

**ANNEXURE "C"**

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Our Ref:

16119emmMaple

**A REPORT**

ON

**A FEASIBILITY INVESTIGATION**  
**FOR A PROPOSED RESIDENTIAL DEVELOPMENT**  
**ON STANDS 862, 863, 865 AND 866**  
**IN MAPLETON EXTENSION 10,**  
**EKURHULENI METRO MUNICIPALITY,**  
**GAUTENG.**

BY

**RELLY, MILNER AND SHEDDEN**  
PRETORIA

**DATE:** June 2016

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## **1. INTRODUCTION**

This report (16119emmmapple) presents the results of a desk study undertaken for the establishment of a proposed township on the stands 862, 863, 865 and 866 in Mapleton Extension 10. The properties are located in the Ekurhuleni Metro Municipality (EMM) of Gauteng (see locality plan overleaf).

The purpose of the study was to provide generalised information regarding the feasibility of developing housing on the site. The geology, nature of the shallow soils and their geotechnical properties are considered. A geotechnical report needs to meet the requirements of the NHBRC's 2015 manual (Reference 8) and the requirements of the National Department of Housing guideline [Generic Specification GFSH-2 (September 2002)] (Reference 7). As the site is located within a known karst environment, a comprehensive dolomite stability assessment meeting the requirements of SANS 1936 [2012] (Reference 10) will be necