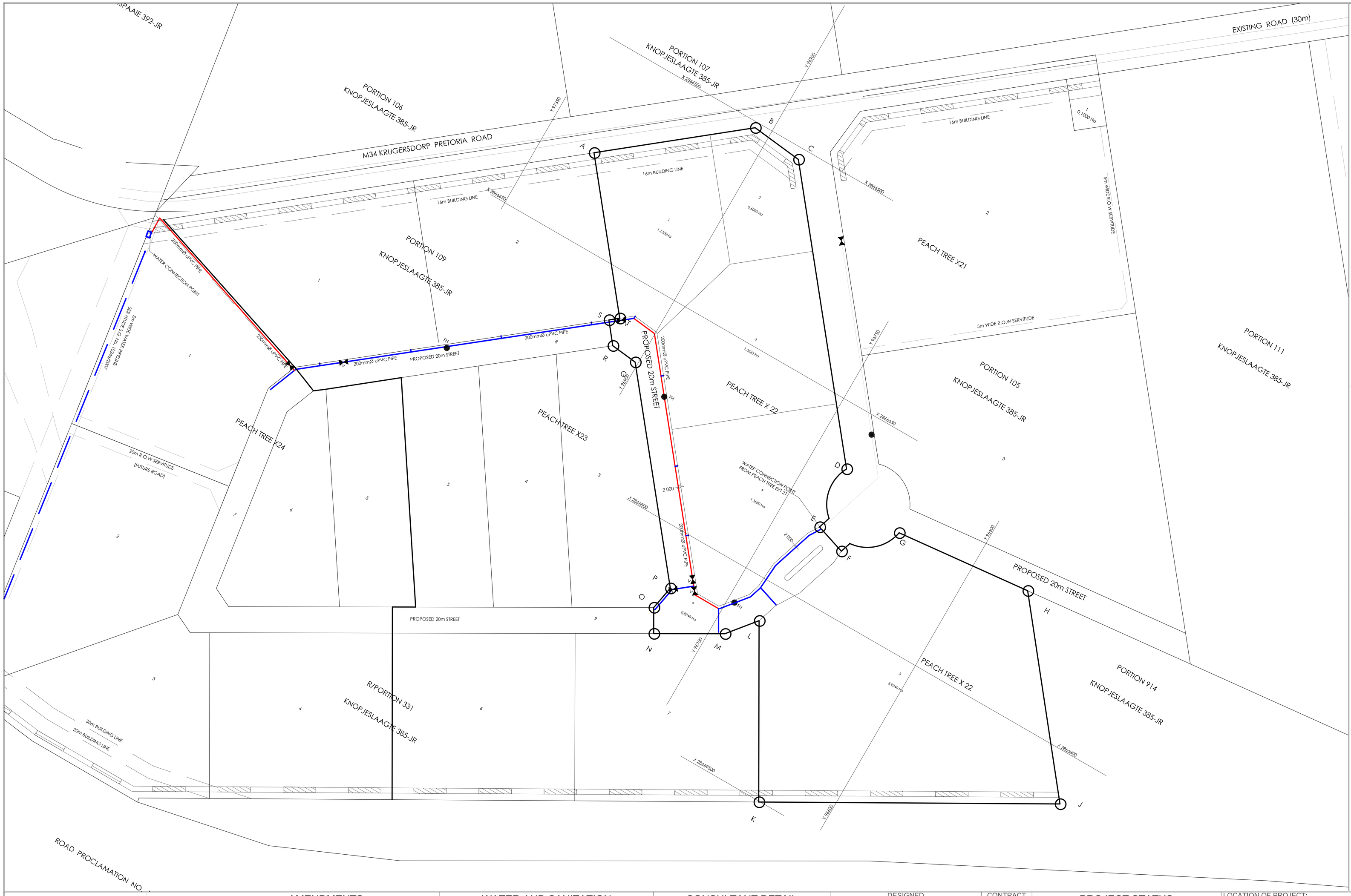
DESCRIPTION OF PROJECT

STORM WATER

CONTRACT No. :	PROJECT No. :
1632	1632
DATE : JUNE 2016	SCALE : 1:1000
ORIGINAL PAPER SIZE: A0	
DRAWING NO.: 1632/510/02	SHEET NO.: 1 OF 1
REVISION: A	

SCALE 1:1000 (0 10 20 40 60 80m)

M. HADEBE



NOTES AND SPECIFICATIONS

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10. FINAL POSITION OF SERVICES TO BE DETERMINED ON SITE.

LEGEND

WATER

- NEW HYDRANT
- PROPOSED / NEW PIPE
- NEW VALVE
- NEW VALVE ON EXISTING PIPE
- NEW HYDRANT ON EXISTING PIPE
- NEW END CAP
- NEW PRV
- NEW AIR VALVE
- NEW WATER METER
- EXISTING PIPE CAPPED
- EXISTING END CAP
- EXISTING NETWORK PIPE
- EXISTING BULK PIPELINE
- EXISTING HYDRANT
- NODE NUMBER (123)
- CLOSED VALVE
- EXISTING VALVE
- EXISTNG COMMUNICATION PIPES
- EXISTING AIRVALVE
- EXISTING WATER METER
- EXISTING PRV
- EXISTING PUMP
- PIPE TO BE ABANDONED (TO BE ABANDONED)
- REDUNDANT PIPE (REDUNDANT)
- EXISTING RES DISTRIBUTION ZONE
- PROPOSED RES DISTRIBUTION ZONE
- EXISTING RAND WATER PIPE
- SUBURB BOUNDARY
- SASOL GAS LINE (GAS)
- PETRONET PIPE (P_NET)
- NEW PIPE IN NEW SLEEVE (SLEEVE Ø TYPE CLASS)

SANITATION

- MANHOLE
- CE / LH
- NEW CCTV INSPECTION
- EXIST. LINE INSPECTED BY CCTV
- NEW SEWER LINE
- EXISTING SEWER LINE
- HOUSE CONNECTION

CITY OF TSHWANE
RUNNING EXCELLENCE
PO BOX 1022
PRETORIA
0001

CITY OF TSHWANE
SERVICES INFRASTRUCTURE DEPARTMENT
WATER AND SANITATION
DIVISION

AMENDMENTS

NR	DATE	APPROVED	DESCRIPTION	PAR
A	AUG 2016		FOR APPROVAL	TEL

WATER AND SANITATION

FOR INTERNAL APPROVAL - RECEIVED SIGN WHEN APPLICABLE

	NAME	Prof. Reg. No	SIGNATURE	DATE
DIRECTOR: WATER AND SANITATION - PLANNING				
REGIONAL DIRECTOR: (1,2,3,4,5,6 or 7)				
DIRECTOR: SYSTEM DEVELOPMENT				
DIRECTOR: BULK WATER				
DIRECTOR: INFRASTRUCTURE PROVISION				
DIRECTOR: WASTE WATER TREATMENT				

CONSULTANT DETAIL

TELAVIZE (PTY) LTD
ENGINEERS & PROJECT MANAGERS

P. O. BOX 11141
ERASMUSKLOOF
0048
TEL : (012) 347 6299
FAX :(012) 347 9767
CELL : 082 492 0682
gfc@gfc-holdings.co.za

I, _____ Prof Reg Nr. _____
HEREBY CERTIFY THAT THE SERVICES WILL HAVE BEEN INSTALLED ACCORDING TO NOTE 9 OF THE ABOVE NOTES AND TO THE DRAWING

SIGNATURE _____ DATE _____

CONSULTANT DRAWING NUMBER: 1632/220/01
REVISION: A

DESIGNED

NAME: M. HADEBE Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

DRAWN

NAME: M. HADEBE Prof Reg No: _____
SIGNATURE: _____ DATE: _____

CHECKED

NAME: G. COMBRINCK Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

INFORMATION OFFICE CHECKED

NAME: _____ Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

DESIGN OFFICE APPROVAL

NAME: _____ Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

CONTRACT No: 1632
PROJECT No. 1632
SHEET No. 1 OF 1
PAPER SIZE: A0
SCALE: 1:1000
DATE: AUGUST 2016

PROJECT STATUS

RECEIVED SIGN WHEN APPLICABLE

CONCEPT DRAWING | TENDER DRAWING | APPROVED CONSTRUCTION DRAWING | AS BUILT DRAWING

PROJECT ENGINEER of COT:
NAME: _____ Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

INSPECTOR OF WORKS of COT:
NAME: _____ Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

LOCATION OF PROJECT:

PEACH TREE EXT 22

DESCRIPTION OF PROJECT:

WATER RETICULATION

GENERAL LAYOUT

WBS No. : __-_____-__-_____-__-__

COT DRAWING NUMBER: __-_____-__-_____-__-__
REVISION: 10

NOTES AND SPECIFICATIONS

GENERAL

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10. FINAL POSITION OF SERVICES TO BE DETERMINED ON SITE.

LEGEND

WATER

- NEW HYDRANT
- PROPOSED / NEW PIPE
- NEW VALVE
- NEW VALVE ON EXISTING PIPE
- NEW HYDRANT ON EXISTING PIPE
- NEW END CAP
- NEW PRV
- NEW AIR VALVE
- NEW WATER METER
- EXISTING PIPE CAPPED
- EXISTING END CAP
- EXISTING NETWORK PIPE
- EXISTING BULK PIPELINE
- EXISTING HYDRANT
- NODE NUMBER (123)
- CLOSED VALVE
- EXISTING VALVE
- EXISTNG COMMUNICATION PIPES
- EXISTING AIRVALVE
- EXISTING WATER METER
- EXISTING PRV
- EXISTING PUMP (P)
- PIPE TO BE ABANDONED (TO BE ABANDONED)
- REDUNDANT PIPE (REDUNDANT)
- EXISTING RES DISTRIBUTION ZONE
- PROPOSED RES DISTRIBUTION ZONE
- EXISTING RAND WATER PIPE
- SUBURB BOUNDARY
- SASOL GAS LINE (GAS)
- PETRONET PIPE (P_NET)
- NEW PIPE IN NEW SLEEVE
- SLEEVE Ø TYPE CLASS

SANITATION

- MANHOLE
- CE / LH
- NEW CCTV INSPECTION
- EXIST. LINE INSPECTED BY CCTV
- NEW SEWER LINE
- EXISTING SEWER LINE
- HOUSE CONNECTION

CITY OF TSHWANE
SUSTAINED EXCELLENCE
PO BOX 1022
PRETORIA
0001

CITY OF TSHWANE
SERVICES INFRASTRUCTURE DEPARTMENT
WATER AND SANITATION DIVISION

AMENDMENTS

NR	DATE	APPROVED	DESCRIPTION	PAR
A	SEPT 2016		FOR APPROVAL	TEL

WATER AND SANITATION

FOR INTERNAL APPROVAL - RECEIVED SIGN WHEN APPLICABLE

DIRECTOR: WATER AND SANITATION - PLANNING
NAME Prof. Reg. No SIGNATURE DATE

REGIONAL DIRECTOR: (1,2,3,4,5,6 or 7)
NAME Prof. Reg. No SIGNATURE DATE

DIRECTOR: SYSTEM DEVELOPMENT
NAME Prof. Reg. No SIGNATURE DATE

DIRECTOR: BULK WATER
NAME Prof. Reg. No SIGNATURE DATE

DIRECTOR: INFRASTRUCTURE PROVISION
NAME Prof. Reg. No SIGNATURE DATE

DIRECTOR: WASTE WATER TREATMENT
NAME Prof. Reg. No SIGNATURE DATE

CONSULTANT DETAIL

T&LAWIZE (PTY) LTD
ENGINEERS & PROJECT MANAGERS
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TEL : (012) 347 6299
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gfc@gfc-holdings.co.za

I _____ Prof Reg Nr.
HEREBY CERTIFY THAT THE SERVICES WILL/I HAVE BEEN INSTALLED ACCORDING TO NOTE 9 OF THE ABOVE NOTES AND TO THE DRAWING

SIGNATURE DATE

CONSULTANT DRAWING NUMBER: 1632/320/01

A REVISION

DESIGNED
NAME: M HADEBE Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

DRAWN
NAME: M. HADEBE Prof Reg No: _____
SIGNATURE: _____ DATE: _____

CHECKED
NAME: G. COMBRINCK Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

INFORMATION OFFICE CHECKED
NAME: _____ Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

DESIGN OFFICE APPROVAL
NAME: _____ Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

CONTRACT No: 1632
PROJECT No. 1632
SHEET No. 1 OF 1
PAPER SIZE: A0
SCALE: 1:1000
DATE: AUGUST 2016

PROJECT STATUS

RECEIVED SIGN WHEN APPLICABLE

CONCEPT DRAWING | TENDER DRAWING | APPROVED CONSTRUCTION DRAWING | AS BUILT DRAWING

PROJECT ENGINEER of COT:
NAME: _____ Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

INSPECTOR OF WORKS of COT:
NAME: _____ Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

LOCATION OF PROJECT:

PEACH TREE EXT 22

DESCRIPTION OF PROJECT:

SEWER RETICULATION

GENERAL LAYOUT

WBS No. : __._____._____._____._____._____

COT DRAWING NUMBER: __._____._____._____._____._____ 10 REVISION

PORTION 4
KNOPJESLAAGTE 392-JR

EXISTING ROAD (30m)

PORTION 107
KNOPJESLAAGTE 385-JR

PORTION 106
KNOPJESLAAGTE 385-JR

M34 KRUGERSDORP PRETORIA ROAD

16m BUILDING LINE

PORTION 109
KNOPJESLAAGTE 385-JR

PEACH TREE X21

5m WIDE R.O.W SERVITUDE

PROPOSED 20m STREET

PEACH TREE X 22

PEACH TREE X24

PEACH TREE X23

20m R.O.W SERVITUDE
(FUTURE ROAD)

PORTION 105
KNOPJESLAAGTE 385-JR

PORTION 111
KNOPJESLAAGTE 385-JR

PORTION 914
KNOPJESLAAGTE 385-JR

R/PORTION 331
KNOPJESLAAGTE 385-JR

N14-HIGHWAY (P158/2)

ON NO. 1439/73

A B C D E F G H J K L M N O P R S T

R15.000 R20.000 R8.000

20.000 10.000 8.000

X 2864500 X 2864550 X 2864600 X 2864650 X 2864700 X 2864750 X 2864800 X 2864850 X 2864900 X 2864925

Y 793500 Y 793550 Y 793600 Y 793650 Y 793700 Y 793750 Y 793800

1:3000 Hz 1:3500 Hz 0.9000 Ha 0.1000 Ha 0.8748 Ha 3.9340 Ha

NOTES AND SPECIFICATIONS

GENERAL

1. ALL MATERIAL AND WORKMANSHIP MUST COMPLY WITH THE REQUIREMENTS OF THE LATEST RELEVANT SABS REQUIREMENTS.
2. ALL DIMENSIONS ARE IN MILLIMETERS. (UNLESS OTHERWISE SPECIFIED)
3. DO NOT SCALE FROM THESE DRAWINGS.
4. ALL DIMENSIONS MUST BE CHECKED AND APPROVED ON SITE.
5. ALL CONSTRUCTION TO BE DONE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS FOR MUNICIPAL CIVIL ENGINEERING WORKS, THIRD EDITION 2005 AND THE STANDARD CTMM DETAIL DRAWINGS
6. THESE DRAWINGS MUST BE READ IN CONJUNCTION WITH THE ARCHITECTS DRAWINGS, (IF APPLICABLE)
7. THIS DRAWING MUST BE READ IN CONJUNCTION WITH THE STANDARD SPECIFICATIONS FOR MUNICIPAL CIVIL ENGINEERING WORKS, SERIES 4.
8. THE SIGNATURE OR INITIALS ON THIS DRAWING, OF ANY MANAGER OF THE TRANSPORT DEPARTMENT, IN NO WAY REMOVES ANY RESPONSIBILITY WHATSOEVER FROM THE CONSULTANT.
9. THE CONSULTANT REMAINS RESPONSIBLE TO ENSURE THAT ALL THE GUIDELINES, STANDARD DRAWINGS, STANDARDS AND SPECIFICATIONS OF THE TRANSPORT DEPARTMENT HAVE BEEN MET AND ARE COMPLIED WITH.
10. FINAL POSITION OF SERVICES TO BE DETERMINED ON SITE.

ROADS:

1. KERBING TO BE AS PER STANDARD DETAIL PLANS A AND B AND SECTION 10 OF VOLUME 1 OF CONTRACT DOCUMENT.
2. TRAFFIC CONTROL MUST COMPLY WITH THE REQUIREMENTS OF THE SOUTH AFRICAN ROAD TRAFFIC SIGNS MANUAL (THIRD EDITION),
3. VERTICAL AND HORIZONTAL ALIGNMENT TO FOLLOW THE EXISTING ROAD SURFACE, WITH A MINIMUM CROSS FALL OF 2 % (IF APPLICABLE)

LEGEND:

- EXISTING PAVING
- NO KERBING
- MOUNTABLE KERBING
- SEMI VERTICAL KERBING

STORMWATER

1. MINIMUM PIPE DIAMETER TO BE 450mm.
2. MINIMUM FALL TO BE 1:150.
3. PIPE BEDDING TO BE CLASS B UNLESS OTHERWISE SPECIFIED.
4. ALL EXCAVATIONS AND BEDDING MUST BE INSPECTED AND APPROVED BY THE ENGINEER BEFORE LAYING OF ANY PIPES.
5. CLEAN EXISTING STORMWATER INLETS AND REPAIR WHERE NECESSARY.(IF APPLICABLE)

LEGEND:

PROPOSED:	EXISTING:
STORMWATER LINE	
MANHOLE	
JUNCTION BOX	
KERB INLET	

CATCHPIT LENGTH
2/3/2
TRANSITION LENGHT
CATCHPIT LENGTH
TRANSITION LENGTH

1:1000

SCALE 1:100 (0 1 2 4 6 10m)
SCALE 1:250 (0 25 50 100 150 200m)
SCALE 1:500 (0 50 100 200 300 400m)
SCALE 1:1000 (0 10 20 40 60 80m)
SCALE 1:2500 (0 25 50 100 150 200m)
SCALE 1:2000 (0 20 40 80 120 160m)
SCALE 1:1500 (0 15 30 60 90 120m)
SCALE 1:1000 (0 10 20 40 60 80m)

AMENDMENTS

NR.	DATE	APPROVED	DESCRIPTION	PAR.

DESIGNED: M HADEBE	DRAWN: M HADEBE
DESIGN CHECKED BY: 1:1000	INFRASTRUCTURE TECHNICAL INFORMATION MANAGEMENT: D.J. CHALMERS

PROJECT STATUS

CONCEPT DRAWING | TENDER DRAWING | APPROVED FOR CONSTRUCTION DRAWING | AS BUILT DRAWING

PROJECT ENGINEER (CONSULTANT)
INITIALS AND SURNAME | SIGNATURE AND PR. No. | DATE
INSPECTOR OF WORKS (CITY OF TSHWANE)
INITIALS AND SURNAME | SIGNATURE AND PR. No. | DATE

CONSULTANT DETAIL

TELAWIZE (PTY) LTD
ENGINEERS & PROJECT MANAGERS

333 EMUS ERASMUS STREET
ERASMUSRAND
0181

P. O. BOX 11141
ERASMUSKLOOF
0048

TEL : (012) 347 4299
FAX (012) 347 9767
CELL : 082 492 0682
e-mail : gfc@gfc-holdings.co.za

CITY OF TSHWANE

ROADS AND TRANSPORT DEPARTMENT

Mr P. I. Lefhonkane
STRATEGIC EXECUTIVE DIRECTOR
P.O. BOX 1409
PRETORIA
0001

Ms. L. V. Kegakilwe-Piki
EXECUTIVE DIRECTOR
P.O. BOX 1409
PRETORIA
0001

DRAWING APPROVED BY EXECUTIVE DIRECTOR
Ms. L. V. Kegakilwe-Piki
SIGNATURE: ..... DATE: .....

INFRASTRUCTURE DESIGN, CONSTRUCTION AND MAINTENANCE DIVISION
For Internal Approval
RECEIVED
SIGNATURE/DATE/CIRCLE
DIRECTOR: TRANSPORT INFRASTRUCTURE PROVISION
DIRECTOR: TRANSPORT INFRASTRUCTURE CONSTRUCTION (PROJECT) MANAGEMENT
DIRECTOR: TRANSPORT INFRASTRUCTURE ASSET MANAGEMENT
DIRECTOR: TRANSPORT INFRASTRUCTURE PLANNING
DIRECTOR: INTELLIGENT TRANSPORT SYSTEMS AND TRAFFIC ENGINEERING
DIRECTOR: INFRASTRUCTURE MAINTENANCE MANAGEMENT (IMM)
DIRECTOR: INTEGRATED TRANSPORT PLANNING

SCALE 1:1000 (0 10 20 40 60 80m)

LOCATION OF PROJECT:

PEACH TREE EXT 22

DESCRIPTION OF PROJECT

ROADS

CONTRACT No.: 1632	PROJECT No.: 1632	
DATE: JUNE 2016	SCALE: 1:1000	ORIGINAL PAPER SIZE: A0
DRAWING NO.: 1632/420/01	SHEET NO.: 1 OF 1	REVISION: 0

M. HADEBE

PORTION 4
KRUISPAAIE 392-JR

PORTION 106
KNOPJESLAAGTE 385-JR

PORTION 107
KNOPJESLAAGTE 385-JR

M34 KRUGERSDORP PRETORIA ROAD

EXISTING ROAD (30m)

16m BUILDING LINE

5m WIDE R.O.W SERVITUDE

PORTION 109
KNOPJESLAAGTE 385-JR

PEACH TREE X21

PEACH TREE X 22

PEACH TREE X23

PEACH TREE X24

PORTION 105
KNOPJESLAAGTE 385-JR

PORTION 111
KNOPJESLAAGTE 385-JR

PROPOSED 20m STREET

20m R.O.W SERVITUDE
(FUTURE ROAD)

5m WIDE WATER PIPELINE SERVITUDE S.G. No. 1024/2007

STORM WATER CONNECTION POINT FROM PEACH TREE EXT 21

PEACH TREE X 22

PORTION 914
KNOPJESLAAGTE 385-JR

R/PORTION 331
KNOPJESLAAGTE 385-JR

N14-HIGHWAY (P158/2)

MATION NO. 1439/73

NOTES AND SPECIFICATIONS

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LEGEND:

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NO KERBING
MOUNTABLE KERBING
SEMI VERTICAL KERBING

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MANHOLE
JUNCTION BOX
KERB INLET
CATCHPIT LENGTH
2/3/2
TRANSITION LENGHT
CATCHPIT LENGTH
TRANSITION LENGTH

SCALE 1: 100
SCALE 1: 250
SCALE 1: 500
SCALE 1:1000
SCALE 1: 2500
SCALE 1: 2000
SCALE 1:1500
SCALE 1: 1000

1:1000

AMENDMENTS

NR.	DATE	APPROVED	DESCRIPTION	PAR.

DESIGNED: M HADEBE
DRAWN: M HADEBE
DESIGN CHECKED BY: 1:1000
INFRASTRUCTURE TECHNICAL INFORMATION MANAGEMENT: D.J. CHALMERS

PROJECT STATUS

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INITIALS AND SURNAME / SIGNATURE AND Pr. No. / DATE
INSPECTOR OF WORKS (CITY OF TSHWANE)
INITIALS AND SURNAME / SIGNATURE AND Pr. No. / DATE

CONSULTANT DETAIL

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DRAWING APPROVED BY EXECUTIVE DIRECTOR
Ms. L. V. Kegakilwe-Piki
SIGNATURE: ..... DATE: .....

LOCATION OF PROJECT:

PEACH TREE EXT 22

DESCRIPTION OF PROJECT:

STORM WATER

CONTRACT No. : 1632		PROJECT No. : 1632
DATE: JUNE 2016	SCALE : 1:1000	ORIGINAL PAPER SIZE: A0
DRAWING NO: 1632/520/01	SHEET NO: 1 OF 1	REVISIONS: A

INFRASTRUCTURE DESIGN, CONSTRUCTION AND MAINTENANCE DIVISION
For Internal Approval
RECEIVED
SIGNATURE AND DATE

DIRECTOR: TRANSPORT INFRASTRUCTURE PLANNING
DIRECTOR: TRANSPORT INFRASTRUCTURE CONSTRUCTION PROJECT MANAGEMENT
DIRECTOR: TRANSPORT INFRASTRUCTURE ASSET MANAGEMENT
DIRECTOR: TRANSPORT INFRASTRUCTURE PLANNING
DIRECTOR: INTELLIGENT TRANSPORT SYSTEMS AND TRAFFIC ENGINEERING
DIRECTOR: INFRASTRUCTURE MAINTENANCE MANAGEMENT (ISM)
DIRECTOR: INTEGRATED TRANSPORT PLANNING

SIGNATURE / DATE

0 10 20 40 60 80m
SCALE 1:1000

M. HADEBE

ADDENDUM D

SEWERAGE TREATMENT PLANT DOCUMENTATION

Monday, July 18, 2016.

Attention: Mr. DeWet Botha.

General Introduction

This is a challenging time to find smart yet low cost engineering solutions with little down side risk. AQUA MEDIA have designed and produced a very successful range of High Speed MBBR Systems to help you provide simple low-cost solutions to meet the most stringent water and wastewater standards.

Wastewater Treatment Innovation from AQUA MEDIA CC.

AQUA MEDIA CC was founded in 1989. Since then, we have designed and supplied many wastewater treatment plants all around the world. AQUA MEDIA would like to work with you to provide 'THE RIGHT Solution" with a single system or a combination of systems to satisfy your specific need. AQUA MEDIA high quality bio systems are automated, extremely reliable, and are selected by high end clients and military around the world.

Your Package Plant Requirements

We understand from the specification we received that your requirements for a wastewater treatment system must meet BOD and Total Suspended Solids standards less than 30 mg/l. The High Speed MBBR Systems proposed are capable of average 400 m3 per day at 30 mg/l BOD effluent and provides low capital and operating cost benefits. They will require a smaller foot print than the other units you may be currently considering and have a greater range of flexibility and higher performance capability. AQUA MEDIA HS MBBR systems offer many unique features.

System Features

We have taken effort to incorporate our considerable past experience in our offer, which has made it elaborate & comprehensive. We have incorporated several world class, renowned, and well supported equipment & instrumentation, which are time tested, both at home & abroad. Care has been taken for selection of proper & robust material of construction of each component in our package plant system, as we believe that appropriate selection of materials is vital in such a sophisticated system.

- Very compact & occupies 50% less space than other sewerage treatment plants.
- Less maintenance, low capital & operating cost benefits
- Simple assembly and operated by trained, on site, labor.
- The system is prefabricated and mounted in ISO size freight containers and no larger than standard ISO freight containers.
- Easily transportable to any location unlike other conventional treatment plants

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Director: Bruce Dalton

- There is no need to add micro organism.
- The system will operate without any chemical addition
- Easy start up, fully automatic operation, reliable & robust once started
- One central control panel for easy operation.
- Clog free air distribution system and by AM biofilm carrier elements.

AQUA MEDIA High-Speed MBBR – STP

A. Buffer Tank

The sewage is pumped or gravitates into the buffer tank from the community. The buffer tank equalizes the variation in flow over the day. The buffer tank is aerated with coarse bubble diffuser so that sewage does not become septic (Anaerobic). **The air supply and air diffusers are included in the AQUA MEDIA scope of supply as a separate item in the price schedule below. The buffer tank is not in the AQUA MEDIA scope of supply and will be supplied by the customer as per our drawing.**

B. Biological Treatment System to be provided

The AQUA MEDIA biological treatment system is based on the moving bed bio reactor (mbbr) process and comes with two moving bed bioreactors (MBBR) in series.

The first reactor is acting as a roughing reactor to reduce peak loads and remove approximately 80% of the influent BOD. The second reactor is a polishing reactor designed to reach the required effluent BOD.

The bioreactors are filled with "AM Biofilm Elements" a specially designed bio film carrier element which is free floating and moves around in the reactor with the flow. The AMB bio medium provides an effective bio film surface of 1000 m2 plus per m3 bulk material. Simultaneously, biomass is trapped inside the carrier elements, providing additional MLVSS in the reactors without need for conventional activated sludge return.

The bioreactors are aerated through a coarse bubble air distribution system at the bottom of the tank, with air supply from a rotary displacement air blower. The diffusers are designed and manufactured by AQUA MEDIA in stainless steel and may be removed and serviced without stopping aeration.

C. Settling Tank and Sludge Separation System

The biodegraded water flows by gravity into the clarification stage where the suspended solids settle by gravity. The water is directed through a skim well to an inclined tube settler,

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which provides the final clarification of the effluent, and where the sludge settles easily to the bottom of the tank.

The sludge is removed by a timer controlled AQUA MEDIA hydrocyclone assembly that separates volatile sludge from non volatile sludge. The excess sludge is transferred to a waste sludge holding tank which may be integrated in the AQUA MEDIA holding tank system, or arranged as freestanding thickener tank for further processing of the sludge using a filter press.

D. Tertiary Filtration system

The suspended solids in the wastewater are further polished by dedicated multimedia filters. The backwash from these units is returned to the start of the process. Clean water from the process is used to backwash the multimedia filters.

E. Chlorination system (Sterilization)

Chlorine is dosed as a calcium hypochlorite solution from a make up tank. This is proportional to flow on the downstream side of the multimedia filters. The make up tank has an electric agitator. We can offer an Ultraviolet system as an alternative sterilization method (or in addition to Chlorine dosing.)

F. Control Panel

A control panel is included which houses the motor control centre for various drives and the control of operation of the sewage treatment plant.

System Operation:

A. Flow Control.

The primary effluent from the holding tank system is pumped into the first MBBR stage by a submerged sewage pump with its own high/low level switch. The pump flow rate is manually controlled by a return control valve at the exit of the pump well, and monitored by a flow indicator with local display.

B. Effluent Control

Samples should be taken and analyzed according to local regulation for BOD and COD. A correlation is to be established between BOD and COD values, and COD measurements to be used for regular operation control. This must be done every 8 days until the system is fully settled. Bio growth accelerators can be added to speed the process initially. Laboratory equipment and chemicals can be purchased from AQUA MEDIA for this purpose if required.

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SCOPE OF SUPPLY

1. **Design and Supply of the systems:**

A Appropriately sized air supply with distribution system.

B 2 x 310-24MAXI-3 High-Speed Bio Systems - Fully automatic systems with automatic sludge separation Main components pre-assembled and tested before shipping. Each unit consists of following components. :

- Main Bio Reactor Tank with three chambers in MS epoxy coated.
- AM Biofilament elements.
- SS Course Air Distribution systems with butterfly valves, coarse air, No clogging. AQUA MEDIA Design
- Non-Return valves (Check valves)
- Necessary Cables & Accessories
- Tube Settler
- Rotary Displacement Blower.
- Submersible Feed Pumps.
- Displacement Sludge / Recycling Pump.
- Necessary uPVC Piping & valves
- Chlorine dosing equipment
- Motor Control Panel.

C Sludge Storage

- 6 000L Sludge Storage Tank
- Piping, valves, tank connectors, etc

D Tertiary Filtration for 26 m3/hr

- Dedicated Filter Feed pumps per Filter
- Pre Strainers
- 5 x 840mm diameter Multimedia Filters
- Pre and Post Filtration sample points
- Pressure Gauges
- Manual Backwash

E Chlorination System

- 1 000L Make-up Tank
- Electric Agitator
- Milton Roy Dosing pump
- Water Make-up Lines
- Drain

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2. Technical Material to be provided with systems:

P&I Diagram and Bill of Material

System Layout and Installation Drawings.

Installation, Operation & Maintenance Manuals.

Fulll training of on site labour.

3. Start-up & Training:

AQUA MEDIA engineers can start-up and train the personnel, see options.

NOTE: More than often clients are able to start-up our bio systems by follow simple instructions in the operational manual. All systems are automatic once started up. AM High-Speed Bio Tec systems are simple to operate and extremely robust and reliable once in operation.

4. Customer To Supply:

Provide interconnecting piping to buffer tank and bioreactor, bioreactor and sludge & clean water holding tanks.

Provide field electrical wiring.

Electrical power to our control panel, 415 volts, 3 ph, 50 hz, 4 wire.

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DESIGN PARAMETERS

FLOW RATE	M3/DAY	310 x 2		CONTAINERISED	YES
TEMPERATURE	^{0}C	20		TOTAL AVE. FLOW M3/H	25.8
			INLET	OUTLET	REMOVAL %
BOD	MG/L		300	30	90%
SS	MG/L		300	30	90.%
OIL & GREASE	MG/L		6	6	0%

PLANT SPECIFICATIONS of each 310-24maxi-3

TECHNICAL SPECIFICATIONS OF		310-24maxi-3		
Description	Specification	Unit	Quantity	Specification
Maximum flow		m3/d		310
Tank container			1	
Bioreactor + Settler	Overall length	mm		12100
	Overall width	mm		2192
	Overall height	mm		2896
Bio media	Proprietary	m3	8	PU/ Levapor
Settling Media	Tube deck	m3	5 .8	PVC

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Rotary displacement blower			**1**	
	Manufacturer			**HPE blowers, Spain or Equivalent**
	Nominal capacity	**m3/h**		**400**
	Back Pressure	**mmwc**		**3700**
	Motor HP	**kw**		**5.5**
Submersible pump			**1**	
	Manufacturer			**Wilo, Germany.**
	Nominal capacity	**m3/h**		**20**
	Back pressure	**m**		**6.5**
	RPM			**2900**
	Motor HP	**kw**		**1.5**
Sludge return pump			**1**	
	Manufacturer			**Alpha, Italy**
	Nominal capacity	**m3/h**		**4**
	Back pressure	**m**		**10**
	RPM			**2900**
	Motor HP	**kw**		**0.75**
Hydrocyclone			**1**	
	Manufacturer			**AQUA MEDIA**
	Nominal capacity	**m3/h**		**3**
	Pressure drop	**m**		**4.0**

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Electricals	**Installed power**	**kw**		**10.00 kW.**
Shipping weight				
Without doors & top covers		**kg**		**12 000**
Operating weight				
Without doors & top covers		**kg**		**75 000**
Overflow pump			**1**	
	Manufacturer			**Espa, Spain**
	Nominal capacity	**m3/h**		**17**
	Back pressure	**m**		**10**
	RPM			**2900**
	Motor	**kw**		**1.1**
Shipping Weight		**kg**		**12 000**
Operating weight		**kg**		**75 000**

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PRICE SCHEDULE.

Per 620 m3/day system.

AQUA MEDIA System Offer as requested.	Qty	Unit Price ZAR	Total ZAR
A. Air blower and air diffusers in Buffer tank.	1	ZAR 98 996.00	ZAR 98 996.00
B. 2 x 310 m3/d – AM HS MBBR 310-24MAXI-3 including:- - Pre Screens, two off in set - 1 x Tertiary filtration system complete, skid mounted, complete with dedicated duty/ standby pumps for each Filter. - AFM media. - 1 x Chlorination system	1	ZAR 2 654 465.00	ZAR 5 308 930.00
C. Sludge Storage tank complete with interconnecting pipework.	1	ZAR 23 875.00	ZAR 23 875.00
C. Transport to Site	1	ZAR 73 500.00	ZAR 73 500.00
D. Clamp-On Flowmeters	2	ZAR 23 790.00	ZAR 47 580.00
E. Startup support engineering. One engineer for 5 (five) days	5	ZAR 3 950.00	ZAR 19 750.00
F. Buffer tank Civils and excavation by Client. Ancillary services by Client: Power supply to boards supplied by Aqua Media cc. Sewer outfall pipe 200 mm and isolating valve. Finished effluent pipe to final use/ disposal.			
Sub-Total Excluding VAT.			**ZAR 5 572 631.00**
Less: 1,5% Discount (subject to Terms & Conditions below)			**(ZAR 83 589.46)**
TOTAL Excluding VAT AFTER DISCOUNT			**ZAR 5 489 041.60**

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Taxes and Transport :

All prices quoted above exclude VAT. Transport cost are subject to fuel and transport costs at time of dispatch.

Recommended Options:

1. Automated raw sewage screening system: ZAR 770 250.00 + VAT.

Validity:

Prices are valid to 31 August 2016.

Payment Terms:

35% on order, 30% materials on hand, 25% on delivery, 5% on completion of installation, 5 % on completion of commissioning.

A 1,5% discount will apply provided payment is received within 15 working days of invoice.

Ownership of all goods vests in Aqua Media cc until paid for in full.

Transportation

There will be a total of two 12 m HIGH CUBE ISO containers, One container per 310m3/day plant (total 2) and one 6 m ISO standard container for shipment of Tertiary Filtration and Chlorination.

Delivery time:

We shall complete the supply of the first Sewage Waste Water Treatment Plant including Tertiary Filtration and Chlorination System as mentioned in our technical specification **within 16-18 weeks from order and payment of the advance payment invoice** (Excluding Freight Duration). Unit two will be ready for delivery in 2 – 4 weeks later.

The delivery period indicated above shall be calculated from the date of receipt of payments. We will not be held responsible for delays due to administration, financial or procurement procedures from the client or any other 3rd party.

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Force Majeure Clause:

AQUA MEDIA shall not be liable for any failure or delay to perform any of its obligations hereunder if such failure or delays has occurred by an act of God, Strike, Lockout, inability to obtain materials, fire, breakdown, war, civil commotion, destruction of plant, governmental act or regulation, or any other cause or events beyond the control of AQUA MEDIA, or its suppliers or shippers / forwarders.

WARRANTY

AQUA MEDIA , warrants the Purchaser that the system, as delivered to Purchaser, shall be free from defective material or workmanship for a period of eighteen (18) months from date of delivery or one (1) year from date of installation, whichever comes first. This warranty does not apply to damages resulting from accident, neglect, and misuse. The foregoing warranty is the only warranty extended by AQUA MEDIA, and is in lieu of other warranties, express or implied.

This Guarantee is also subject to following:

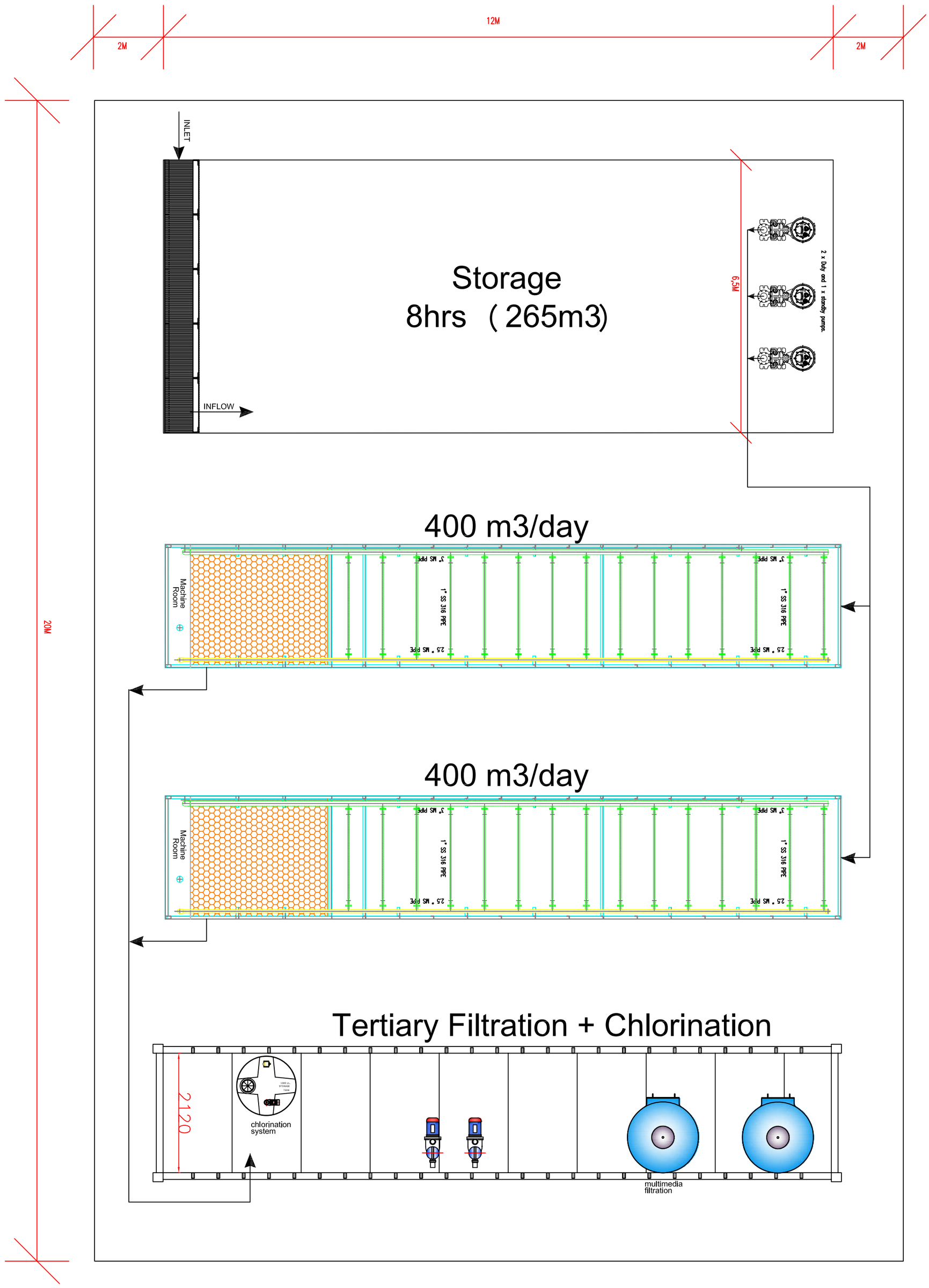
- Strictly following instructions as mentioned in system performance warranty annexure.
- Taking care of preventive maintenance as suggested by us.
- Maintaining operation & maintenance data's / records log sheets & the same is made available whenever asked by us.
- Maintaining parameters as per clauses of various annexure of our offer.

AQUA MEDIA thanks you for the opportunity to be of assistance to you on this project. If you have any questions or require additional information please do not hesitate to let us know at your earliest convenience.

Yours faithfully

Bruce Dalton.
Director.
Aqua Media cc

P.O. Box 685, Kyalami Estate, 1684.South Africa.
Tel: +27116744742/4725789Fax: +27116744743
Mobile:+27832635598Website: www.aquamedia.co.za
Director: Bruce Dalton



AQUA MEDIA CC

Unit 3 BARBECUE HEIGHTS, 9 DYTCHLEY RD.,
Barbecue Downs, Milnerton, 7404
P O Box 685 Woodbridge Estate, 1684, Gauteng, South Africa
Tel: +27(11) 466-0325 / 4255 /5702
Fax: +27(11) 466 0421
e-mail: dalton@aquamedia.co.za

PROJECT	NIGERIA - 2 x 400 m3/day SEWAGE TREATMENT PLANT
CLIENT	STEVE PEARSE
DRAWING TITLE	LAYOUT DIAGRAM
DRAWING No.	REV. 0
SCALE	NTS
DATE	05/11/13
DRAWN	

ADDENDUM E

GLS REPORT

25 1989 - 2014
celebrating 25 years of excellence

B17-04

15 August 2016

General Manager: Water and Sanitation
City of Tshwane Metropolitan Municipality
PO Box 6338
PRETORIA
0001

ATTENTION: Ms. Semakaleng Dlavani

Dear Ma'am,

WATER AND SEWER MASTER PLANS: DEVELOPMENT OF PROPOSED TOWNSHIP/REZONING – KNOPJESLAAGTE 385-JR PORTION 105, 109 AND 331

The attached request from Civilconsult (Gideon Ras) dated 30 March 2016 with regards to accommodating the proposed development in the Tshwane water and sewer systems has reference.

Although the City of Tshwane has water and sewer master plans, you requested this further analysis and report because :

- ☑ The development has large fire flow requirements (e.g. 20ℓ/s, 25ℓ/s or 50ℓ/s which is usually the case for higher density cluster developments, industry, general business, shopping centres or high-rise flats >= 4 storeys).
- ☑ The development has a substantially higher water demand than used in the master plan.
- ☑ The reservoir which will supply the development in future will be different to the reservoir which currently supplies the development (i.e. a change in reservoir supply zones).
- ☑ The reservoir zone in which the development falls is currently experiencing inadequate bulk water system capacity.
- ☑ The drainage area in which the development falls is currently experiencing inadequate bulk sewer system capacity.

This report is a technical report stating upgrades required in the distribution networks in the vicinity of the proposed development. The City of Tshwane engineer (yourself) will accept the report or suggest changes and will make a final decision on works to be implemented by the proposed development.

This analysis and report is based on the 2010 water and sewer master plans which are updated every quarter. The latest master plans used in this analysis were the January 2016 master plans.

All costs shown in this report are year 2015/16 Rand value estimates and **include** 40% surcharge for P&Gs, contingencies and fees but **exclude** VAT.

GLS Consulting (Pty) Ltd
Tel +27 21 880 0388 | **email:** info@gls.co.za
PO Box 814, Stellenbosch, 7599, South Africa
13 Elektron Street, Techno Park, Stellenbosch
www.eoh.co.za | **www.gls.co.za**
Reg no: 2007/003039/07

1 WATER DISTRIBUTION NETWORK

1.1 Water Resource

The City of Tshwane (CoT) straddles two primary water catchments namely: the Crocodile River basin in the west and the Olifants River basin in the east. The dividing line between these two catchments runs in a north-south direction approximately through Cullinan. Water resources in the Crocodile River basin in the west together with imports from the Vaal River basin via the Rand Water system are sufficient to supply CoT reservoirs in this basin. However, water resources in the Olifants River basin in the east are fully committed and cannot supply **additional** water to any existing or future CoT reservoirs without additional Rand Water supply through new pipelines, especially to the Cullinan WTP and Bronkhorstspruit WTP.

The CoT Water Resources Master Plan (2014) indicates that the reservoir listed in section 1.2 below is supplied from the water source shown in the table below. From this information it can be seen that this water source is adequate to cater for the proposed development.

Catchment	Water Source	%	Comment
Vaal River basin	Rand Water	100%	The master plan calculates the water volumes required at all Rand Water connections to supply applicable reservoirs. These calculations are supplied by the CoT to Rand Water and the City obtains agreements from Rand Water for these volumes.

1.2 Distribution Zone

The proposed development was taken into consideration in the above mentioned water master plan as part of the Knopjeslaagte 385-JR Ptns 105-109-331 future development area with a landuse of low density residential.

The master plan indicates that the proposed development currently falls in no reservoir supply zone but in the future will form part of the Mnandi reservoir zone as shown in **Figure 1 (Water)**.

1.3 Revised Water Demand

The combined AADD for the proposed development as originally calculated and used in the analysis of the water distribution network in the master plan was 441 kℓ/d.

The revised AADD, peak flow and fire flow calculated for the proposed development and used in the re-analysis of the water distribution network was 906 kℓ/d calculated as follows:

Erf No.	Anticipated Landuse	New Dev. Area (ha)	Density (Units/ ha)	FSR	Floor space (ha)	No. of Units	FSR Units	UWD Type	UWD (inc.UAW)		AADD (inc.UAW) (kl/d)	PDDWF incl. Infil. (kl/d)	Water / Sewer Ratio	IPDWF (l/s)	IPWWF (l/s)
	NEW DEVELOPMENT														
Erven 1 & 2	Industrial (dry)	12.391		0.60	7.434		743.43	floor	0.40	kl/100m²/d	297	211	71%	3.6	5.1
Erven 3 & 4	Industrial (dry)	16.304		0.60	9.782		978.22	floor	0.40	kl/100m²/d	391	277	71%	4.7	6.7
Erf 5	Gate house for security villages	1.147	1			1		unit	0.60	kl/unit/d	1	0	67%	0.0	0.0
Erf 6	Private open space	0.745						area	15.00	kl/ha/d	11	0	0%	0.0	0.0
Ptn 105	Industrial (dry)	8.564		0.60	5.138		513.85	floor	0.40	kl/100m²/d	206	146	71%	2.5	3.5
	Roads	1.717						none	0.00	kl/unit/d	0	0	0%	0.0	0.0
	New Master Plan Total	**40.867**				**1**	**2235**				**906**	**634**		**10.8**	**15.4**

- Peak flow using zone peak hour factor of: 3.0‡ = 31.5 ℓ/s
- Fire flow for type: Industrial/business (moderate risk) = 50 ℓ/s @ 15 m

‡ Higher peak flow factors might be applicable for internal networks.

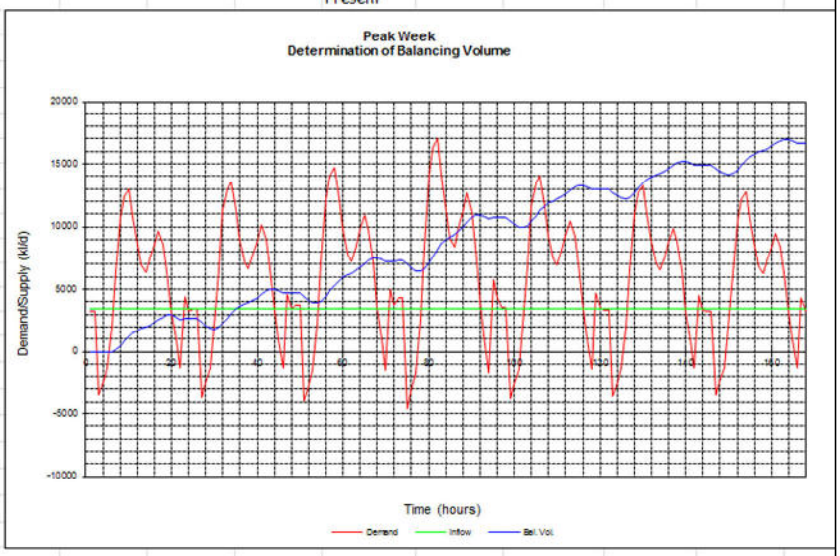
1.4 Accommodation of Proposed Development in the Existing Water System

Accommodation of the proposed development, with its revised AADD, requires implementation of the following additions and adjustments to the *existing* water system:

1.4.1 Bulk Items

The current Mnandi reservoir zone AADD plus UAW ("scenario 2" in WADISO) in the m2016-01 Tshwane water model is 3 487 kℓ l/d. The capacity of the existing Mnandi reservoir is 15 000 kℓ. The two existing FCVs can only supply 20 ℓ/s each (which is too low). Using these three input variables in a reservoir sizing spreadsheet, it shows that demand consistently exceeds supply and thus the balancing volume increases to unworkable volumes.

Type in values in shaded cells				Mnandi reservoir		
Full zone	MNANDIRES		3487		Present	
Direct zone	MNANDIRES		7190			
AADD	**3487**	kl/d				
PDF	**2.00**	* AADD				
PWF	**1.65**	* AADD				
P3DF	1.79	* AADD				
Supply	**1**	* AADD				
=	3487	kl/d				
=	40.4	l/s	Pipe @ 1.8m/s			
			0.169			
Bal.Vol.	16981.7	kl				
=	116.9	h*AADD				
			%			
Pattern 1	Residential	Large	**0.0%**			
Pattern 2	Residential	Medium	**206.2%**			
Pattern 3	Residential	Small	**0.0%**			
Pattern 4	LC Housing		**0.0%**			
Pattern 5	B/C-Indust	Medium	**0.0%**			
Pattern 6	B/C-Indust	Large	**0.0%**			
Pattern7	Even	To a res.	**-106.2%**			
Must add up to 100 --> check			100.0%			



VOLUME ANALYSIS (applies only to area directly supplied, I.e. not to the Pattern 7 supply)						
Capacity	15000 kl	=	50.1 h x AADD	Mnandi Res	0 l/s	
Required balancing	16982 kl	=	56.7 h x AADD	Mnandi Res2 FCV	20 l/s	
Available volume	-1982 kl	=	-6.6 h x AADD	Mnandi Res2 FCV	20 l/s	
Required emergency	5392 kl	=	**18.0** h x AADD		**40 l/s**	

The Mnandi reservoir thus needs its own new RW connection to increase the supply into the Mnandi reservoir.

1.4.2 Reticulation Items

Items required to alleviate existing problems in the water distribution system:

- None

Items required to accommodate the proposed development (excluding fire flow requirements):

• MNR.6	475	m	x	600	mm Ø REPLACEMENT pipe (replacing an existing 110 mm Ø pipe)	R	3 100 000
• MNR.7	2 460	m	x	450	mm Ø main pipe	R	9 500 000
• MNR.8	710	m	x	450	mm Ø main pipe	R	2 800 00
• MNR.9 (part of)	1 045	m	x	**355**	mm Ø main pipe	R	1 900 000

Items required to accommodate the proposed development (including fire flow requirements):

- As above, and

• ITEM 1	580	m	x	250	mm Ø main pipe (this pipe is internal to the development)	R	-

Should this development and the above pipe routes fall within a dolomitic area, the diameters stated above should be read as internal diameter sizes due to the wall thickness of HDPE pipes.

The proposed connection point to the existing water distribution system is shown in **Figure 1 (Water)** attached.

1.5 Internal Reticulation

The internal network design on the property of the proposed development is beyond the scope of this report. However, the consulting engineer for the development is required to allow for the fire flow demand as listed in 1.2 above on the internal networks.

For internal network design purposes the water distribution network provides the following energy gradelines (EGLs) at the proposed connection point (see **Figure 1 (Water)**):

- Static EGL = 1 542 m a.s.l. (76 m)
- Residual EGL = 1 523 m a.s.l. (57 m)
- Fire Flow EGL = 1 505 m a.s.l. (39 m)
- Ground Level = 1 466 m a.s.l.

1.6 Adjustments to the Master Plan

The revised AADD of the proposed development requires the following additions and adjustments to the *master plan* as indicated in **Figure 1 (Water)** attached:

Internal reticulation pipes to be re-rerouted according to the township layout and the water demand to be more than doubled from 441 kℓ/d to 906 kℓ/d.

2 SEWER NETWORK

2.1 Drainage Area

The proposed development was taken into consideration in the above mentioned sewer master plan as part of the Knopjeslaagte 385-JR Ptns 105-109-331 future development area with a landuse of low density residential.

The master plan indicates that the proposed development falls in the Swartspruit drainage area as shown in **Figure 2 (Sewer)** attached. This drainage area drains to the Sunderland WWTP.

2.2 Revised Sewer Flow

The combined peak day dry weather flow (PDDWF) for the proposed development as originally calculated and used in the analysis of the sewer system in the master plan was 193 kℓ/d.

The revised PDDWF calculated for the proposed development and used in the re-analysis of the sewer system was 634 kℓ/d with an instantaneous peak dry weather flow (IPDWF) of 10.8 ℓ/s. The design flow, or instantaneous peak wet weather flow (IPWWF), is 15.4 ℓ/s.

2.3 Accommodation of the Proposed Development in the Existing Sewer System

Accommodation of the proposed development, with its revised PDDWF, requires implementation of the following additions and adjustments to the *existing* sewer system as indicated in **Figure 2 (Sewer)** attached:

2.3.1 Sewer Bulk Items

- None.

2.3.2 Sewer Reticulation Items

MP Item No	MP Description	Total Length (m)	Design Flow	Design Flow Unit	Name	New Pipe ND (mm)	Total Cost
SB_F047.00	New Gravity	554	15.4	L/s		200	R 635 700
SB_F039.17	New Gravity	77	122.3	L/s		315	R 213 400
SB_F039.18	New Gravity	62	258.3	L/s		525	R 268 200
SB_F039.19	New Gravity	350	262.9	L/s		450	R 1 052 300
SB_F039.20	New Gravity	854	267.8	L/s		525	R 2 882 400
SB_F039.21	New Gravity	251	268.5	L/s		450	R 769 500
SB_F039.22	New Gravity	556	273.5	L/s		525	R 1 896 900
SB_F039.23	New Gravity	102	298.7	L/s		600	R 462 400
SB_F039.24	New Gravity	625	331.5	L/s		600	R 2 468 000
SB_F039.25	New Gravity	250	339.9	L/s		525	R 886 800
SB_F039.26	New Gravity	1455	356.4	L/s		600	R 5 644 600
SB_F103.01	New Flow Diversion	0	356.4	L/s		0	R 0
SB_F103.02	Alternative Gravity	396	0.2	L/s		600	R 1 588 400
SB_F004.02	New Gravity	759	36.8	L/s		250	R 1 217 200
SB_F004.03	New Gravity	310	37.9	L/s		250	R 519 700

MP Item No	MP Description	Total Length (m)	Design Flow	Design Flow Unit	Name	New Pipe ND (mm)	Total Cost
RS_F081.02	Alternative Gravity	23	240.0	L/s		525	R 146 900
RS_F081.03	New Pump Station	0	240.0	kL/d	Vlakplaats 5A PS	0	R 3 112 200
RS_F081.04	Alternative Rising	3951	0.0	L/s	Vlakplaats 5A PS	560	R 21 393 400
RS_F081.05	Alternative Gravity	640	240.4	L/s		525	R 2 377 400
RS_F082.01	New Gravity	640	246.1	L/s		525	R 2 377 300
RS_F082.02	New Gravity	165	251.2	L/s		450	R 571 100
RS_F082.03	New Gravity	398	254.9	L/s		450	R 1 298 400
RS_F082.04	New Gravity	331	257.6	L/s		450	R 1 086 500
RS_F069.00	New Gravity	423	262.1	L/s		525	R 1 591 000
RS_F068.03	New Gravity	586	273.5	L/s		525	R 2 181 700

The proposed connection point to the existing sewer system is shown in **Figure 2 (Sewer)** attached.

In **Figure 2 (Sewer)** attached pipes in future development areas are indicated schematically.

The above Design Flows (or IPWWF) and thus pipe sizes were calculated taking cognizance of future developments upstream and downstream of the proposed development. In this regard, sewer pipes must be designed (layout and sizing) to receive design flows from all interconnecting sewer pipes as shown in **Figure 3.3 (Option 3)**.

2.4 Adjustments to the Master Plan

No adjustments to the sewer master plan are required due to the revised PDDWF of the proposed development.

Yours sincerely,

Per: Dr BF Loubser
GLS Consulting

(Report done by: Adie Vienings)

REQUEST FROM CONSULTANT TO GLS

From: Gideon Ras <ras@civilconsult.co.za> Sent: Wed 30/03/2016 09:51
To: Adie Vienings
Cc: 'Leon Wentzel'; 'Civilconsult'; 'Damian Queck'; 'Danie Meintjies'
Subject: RE: Portion 109 and 331 of the Farm Knopjeslaagte 385-JR

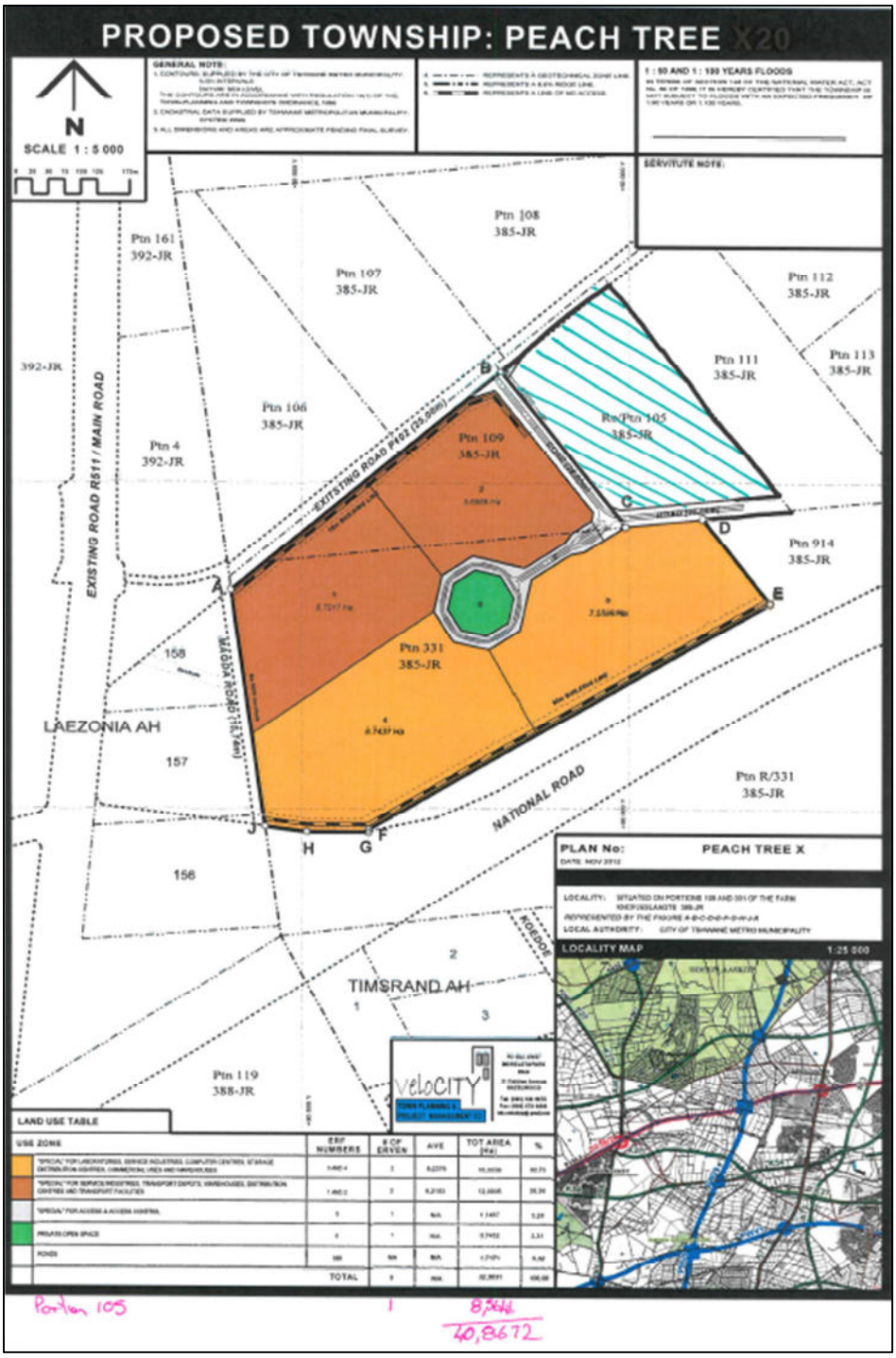
Message SKMBT_C224e16031111260.pdf

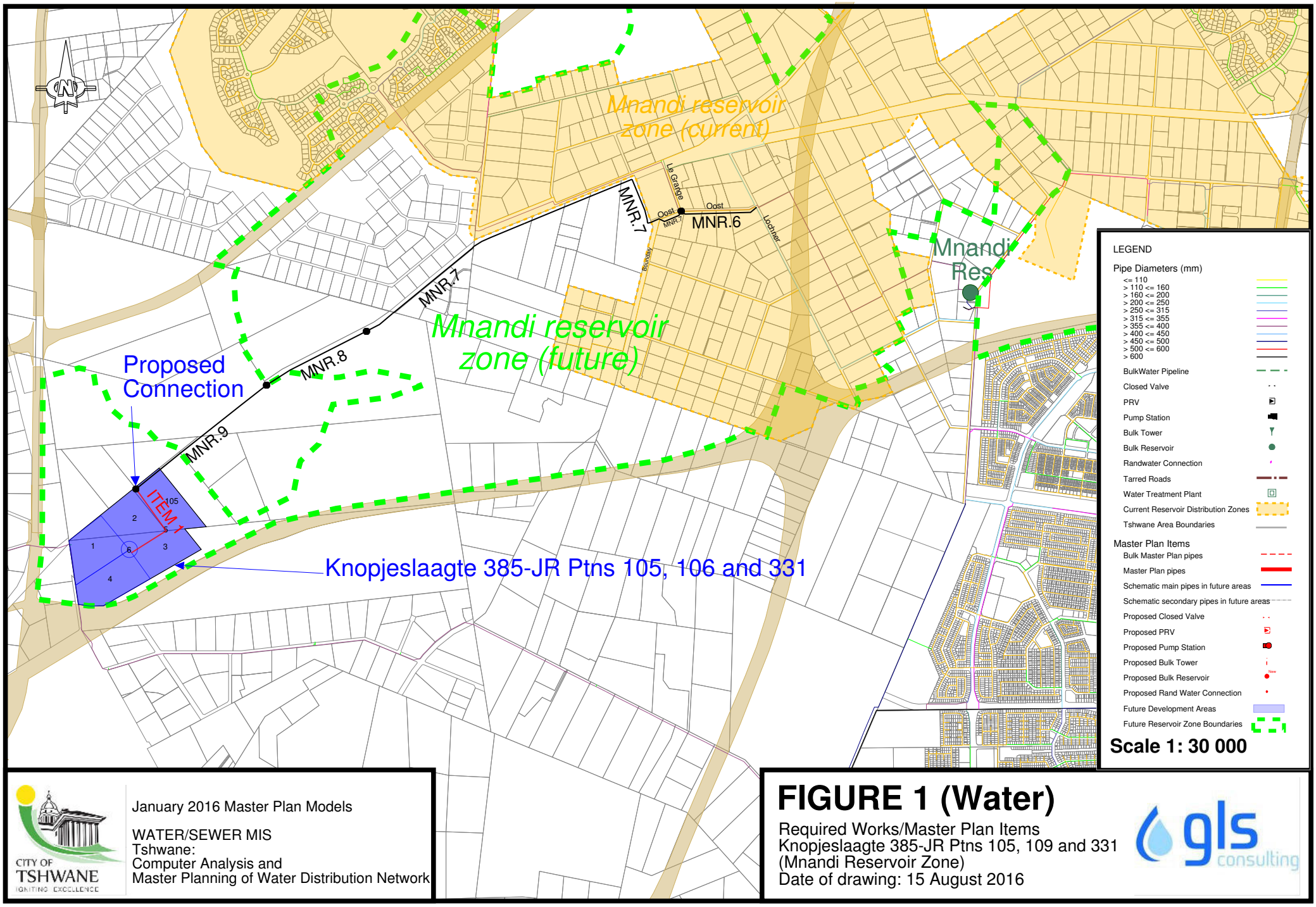
Hi Adie,

Thank you for the feedback.

Please include Remainder of Portion 105 in the analysis/report. The total area is thus approximately 40.8672ha.

Use Zone / Reservation	Erf No.	Area (ha)	FAR / Coverage	Floor Area(m^2)
"Special" for laboratories, service industries, computer centres, storage distribution centres, commercial uses and warehouse		8.5641	0.6	51384.6
"Special" for laboratories, service industries, computer centres, storage distribution centres, commercial uses and warehouse	3 & 4	16.3038	0.6	97820
"Special" for service industries, transport depots, warehouses, distribution centres and transport facilities	1 & 2	12.3905	0.6	74340
"special" for access & access control	5	1.1467	0.6	6880
Private Open Space	6	0.7452	0	-
Roads	N\A	1.7171	0	-


PROPOSED TOWNSHIP: PEACH TREE X20
N
SCALE 1 : 5 000
GENERAL NOTE:
SERVITUTE NOTE:
1 : 50 AND 1 : 100 YEARS FLOODS
Ptn 161
392-JR
Ptn 107
385-JR
Ptn 108
385-JR
Ptn 112
385-JR
Ptn 111
385-JR
Ptn 113
385-JR
392-JR
EXISTING ROAD R511 / MAIN ROAD
Ptn 106
385-JR
Ptn 4
392-JR
EXISTING ROAD P482 (25.00m)
Ptn 109
385-JR
Rm/Ptn 105
385-JR
Ptn 914
385-JR
A
B
C
D
E
F
G
H
J
Ptn 331
385-JR
158
LAEZONIA AH
157
156
NATIONAL ROAD
Ptn R/331
385-JR
PLAN No:
PEACH TREE X
LOCALITY:
LOCAL AUTHORITY:
CITY OF TSHWANE METRO MUNICIPALITY
LOCALITY MAP
1:25 000
TIMSRAND AH
Ptn 119
388-JR
velocity
LAND USE TABLE
USE ZONE
ERF NUMBERS
OF ERVEN
AVE
TOT AREA (Ha)
%
TOTAL
Portion 105
1
8,3441
40,8672



CITY OF TSHWANE
IGNITING EXCELLENCE

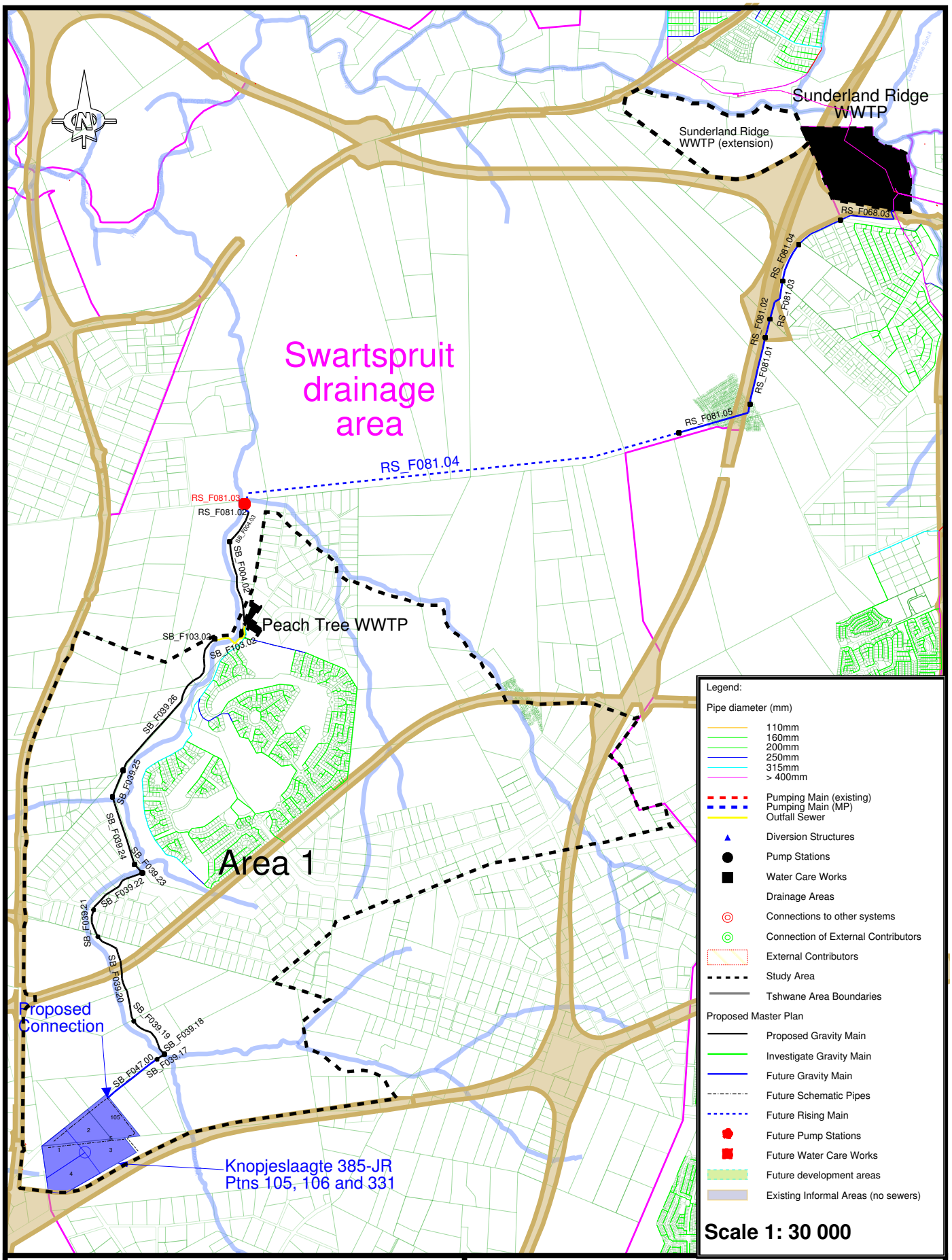
January 2016 Master Plan Models

WATER/SEWER MIS
Tshwane:
Computer Analysis and
Master Planning of Water Distribution Network

FIGURE 1 (Water)

Required Works/Master Plan Items
Knopjeslaagte 385-JR Ptns 105, 109 and 331
(Mnandi Reservoir Zone)
Date of drawing: 15 August 2016

gls consulting



CITY OF TSHWANE
IGNITING EXCELLENCE

January 2016 Master Plan Models

WATER/SEWER MIS
Tshwane:
Computer Analysis and
Master Planning of Water Distribution Network

FIGURE 2 (Sewer)

Required Works/Master Plan Items
Knopjeslaagte 385JR Ptns 105, 109 and 331
(Swartspruit Drainage Area)
Date of Drawing: 15 August 2016

gls consulting

Option 3:
Interim Vlakplaats 5A PS,
rising main and outfall sewer
to Sunderland Ridge WWTW
(eliminate Peach Tree WWTW)

To Schuveberg WWTW

Area 6

(Cost R 301m)

Erasmia PS

Sunderland Ridge WWTW

Sunderland Ridge WWTW

Area 5

Area 3

Area 4

(Cost R 36m)

Vlakplaats 5A PS

Peach Tree WWTW

Peach Tree

Area 1

(Cost R 62m)

Conn 6

Conn 5

Conn 4

Conn 3

Conn 2

Conn 1

Laezonia AH 1 PS

Area 2

FIGURE 3.3

Swartspruit Drainage Area
Option 3
m2016-04

0 500 1000 1500 2000 m

Scale 1:40000

ADDENDUM F

GEOTECHNICAL INVESTIGATION

REPORT
ON
THE ENGINEERING GEOLOGICAL INVESTIGATION
ON
THE REMAINDER OF PORTION 105
POTION 109
PORTION 111
AND
ON
THE REMAINDER OF PORTION 331
OF
THE FARM
KNOPJESLAAGTE 385 JR.

LOUIS KRUGER GEOTECHNICS CC
PO BOX 90093
Garsfontein
0042
Tel 082 651 4819
Fax 086 671 1684

JANUARY 2016

Client

Keymacx

REPORT ON THE ENGINEERING GEOLOGICAL INVESTIGATION ON THE REMAINDER OF PORTION 105, POTION 109, PORTION 111 AND ON THE REMAINDER OF PORTION 331 OF THE FARM KNOPJESLAAGTE 385 JR.

CONTENTS Page

REPORT ON THE ENGINEERING GEOLOGICAL INVESTIGATION ON THE REMAINDER OF PORTION 105, POTION 109, PORTION 111 AND ON THE REMAINDER OF PORTION 331 OF THE FARM KNOPJESLAAGTE 385 JR.

1. INTRODUCTION

Louis Kruger Geotechnics CC was appointed to do an engineering investigation on the Remainder of Portion 105, Potion 109, Portion 111 and on the Remainder of Portion 331 of the farm Knopjeslaagte 385 JR. The investigation was undertaken according to the normal requirements to assess the suitability of the site (SANS 634: Geotechnical Investigations For Township Development, SANS 633: Profiling, and Percussion and Core Borehole Logging In Southern Africa for Engineering Purposes, Home Building Manual Part 1 & 2", National Home Builders Registration Council, 1999) and Guidelines for Urban Engineering Geological Investigations 1997). The following aspects are addressed in this report:

- Geology and Soil profile
- Geohydrology
- Foundation conditions
- Construction material

2. TERMS OF REFERENCE

The appointment was to do an engineering investigation on the Remainder of Portion 105, Potion 109, Portion 111 and on the Remainder of Portion 331 of the farm Knopjeslaagte 385 JR. The following aspects were to be addressed:

- The geotechnical characteristics of the site
- Geotechnical constraints
- Founding conditions
- NHBRC Zoning

The locality of the site is shown on Figure 1.

3. AVAILABLE INFORMATION

The following information was available:

- 1 : 50 000 Geological Map 2528CC Lyttelton
- Cadastral map
- Colour aerial photographs, Tshwane Metropolitan Council
- Tshwane Internet Geographical information System

4. LOCALITY

The site is situated on the Remainder of Portion 105, Potion 109, Portion 111 and on the Remainder of Portion 331 of the farm Knopjeslaagte 385 JR and is bounded by the N14 Krugerdorp Highway in the south, by Fig Street in the west, by the R114 Pretoria Road in the north and by Imbovane Street in the east. The locality of the site is shown on Figure 1.

LOCALITY	FIGURE 1 NTS

5. TOPOGRAPHY AND DRAINAGE

No topographical information was available. The Tshwane Internet Geographical information System shows that the site slopes at an average of 4% towards the north-east. No drainage features are present on the site and according to the available information it is not affected by flood lines. The topography of the site is shown on Figure 2.

6. METHOD OF INVESTIGATION

Twenty-five test pits were dug on the site and the soil profiles were described according to the standard method proposed by Jennings, Brink and Williams (1973). Disturbed samples of the most prominent soil horizons were taken and submitted to a soils laboratory for foundation indicator tests. Due to the high gravel content and the consistency of the materials encountered on the site, no undisturbed samples were taken

7. GEOLOGY AND SOIL PROFILE

According to the 1: 50 000 scale geological map the site is underlain by migmatite gneiss (granite) of the Halfway House Suite. The geology of the site was confirmed during this investigation, granite bedrock was encountered in the test pits. The test pit positions are shown on Figure 2 and the soil profiles are attached as Appendix A. The following materials were encountered on the site:

7.1 Soil profile

The test pit positions are shown on Figure 3 and the soil profiles are attached as Appendix A. The following materials were encountered on the site:

7.1.1 Colluvium

Two types of colluvium were encountered on the site:

Type A: Slightly moist, dark brown, soft, shattered, silty sand with plant roots covers the eastern part of the site. This material was encountered in fourteen test pits from surface up to an average depth of 0,3 meters.

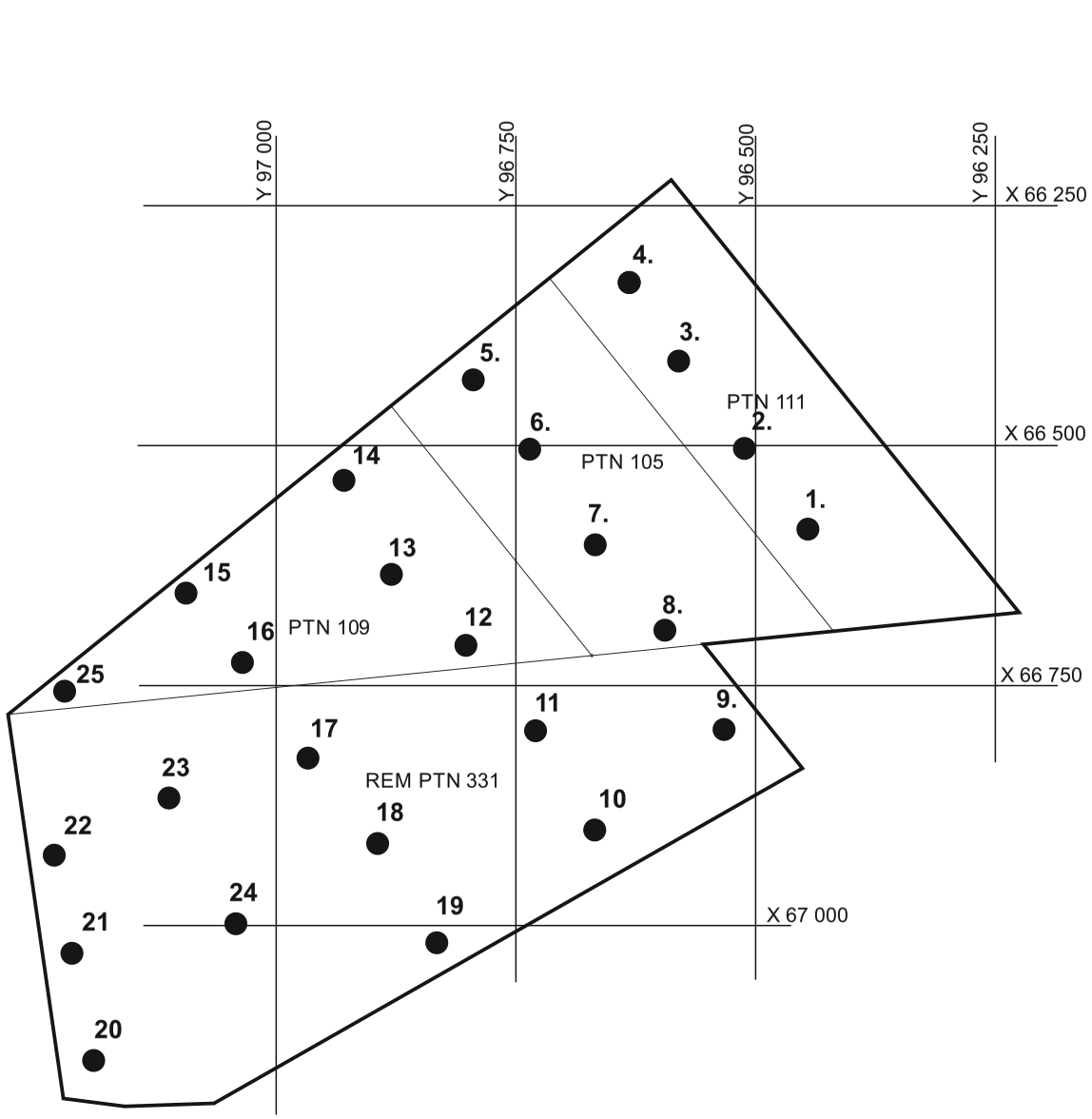
Type B: Slightly moist, brown, soft, shattered, silty, gravelly, sand with plant roots was encountered on the western part of the site. This material was encountered in eight test pits from surface up to an average depth of 0,6 meters.

7.1.2 Ferricrete

Slightly moist, dark brown becoming yellow mottled orange and black, loose, silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles was encountered in twenty-three test pits from an average depth of 0,4 meters up to an average depth of 1,0 meters. In nine test pits the back actor refused hardpan ferricrete at an average depth of 0,7 meters.

7.1.3 Granite

Residual granite consisting of slightly moist, greyish white mottled orange and black, firm, intact, clayey sand with medium and large ferricrete concretions and with patches of very soft rock granite was encountered in three test pits from an average depth 0,7 meters up to an average depth of 1,3 meters and slightly moist, greyish white mottled orange, firm, intact, silty sand with very soft rock fragments was encountered in two test pits from an average depth 1,0 meters up to an average depth of 1,6 meters. Very soft rock granite was encountered in sixteen test pits from an average depth of 1,3 meters up to an average depth of 1,7 meters. The back actor refused on soft- to medium hard rock granite in sixteen test pits at an average depth of 1,4 meters.



TEST PIT POSITIONS	SCALE 1 : 7 500	FIGURE 2

8. GEOHYDROLOGY

No ground water was encountered during the investigation. The presence of pedogenic material however indicates that a perched water table could be present during and after periods of high rainfall.

9. LABORATORY TEST RESULTS

9.1 Indicator test results

The laboratory test results are attached as Appendix B and are summarized in the following table:

MATERIAL	TP	DEPTH (m)	PI	% Clay	% Silt	% Sand	% Gravel
Colluvium Type A	1	0.2	SP	3	11	85	1
Colluvium Type A	8	0.3	NP	1	11	86	2
Colluvium Type B	17	0.3	7	6	18	56	20
Colluvium Type B	20	0.3	NP	3	21	55	21
Colluvium Type B	24	0.4	7	7	14	46	33
Nodular ferricrete	1	0.8	SP	2	10	49	39
Nodular ferricrete	15	1.0	SP	4	8	45	43
Nodular ferricrete	22	1.0	SP	1	2	47	51
Residual granite Type 1	2	0.8	NP	1	13	47	39
Residual granite Type 2	21	1.3	SP	3	10	59	28

The difference between the Type A colluvium and the Type B colluvium is reflected by the higher sand- and lower gravel content of the Type A hillwash. The difference between the nodular ferricrete and the colluvium is shown by the higher gravel content and the difference between the nodular ferricrete and the residual granite is shown by the higher silt- and lower gravel content of the residual granite. The difference between the two types of residual granite is reflected by the higher gravel- and lower sand content of the Type 1 residual granite. The variation in the composition of the materials is clearly reflected by the results.

9.2 Potential expansiveness

The potential expansiveness of the materials encountered on the site was calculated according to the method proposed by Van der Merwe (1964). The following material characteristics are considered when applying this method:

- Plasticity index
- Clay fraction (< 0,002 mm)
- Thickness of expansive material
- Thickness of non - expansive material

Assuming the laboratory test results typify the material encountered on the site, the application of the method of Van der Merwe shows that all the materials classify as “Low” and is therefore considered to be non-expansive.

9.3 Collapse potential

Due to the consistency and the gravel content of the materials, no undisturbed samples were taken.

10. ENGINEERING GEOLOGICAL ZONING

The site was divided into the following Engineering Geological Zones:

Zone 1: Colluvium, nodular ferricrete and residual granite underlain by granite bedrock

Zone 2: Colluvium and nodular ferricrete underlain by hardpan ferricrete

The engineering geological zones are shown on Figure 3. *The boundaries between the different zones are based on field observations, aerial photographic interpretation and the interpolation of information between test pits. Therefore a conservative approach to the use of the engineering geological boundaries is recommended*

11. GEOTECHNICAL CONSIDERATIONS

The following geotechnical considerations, which could influence the proposed development, were identified:

11.1 Founding of structures

11.1.1 Engineering geological zone 1: Colluvium, nodular ferricrete and residual granite underlain by granite bedrock

- The composition and consistency of the colluvium varies considerably and the overall consistency is soft, therefore, it is not considered suitable founding material for unadapted structures. If unadapted structures are founded on this material, and the moisture content should increase, unacceptable differential, vertical movements could occur, with resultant cracking of structures.

- The consistency of the nodular ferricrete with patches of honeycomb ferricrete is loose and the gravel content varies considerably, therefore, it is not considered suitable founding material for unadapted structures. If unadapted structures are founded on this material, and the moisture content should increase, unacceptable differential, vertical movements could occur, with resultant cracking of structures.

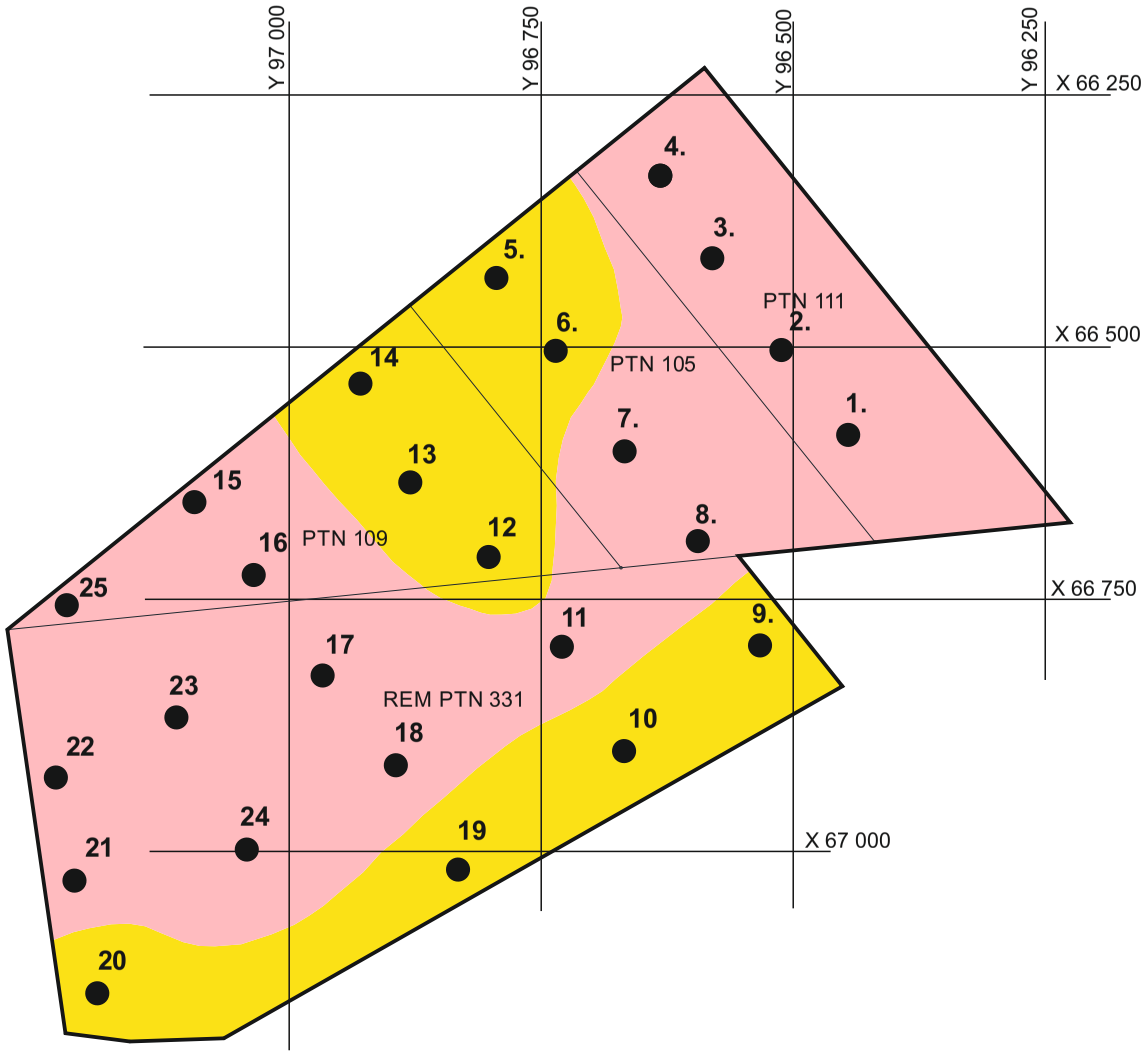
- The consistency of the nodular ferricrete with patches of honeycomb ferricrete is loose and the gravel content varies considerably, therefore, it is not considered suitable founding material for unadapted structures. If unadapted structures are founded on this material, and the moisture content should increase, unacceptable differential, vertical movements could occur, with resultant cracking of structures.

- The soft- to medium hard rock granite bedrock is considered suitable for the founding of structures.

11.1.2 Engineering geological zone 2: Colluvium and nodular ferricrete underlain by hardpan ferricrete

- The composition and consistency of the colluvium varies considerably and the overall consistency is soft, therefore, it is not considered suitable founding material for unadapted structures. If unadapted structures are founded on this material, and the moisture content should increase, unacceptable differential, vertical movements could occur, with resultant cracking of structures.

- The consistency of the nodular ferricrete with patches of honeycomb ferricrete is loose and the gravel content varies considerably, therefore, it is not considered suitable founding material for unadapted structures. If unadapted structures are founded on this material, and the moisture content should increase, unacceptable differential, vertical movements could occur, with resultant cracking of structures.



Zone 1: Colluvium, nodular ferricrete and residual granite underlain by granite bedrock.

Zone 2: Colluvium and nodular ferricrete underlain by hardpan ferricrete

The boundaries between the different zones are based on field observations, aerial photographic interpretation and the interpolation of information between test pits. Therefore a conservative approach to the use of the engineering geological boundaries is recommended

ENGINEERING GEOLOGICAL ZONING	SCALE 1 : 7 500	FIGURE 3

- The consistency of the nodular ferricrete with patches of honeycomb ferricrete is loose and the gravel content varies considerably, therefore, it is not considered suitable founding material for unadapted structures. If unadapted structures are founded on this material, and the moisture content should increase, unacceptable differential, vertical movements could occur, with resultant cracking of structures.

- Depending on the lateral and vertical continuity, the hardpan ferricrete is considered suitable for the founding of structures.

11.2 Excavatability

In engineering geological zone 1 the back actor refused at an average depth of 1,4 meters and in engineering geological zone 2 the back actor refused at an average depth of 0,7 meters.

11.3 Construction material

Both types of colluvium classify as A-2-4, the nodular ferricrete and residual granite classifies as A-1-b. The Plasticity Index and Grading Modulus were used to assess the suitability as construction material (TRH 14)

11.4 Groundwater

A perched water table, which could cause the flooding of excavations, could be present during or after periods of high rainfall. This is confirmed by the presence of pedogenic material.

11.5 Stability of excavations

Limited instability occurred in the sidewalls of the test pits.

12. GEOTECHNICAL CLASSIFICATION

The site was classified according to the Geotechnical Classification for Urban Development (after Partridge, Wood and Brink 1993). The criteria for the classification are shown in the following table:

GEOTECHNICAL CLASSIFICATION FOR URBAN DEVELOPMENT (after Partridge, Wood and Brink 1993)

CONSTRAINT		MOST FAVOURABLE (1)	INTERMEDIATE (2)	LEAST FAVOURABLE (3)
A	Collapsible soil	Any collapsible horizon or consecutive horizons totalling a depth of less than 750 mm in thickness	Any collapsible horizon or consecutive horizons totalling a depth of more than 750 mm in thickness	A least favourable situation for this constraint does not occur
B	Seepage	Permanent or perched water table more than 1,5 meters below surface	Permanent or perched water table less than 1,5 meters below surface	Swamps or marshes
C	Active soil	Low soil heave predicted	Moderate soil heave predicted	High soil heave predicted
D	Highly compressible soil	Low soil compressibility expected	Moderate soil compressibility expected	High soil compressibility expected
E	Erodibility of soil	Low	Intermediate	High
F	Difficulty of excavation to 1,5 m depth	Scattered or occasional boulders less than 10% of the total volume	Rock or hardpan pedocretes between 10 and 40% of the total volume	Rock or hardpan pedocretes more than 40% of total volume
G	Undermined ground	Undermining at a depth greater than 100 m below surface (except where total extraction mining has not occurred)	Old undermined areas to a depth of 100 m below surface where stope closure has ceased	Mining within less than 100 m of surface or where total extraction mining has taken place
H	Instability in areas of soluble rock	Possibly unstable	Probably unstable	Known sinkholes and dolines
I	Steep slopes	Between 2 and 6 degrees (all regions)	Slopes between 6 and 18 degrees and less 2 degrees (Natal and Western Cape) Slopes between 6 and 12 degrees and less 2 degrees (all other regions)	More than 18 degrees (Natal and western Cape) More than 12 degrees (all other regions)

	CONSTRAINT	MOST FAVOURABLE (1)	INTERMEDIATE (2)	LEAST FAVOURABLE (3)
J	Areas of unstable natural slopes	Low risk	Intermediate risk	High risk (especially in areas subject to seismic activity)
K	Areas subject to seismic activity	10% probability of an event less than 100 cm/s^2 within 50 years	Mining induced seismic activity more than 100 cm/s^2	Natural seismic activity more than 100 cm/s^2
L	Areas subject to flooding	A "most favourable" situation for this constraint does not occur	Areas adjacent to a known drainage channel or floodplain with slope less than 1%	Areas within a known drainage channel or floodplain

Based on the above, the site is classified as follows:

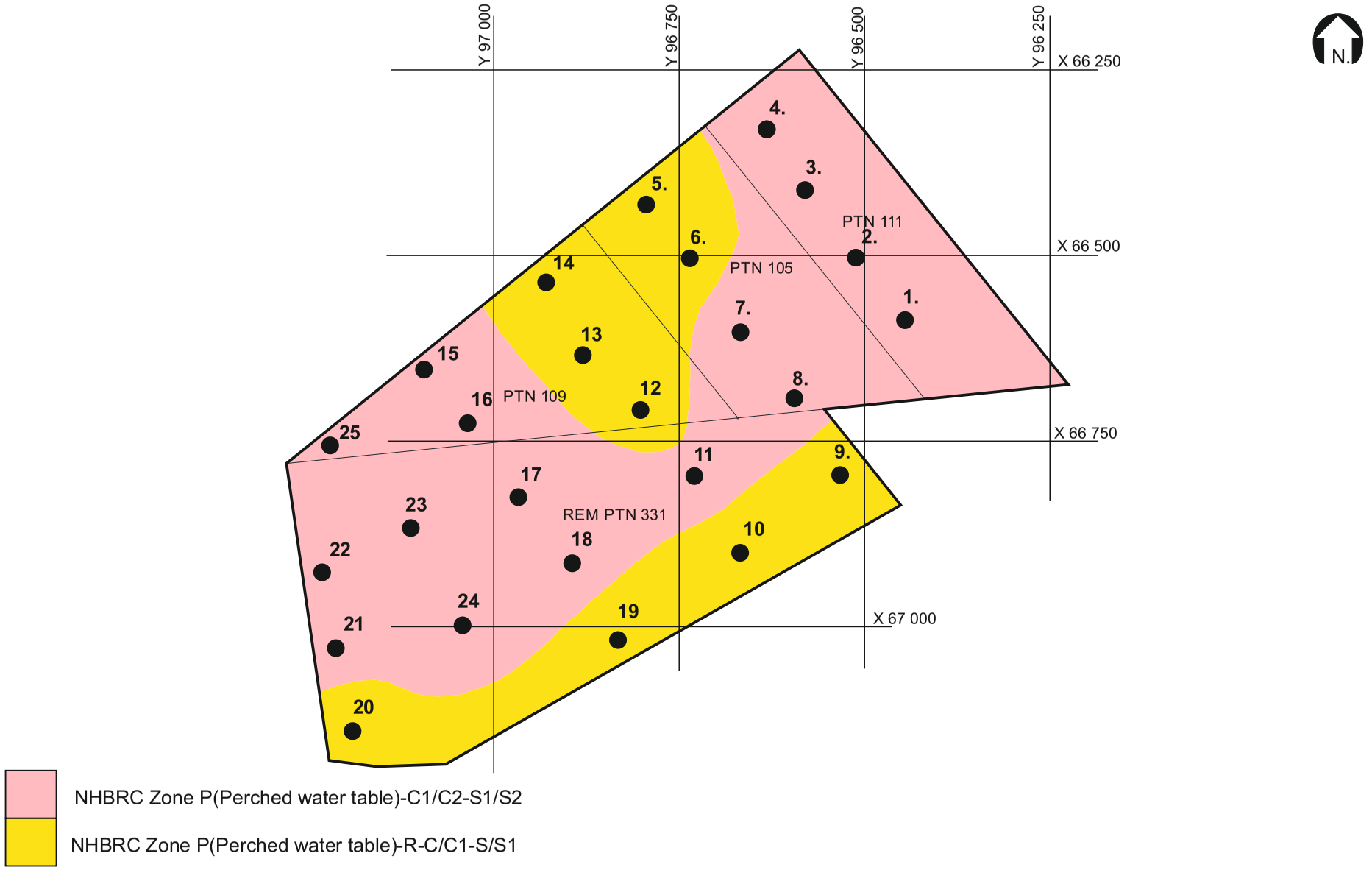
Engineering geological zone 1: 2A 1/2B 1C 2D 2E 2F 1I

Engineering geological zone 2: 1/2A 2B 1C 2D 2E 2/3F 1I

13. NHBRC CLASSIFICATION (SANS 10400-H: THE APPLICATION OF THE NATIONAL BUILDING REGULATIONS - PART H)

ZONE	NHBRC ZONE	MOTIVATION
Engineering geological zone 1 Geotechnical classification: 2A 1/2B 1C 2D 2E 2F 1I (see table)	P(Perched water table)-C1/C2-S1/S2	Due to the variation in composition, and the overall consistency, collapse is expected in the colluvium, nodular ferricrete and in the residual granite if unadapted structures are founded on it. The average thickness of the collapsible material is 1,4 meters and the thickness varies between 1,0 and 1,8 meters, therefore this part of the site is zoned as C1/C2-S1/S2. The presence of the shallow perched water table is accommodated by adding a zoning of P(Perched water table.
Engineering geological zone 2 Geotechnical classification: 1/2A 2B 1C 2D 2E 2/3F 1I (see table)	P(Perched water table)-R-C/C1-S/S1	Due to the variation in composition, and the overall consistency, collapse is expected in the colluvium and nodular ferricrete if structures are founded on it. The average thickness of the collapsible material is 0,7 meters and the thickness varies between 0,5 and 1,0 meters, therefore this part of the site is zoned as C/C1-S/S1. The presence of the shallow perched water table is accommodated by adding a zoning of P(Shallow water table),), and the presence of shallow hardpan ferricrete is accommodated by adding a zoning of R.

It is important to note that the zoning is based on the profiling of test pits and the interpolation of information between test pits; therefore it is possible that variations from the expected conditions can occur. The zoning is shown on Figure 4.



NHBRC Zone P(Perched water table)-C1/C2-S1/S2

NHBRC Zone P(Perched water table)-R-C/C1-S/S1

The boundaries between the different zones are based on field observations, aerial photographic interpretation and the interpolation of information between test pits. Therefore a conservative approach to the use of the engineering geological boundaries is recommended

NHBRC ZONING	SCALE 1 : 7 500	FIGURE 4

14. CONCLUSIONS AND RECOMMENDATIONS

It is important to note that the recommendations are based on the profiling of test pits and the interpolation of information. It is therefore possible that variations from the expected conditions can occur.

14.1 Foundations for light structures

14.1.1 NHBRC Zone P(Perched water table)-C1/C2-S1/S2

The colluvium, nodular ferricrete and the residual granite are expected to be potentially collapsible / compressible. Therefore this material is considered unsuitable in its natural state to act as a founding medium. This even applies for light structures with a foundation pressure of less than 100kPa. From the discussion foundation improvement and imparting flexibility in the brickwork are clearly required. The following alternatives are recommended:

If granite bedrock is present at shallow depth:

- *Deep strip footings:*
  Found structures below the potentially collapsible material. Structures should be provided with vertical movement joints, light reinforcement in the masonry and floor slabs should be provided with fabric reinforcement.

If the depth to granite bedrock becomes too deep to found economically:

- *Modified normal:*
  Found structures on reinforced strip footings, the foundation pressure should not exceed 50 kPa and structures should be provided with light reinforcement in the masonry and articulation joints at internal and external doors.

- *Stiffened strip footings, stiffened or cellular raft:*
  Found structures on stiffened strip footings or a stiffened or cellular raft with lightly reinforced masonry. The bearing pressure should not exceed 50 kPa and floor slabs should be reinforced.

- *Compaction of insitu soil below footings:*
  Remove unsuitable material up to a depth and width of 1,5 times the foundation width, below normal founding depth. The loose material in the bottom of excavations should be compacted, and the excavations backfilled with suitable material, compacted in 150 mm layers to at least 93% of Mod AASHTO density at -1% to +2% of optimum moisture content. Structures can be founded on normal reinforced strip footings on the backfill and should be provided with vertical movement joints, light reinforcement in the masonry and floor slabs should be provided with fabric reinforcement.

- *Soil raft:*
  Remove the collapsible material to 1,0 meters beyond the perimeter of the structure to at least a depth of 1,5 times the width of the widest foundation. The loose material in the bottom of excavations should be compacted, and the excavations backfilled with suitable material, compacted in 150 mm layers to at least 93% of Mod AASHTO density at -1% to +2% of optimum moisture content. Structures can be founded on normal reinforced strip footings on the backfill and should be provided with vertical movement joints and light reinforcement in the masonry.

- *Piled or pier foundations:*
  Found structures on piled or pier foundations with reinforced ground beams or solid slabs on piled or pier foundations

It is important though that in spite of the guidelines given above, inspection of foundation excavations and the involvement of a competent engineer familiar with structural founding are necessary. ***It is furthermore recommended that the trenches for services be profiled***

and that a construction report be compiled for the development. The purpose of the construction report is to confirm or adapt the zoning of the site, and to provide more accurate information regarding the founding conditions.

14.1.2 NHBRC Zone P(Perched water table)-R-C/C1-S/S1

The colluvium and nodular ferricrete are considered to be potentially collapsible. Therefore these materials are considered unsuitable in its natural state to act as a founding medium. This even applies for light structures with a foundation pressure of less than 100kPa. From the discussion foundation improvement and imparting flexibility in the brickwork are clearly required. The following alternatives are recommended:

If hardpan ferricrete is present at shallow depth and the lateral and vertical continuity is confirmed:

- *Deep strip footings:*
  Found structures below the potentially collapsible material. Structures should be provided with vertical movement joints, light reinforcement in the masonry and floor slabs should be provided with fabric reinforcement.

If the depth to hardpan ferricrete becomes too deep to found economically:

- *Modified normal:*
  Found structures on reinforced strip footings, the foundation pressure should not exceed 50 kPa and structures should be provided with light reinforcement in the masonry and articulation joints at internal and external doors.

- *Compaction of insitu soil below footings:*
  Remove unsuitable material up to a depth and width of 1,5 times the foundation width, below normal founding depth. The loose material in the bottom of excavations should be compacted, and the excavations backfilled with suitable material, compacted in 150 mm layers to at least 93% of Mod AASHTO density at -1% to +2% of optimum moisture content. Structures can be founded on normal reinforced strip footings on the backfill and should be provided with vertical movement joints and light reinforcement in the masonry.

- *Soil raft:*
  Remove the collapsible material to 1,0 meters beyond the perimeter of the structure to at least a depth of 1,5 times the width of the widest foundation. The loose material in the bottom of excavations should be compacted, and the excavations backfilled with suitable material, compacted in 150 mm layers to at least 93% of Mod AASHTO density at -1% to +2% of optimum moisture content. Structures can be founded on normal reinforced strip footings on the backfill and should be provided with vertical movement joints and light reinforcement in the masonry.

It is important though that in spite of the guidelines given above, inspection of foundation excavations and the involvement of a competent engineer familiar with structural founding are necessary. ***It is furthermore recommended that the trenches for services be profiled and that a construction report be compiled for the development. The purpose of the construction report is to confirm or adapt the zoning of the site, and to provide more accurate information regarding the founding conditions.***

14.1.3 Recommendations that apply to the entire site

Due to the slope of the site, it is envisaged that a level platform for the structure will be created by way of a balanced cut to fill operation. This means that on the cut end of the platform, excavations may have proceeded to the level of the hardpan ferricrete or granite bedrock, depending on the depth of cut and the thickness of the transported material at the cut end. When building platforms are constructed, the soil profile should be investigated to establish the approximate thickness of the various horizons within the platform area. The following guidelines should be followed:

- In cut sections, the alternatives listed in the previous section apply. Should the cut extend up to competent founding material, only loose material at founding level has to be removed or must be compacted

- On the fill end, the founding alternatives listed in the previous section apply. If the entire fill section is constructed by compacting a competent material, founding at shallow depth is possible.

It is important though that in spite of the guidelines given above, inspection of foundation excavations and the involvement of a competent engineer familiar with structural founding are necessary. ***It is furthermore recommended that the trenches for services be profiled and that a construction report be compiled for the development. The purpose of the construction report is to confirm or adapt the zoning of the site, and to provide more accurate information regarding the founding conditions.***

14.2 Foundations for large structures

Detailed foundation investigations should be done on the footprints of large structures.

14.3 Excavatability

The excavatability of the materials encountered on the site was evaluated according to the South African Bureau of Standards Standardized Specification for Civil Engineering Construction DB: Earthworks (Pipe Trenches. In NHBRC Zone P(Perched water table)-C1/C2-S1/S2 the excavatability is considered to classify as "soft to intermediate" up to an **average** depth of one meter. In NHBRC Zone P(Perched water table)-R-C/C1-S/S1 the excavatability is considered to classify as "soft to intermediate" up to an **average** depth of 0,5. *It is important to note that the evaluation is based primarily on the profiling of test pits and the interpolation of information between test pits. It is therefore possible that variations from the expected conditions can occur.*

14.4 Geohydrology

All excavations should be provided with adequate drainage. Structures should be provided with damp proofing and provision should be made to prevent the ingress of water into– and below foundations.

14.5 Construction material

Both types of hillwash could be suitable as fill and selected sub-grade, the nodular ferricrete and the residual granite could be suitable as fill, selected sub-grade and sub-base. *It is recommended that the suitability of material that is to be used, be confirmed by detailed laboratory testing*.

14.5 Services

Due to the expected corrosivity, it is recommended that all services be protected.

14.7 Stability of excavations

It is recommended that all excavations be cut back or shored.

14.8 General recommendations

- Water has a significant influence on the behaviour of the in-situ material. To reduce differential movements of structures it is necessary to maintain moisture equilibrium under the structures. Therefore it is recommended that the following measures regarding drainage around structures be implemented:

- No accumulation of surface water must be allowed around the perimeter of the structures and the entire development must be properly drained.

- Down pipes should discharge into a lined or precast furrow. This furrow should discharge the water 1,5 meters away from the foundation onto a paved or grassed surface sloping away from the building.

- Preferably, if no gutters or paving is to be provided around structures, a 1,5 meter wide sealed concrete apron should be cast along the perimeter of the structures the water must be channeled away from the foundation.

- Leaks in water bearing services should be attended to without undue delay.

- No large shrubs or trees should be planted closer to structures than the distances provided in the following Table:

DESCRIPTION	**MATURE HEIGHT OF TREE**		
	Up to 8m	**8m tot 15m**	**Over 15m**
Buildings other than single storey buildings of lightweight construction	-	0.5	1,2
Single storey buildings of lightweight construction (e.g. timber framed)	-	0.7	1,5
Free standing masonry walls	-	1,0[1] 0,5[2]	2,0[1] 1,0[2]
Drains and underground services • less than 1 meter deep • more than 1 meter deep	 0,5 -	 1,5 1,0	 3,0 2,0

Note:
1) These distances will generally avoid all direct damage
2) These distances assume that some movement and minor damage, which may be tolerated, might occur.
This table provides guidance on the acceptable proximity of young trees or new planting to allow for future growth. This table should not be taken to imply that construction work can occur at the specified distances from existing trees; as such work might damage the tree, or render it dangerous, but refers to the potential for future growth, either of a young tree or of planting, occurring subsequent to construction

L.J Kruger Pr. Sci. Nat.

15. REFERENCES

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- "The Prediction of Soil Heave from the Plasticity Index and Percentage Clay Fraction of Soils", D.H van der Merwe, The Civil Engineer in South Africa, 1964
- "A Guide to Construction on or with Materials Exhibiting Additional Settlement due to Collapse of Grain Structure", Jennings and Knight 1975
- "A Short Workshop on Suggested Interpretation Techniques of Soil Movement with Emphasis on Heave and Collapse Conditions": SAIEG, 1999
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- "Soil Survey for Engineering", Brink, Partridge & Williams
- South African Bureau of Standards Standardized Specification for Civil Engineering Construction DB: Earthworks (Pipe Trenches) SABS 1200 DB-1982
- Technical Recommendations for Highways, TRH 14 of 1985

APPENDIX A

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 1. DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,3
			Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			1,5
			Slightly moist, orange speckled white with black stained joints, very soft rock granite
			1,8
			Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 2. DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,3
			Slightly moist, greyish white mottled orange and black, firm, intact, clayey sand with medium and large ferricrete concretions and with patches of very soft rock granite - Reworked residual granite
			1,3 Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

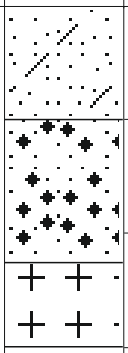
SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 3. DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,5 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			1,2 Slightly moist, orange speckled white with black stained joints, very soft rock granite
			1,5 Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

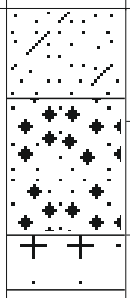
SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 4. DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium 0,4 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles 1,0 Slightly moist, orange speckled white with black stained joints, very soft rock granite 1,3 Refusal on soft rock granite No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 5. DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,3 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			0,8 Refusal on hardpan ferricrete
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 6. DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,3 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			0,5 Refusal on hardpan ferricrete
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 7 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,3 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			0,8 Slightly moist, greyish white mottled orange and black, firm, intact, clayey sand with medium and large ferricrete concretions and with patches of very soft rock granite - Reworked residual granite
			1,2 Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 8. DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
		0,5	Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
		1,0	Slightly moist, greyish white mottled orange and black, firm, intact, clayey sand with medium and large ferricrete concretions and with patches of very soft rock granite - Reworked residual granite
		1,5	Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 9 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,3 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			0,8 Refusal on hardpan ferricrete
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 10 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,4 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			0,8 Refusal on hardpan ferricrete
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 11 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,4 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			1,0 Slightly moist, greyish white mottled orange, firm, intact, silty sand with very soft rock fragments - Residual granite
			1,4 Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 12 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,2 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			0,5 Refusal on hardpan ferricrete
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

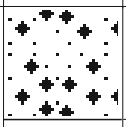
SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 13 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			0,5 Refusal on hardpan ferricrete
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

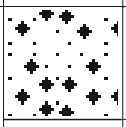
SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 14 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			0,5 Refusal on hardpan ferricrete
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 15 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,3
			Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			1,5
			Slightly moist, orange speckled white with black stained joints, very soft rock granite
			1,8
			Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 16 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,3
			Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			1,5
			Slightly moist, orange speckled white with black stained joints, very soft rock granite
			1,8
			Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 17 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, brown, soft, shattered, silty, gravelly, sand with plant roots - Colluvium
			0,5 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			1,2 Slightly moist, orange speckled white with black stained joints, very soft rock granite
			1,8 Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 18 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, brown, soft, shattered, silty, gravelly, sand with plant roots - Colluvium
			0,6 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			1,0 Slightly moist, orange speckled white with black stained joints, very soft rock granite
			1,5 Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 19 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, brown, soft, shattered, silty, gravelly, sand with plant roots - Colluvium
			0,3 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			1,0 Refusal on hardpan ferricrete
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 20 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, brown, soft, shattered, silty, gravelly, sand with plant roots - Colluvium
			0,5 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			0,9 Refusal on hardpan ferricrete
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 21 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, brown, soft, shattered, silty, gravelly, sand with plant roots - Colluvium
			0,9
			Slightly moist, greyish white mottled orange, firm, intact, silty sand with very soft rock fragments - Residual granite
			1,8
			Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 22 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, brown, soft, shattered, silty, gravelly, sand with plant roots - Colluvium
			0,5
			Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			1,6
			Slightly moist, orange speckled white with black stained joints, very soft rock granite
			2,0
			Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 23 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, brown, soft, shattered, silty, gravelly, sand with plant roots - Colluvium
			0,6
			Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			1,5
			Slightly moist, orange speckled white with black stained joints, very soft rock granite
			2,3
			Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 24 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, brown, soft, shattered, silty, gravelly, sand with plant roots - Colluvium
			0,6
			Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			1,5
			Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

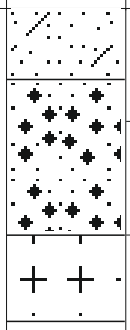
SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 25 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Fill, consisting of dark brown, soft, clayey sand with plant roots 0,3 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles 1,0 Slightly moist, orange speckled white with black stained joints, very soft rock granite 1,4 Refusal on soft rock granite No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

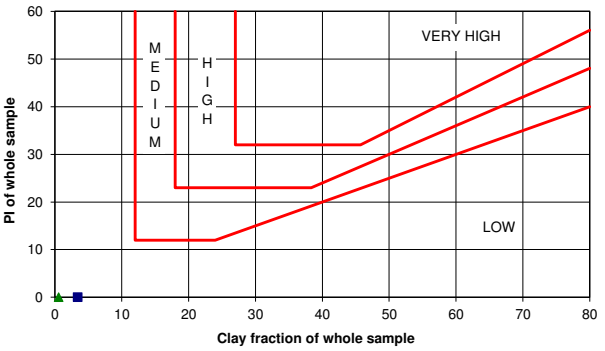
APPENDIX B

PARTICLE SIZE ANALYSIS

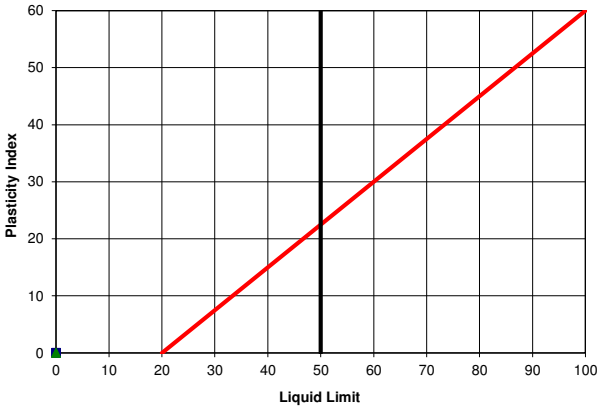
Sample No.	1	2
Soillab Sample No.	2015-S-1607-01	2015-S-1607-02
Depth (m)		
Position	SAMPLE 1	SAMPLE 2
Material Description	DARK GREY SILTY SAND	DARK GREY FERRICRETE W/ GRANITE SANDY GRAVEL
Organic Material	YES	YES
Moisture (%) / Dispersion (%)		
SCREEN ANALYSIS (% PASSING) **(TMH 1 A1(a) & A5)**		
63.0 mm	100	100
53.0 mm	100	100
37.5 mm	100	100
26.5 mm	100	100
19.0 mm	100	100
13.2 mm	100	100
4.75 mm	100	78
2.00 mm	99	49
0.425 mm	57	7
0.075 mm	16	3
HYDROMETER ANALYSIS (% PASSING) **(TMH 1 A6)**		
0.040 mm	11	2
0.027 mm	10	2
0.013 mm	7	1
0.005 mm	6	1
0.002 mm	3	1
% Clay	3	1
% Silt	11	2
% Sand	85	47
% Gravel	1	51
ATTERBERG LIMITS **(TMH 1 A2 - A4)**		
Liquid Limit		
Plasticity Index	SP	SP
Linear Shrinkage (%)	0.5	1.0
Grading Modulus	1.27	2.41
Uniformity coefficient	19	6
Coefficient of curvature	1.5	0.7
Classification	A-2-4 (0)	A-1-a (0)
Unified Classification	SM	SP
Chart Reference		

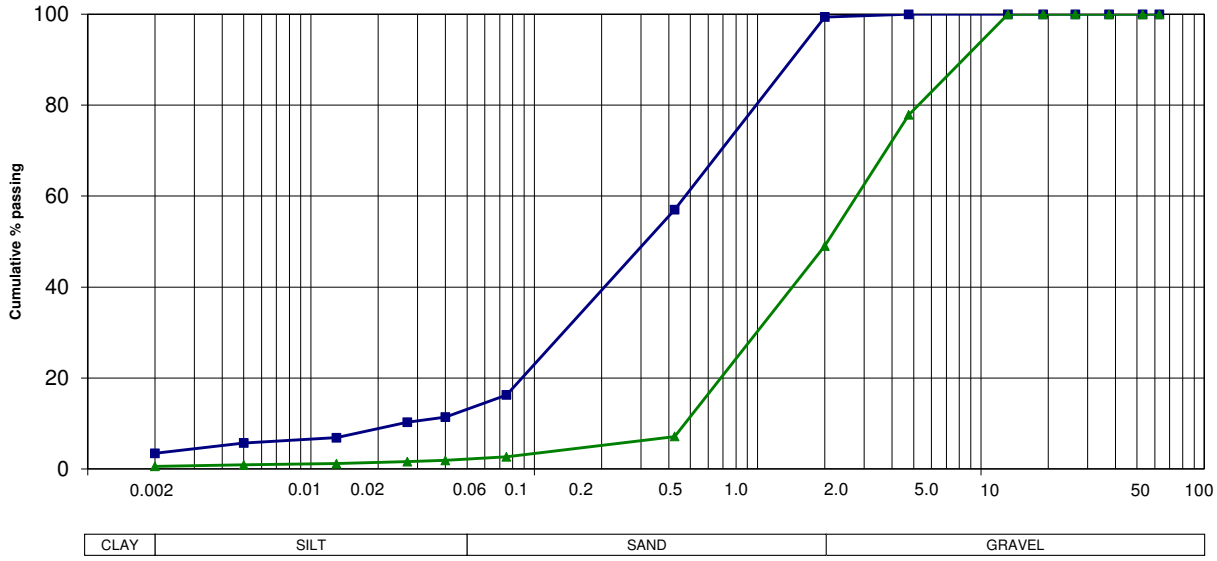
PROJECT : KNOPJESFONTEIN X2
JOB No. : 2015-S-1607
DATE : 18-11-2015

POTENTIAL EXPANSIVENESS



PLASTICITY CHART





CLAY	SILT	SAND	GRAVEL

HIDROMETER/1607-01.xls

SOILLAB Part of the SMEC Group
sanas T-0284
Soillab is a SANAS accredited Testing Laboratory.
Engineering Materials Laboratory
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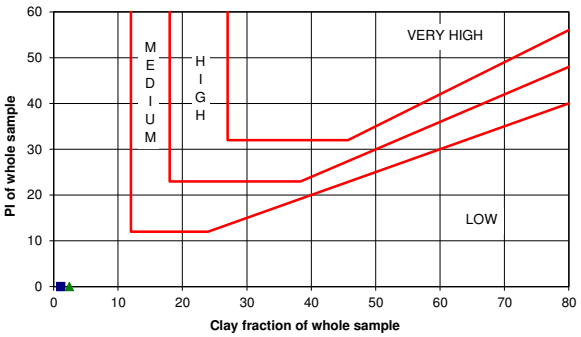
Soillab Pretoria
www.soillab.co.za

PARTICLE SIZE ANALYSIS

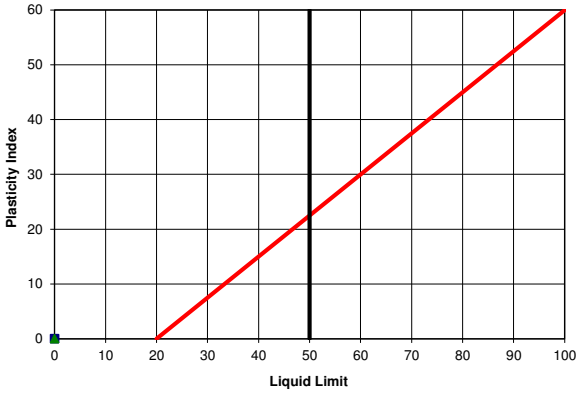
Sample No.	3	4
Soillab Sample No.	2015-S-1607-03	2015-S-1607-04
Depth (m)		
Position	SAMPLE 3	SAMPLE 4
Material Description	LIGHT GREY SILTY SAND	DARK GREY FERRICRETE QUARTZ GRAVELLY SAND
Organic Material	YES	YES
Moisture (%) / Dispersion (%)		
SCREEN ANALYSIS (% PASSING) **(TMH 1 A1(a) & A5)**		
63.0 mm	100	100
53.0 mm	100	100
37.5 mm	100	92
26.5 mm	100	92
19.0 mm	100	91
13.2 mm	100	89
4.75 mm	100	75
2.00 mm	98	61
0.425 mm	56	41
0.075 mm	14	14
HYDROMETER ANALYSIS (% PASSING) **(TMH 1 A6)**		
0.040 mm	9	10
0.027 mm	7	8
0.013 mm	4	6
0.005 mm	3	5
0.002 mm	1	2
% Clay	1	2
% Silt	11	10
% Sand	86	49
% Gravel	2	39
ATTERBERG LIMITS **(TMH 1 A2 - A4)**		
Liquid Limit		
Plasticity Index	NP	SP
Linear Shrinkage (%)	0.0	0.5
Grading Modulus	1.32	1.84
Uniformity coefficient	11	45
Coefficient of curvature	0.9	0.6
Classification	A-2-4 (0)	A-1-b (0)
Unified Classification	SM	SM
Chart Reference		

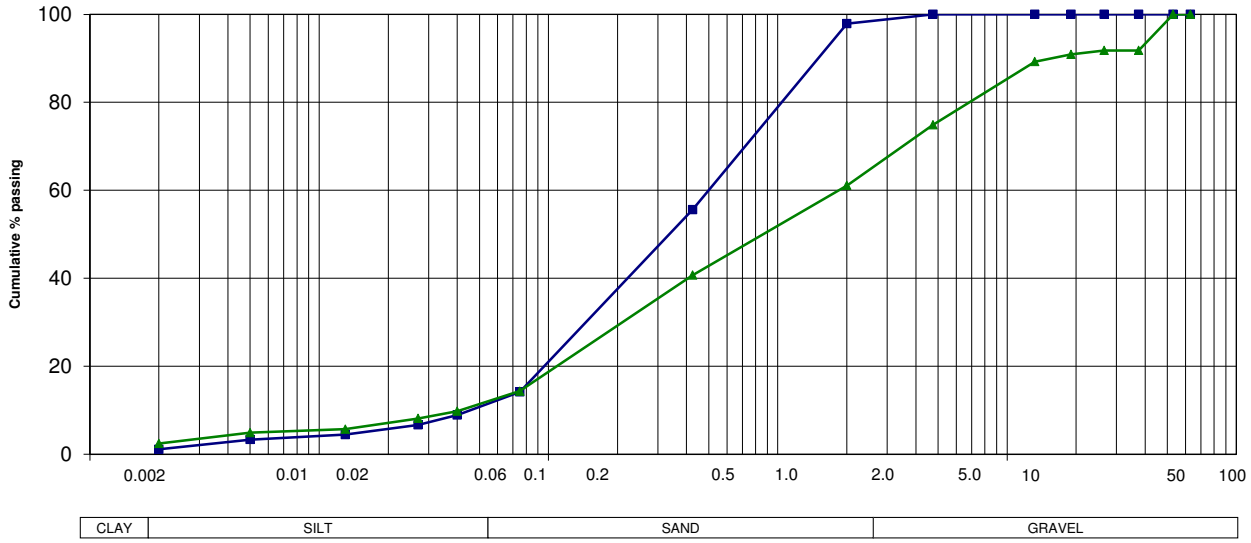
PROJECT : KNOPJESFONTEIN X2
JOB No. : 2015-S-1607
DATE : 18-11-2015

POTENTIAL EXPANSIVENESS



PLASTICITY CHART



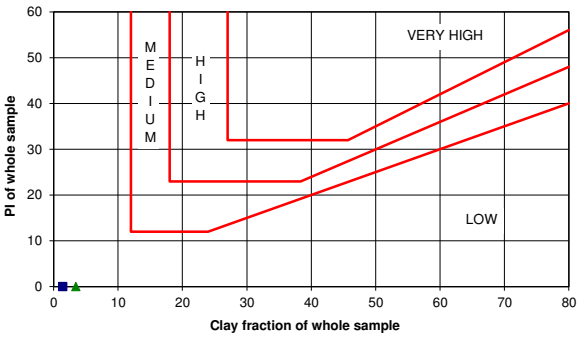


PARTICLE SIZE ANALYSIS

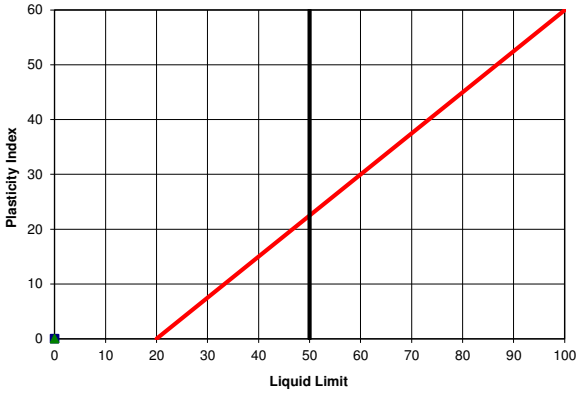
Sample No.	5	6
Soillab Sample No.	2015-S-1607-05	2015-S-1607-06
Depth (m)		
Position	SAMPLE 5	SAMPLE 6
Material Description	DARK REDDISH BROWN FERRICRETE QUARTZ GRAVELLY SAND	DARK GREY FERRICRETE QUARTZ GRAVELLY SAND
Organic Material		YES
Moisture (%) / Dispersion (%)		
SCREEN ANALYSIS (% PASSING) **(TMH 1 A1(a) & A5)**		
63.0 mm	100	100
53.0 mm	100	100
37.5 mm	100	100
26.5 mm	100	100
19.0 mm	100	100
13.2 mm	98	96
4.75 mm	74	82
2.00 mm	61	72
0.425 mm	35	43
0.075 mm	17	15
HYDROMETER ANALYSIS (% PASSING) **(TMH 1 A6)**		
0.040 mm	11	10
0.027 mm	8	9
0.013 mm	4	6
0.005 mm	3	5
0.002 mm	1	3
% Clay	1	3
% Silt	13	10
% Sand	47	59
% Gravel	39	28
ATTERBERG LIMITS **(TMH 1 A2 - A4)**		
Liquid Limit		
Plasticity Index	NP	SP
Linear Shrinkage (%)	0.0	1.0
Grading Modulus	1.87	1.69
Uniformity coefficient	50	28
Coefficient of curvature	1.0	0.9
Classification	A-1-b (0)	A-1-b (0)
Unified Classification	SM	SM
Chart Reference		

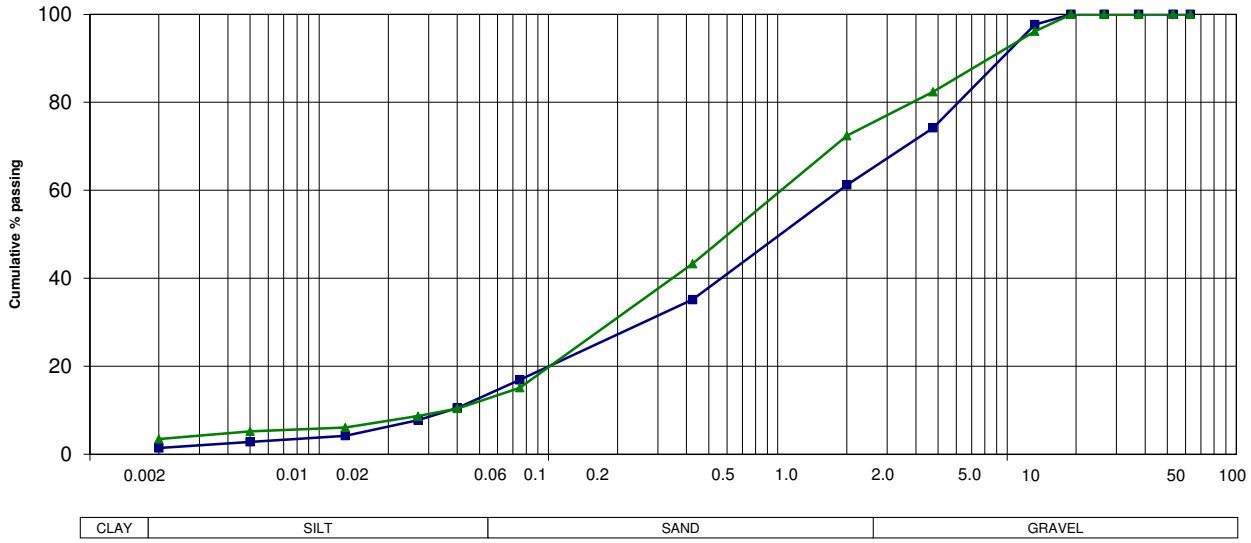
PROJECT : KNOPJESFONTEIN X2
JOB No. : 2015-S-1607
DATE : 18-11-2015

POTENTIAL EXPANSIVENESS



PLASTICITY CHART





PARTICLE SIZE ANALYSIS

Sample No.	7	8
Soillab Sample No.	2015-S-1607-07	2015-S-1607-08
Depth (m)		
Position	SAMPLE 7	SAMPLE 8
Material Description	LIGHT BROWN FERRICRETE W/ GRANITE GRAVELLY SAND	DARK GREY FERRICRETE W/ GRANITE GRAVELLY SAND
Organic Material		YES
Moisture (%) / Dispersion (%)		
SCREEN ANALYSIS (% PASSING) **(TMH 1 A1(a) & A5)**		
63.0 mm	100	100
53.0 mm	100	100
37.5 mm	100	100
26.5 mm	100	100
19.0 mm	100	100
13.2 mm	95	98
4.75 mm	87	89
2.00 mm	79	80
0.425 mm	52	57
0.075 mm	28	28
HYDROMETER ANALYSIS (% PASSING) **(TMH 1 A6)**		
0.040 mm	18	19
0.027 mm	13	16
0.013 mm	7	11
0.005 mm	5	9
0.002 mm	3	6
% Clay	3	6
% Silt	21	18
% Sand	55	56
% Gravel	21	20
ATTERBERG LIMITS **(TMH 1 A2 - A4)**		
Liquid Limit		20
Plasticity Index	NP	7
Linear Shrinkage (%)	0.0	3.0
Grading Modulus	1.40	1.36
Uniformity coefficient	35	72
Coefficient of curvature	0.6	1.9
Classification	A-2-4 (0)	A-2-4 (0)
Unified Classification	SM	SM & SC
Chart Reference		

PROJECT : KNOPJESFONTEIN X2
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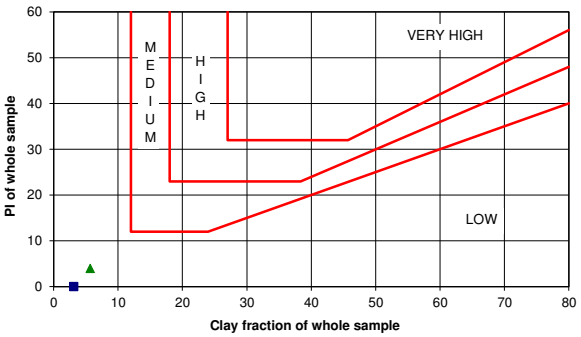
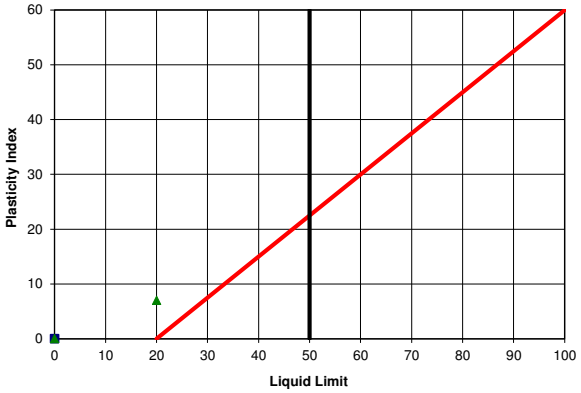
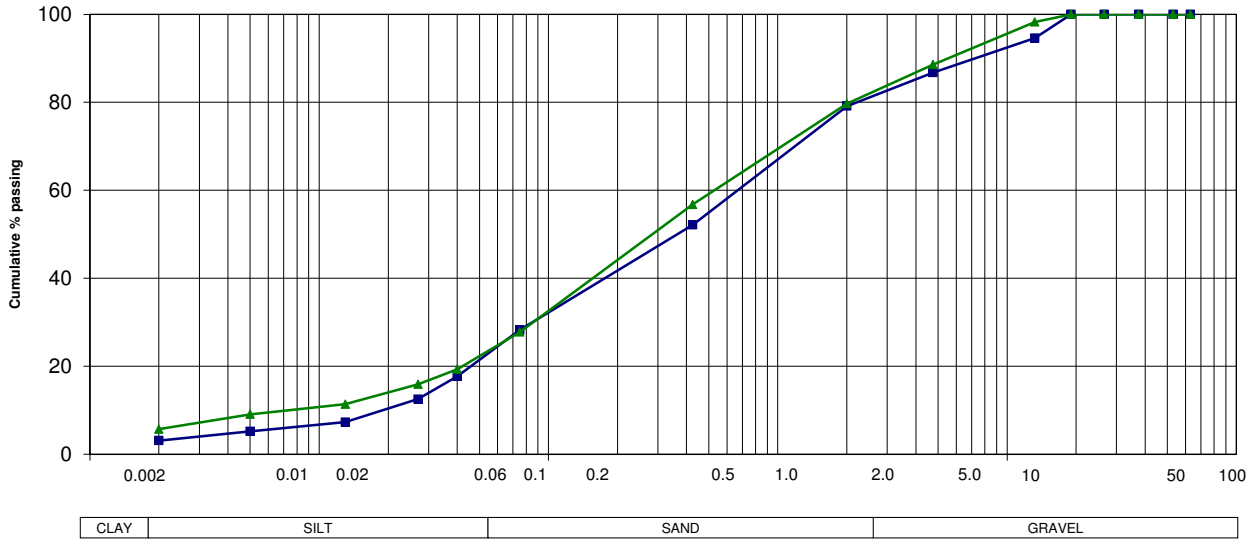
POTENTIAL EXPANSIVENESS



PLASTICITY CHART





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PARTICLE SIZE ANALYSIS

Sample No.	9	10
Soillab Sample No.	2015-S-1607-09	2015-S-1607-10
Depth (m)		
Position	SAMPLE 9	SAMPLE 10
Material Description	DARK BROWN QUARTZ FERRICRETE GRAVELLY SAND	LIGHT BROWN FERRICRETE W/ GRANITE GRAVELLY SAND
Organic Material		
Moisture (%) / Dispersion (%)		
SCREEN ANALYSIS (% PASSING) **(TMH 1 A1(a) & A5)**		
63.0 mm	100	100
53.0 mm	100	100
37.5 mm	100	100
26.5 mm	100	100
19.0 mm	100	100
13.2 mm	94	98
4.75 mm	75	90
2.00 mm	57	67
0.425 mm	37	42
0.075 mm	15	25
HYDROMETER ANALYSIS (% PASSING) **(TMH 1 A6)**		
0.040 mm	9	16
0.027 mm	8	13
0.013 mm	7	10
0.005 mm	5	7
0.002 mm	4	7
% Clay	4	7
% Silt	8	14
% Sand	45	46
% Gravel	43	33
ATTERBERG LIMITS **(TMH 1 A2 - A4)**		
Liquid Limit		21
Plasticity Index	SP	7
Linear Shrinkage (%)	1.0	3.0
Grading Modulus	1.91	1.67
Uniformity coefficient	52	99
Coefficient of curvature	0.6	1.0
Classification	A-1-b (0)	A-2-4 (0)
Unified Classification	SM	SM & SC
Chart Reference		

PROJECT : KNOPJESFONTEIN X2
JOB No. : 2015-S-1607
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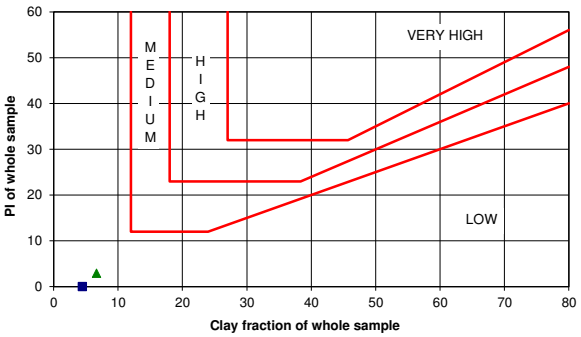
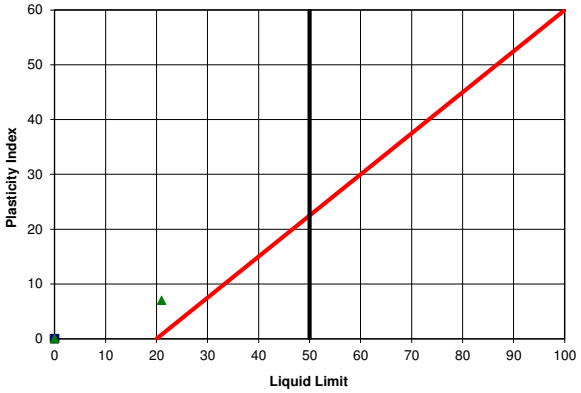
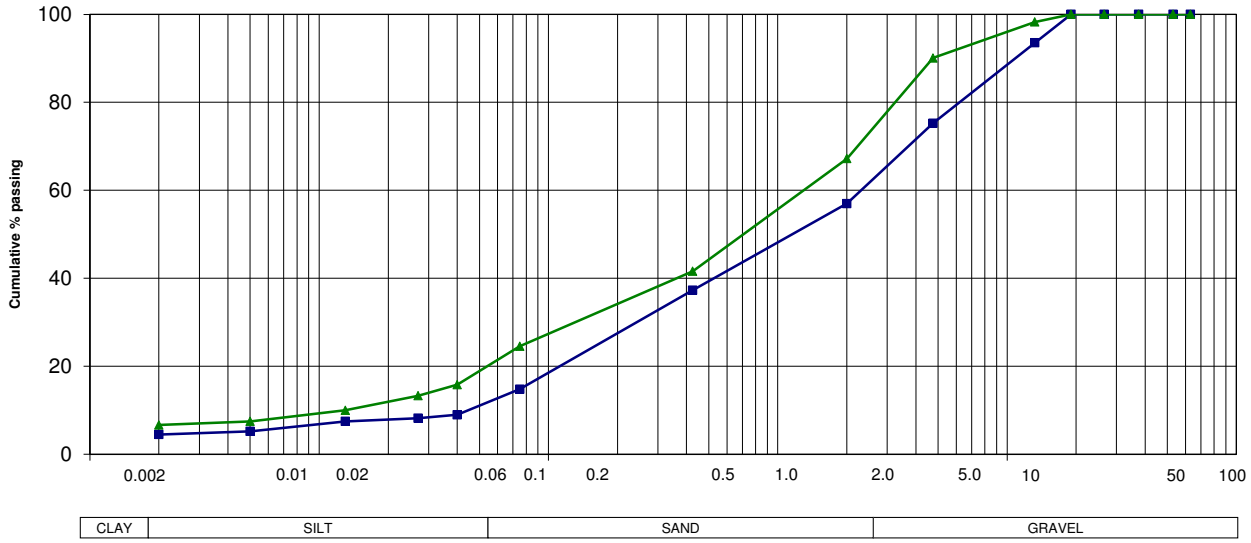
POTENTIAL EXPANSIVENESS



PLASTICITY CHART





ADDENDUM G

TRAFFIC IMPACT STUDY

TRAFFIC IMPACT STUDY

Portions 105, 109 & 331 of the Farm Knopjeslaagte 385 JR

May 2016

route 2
transport strategies

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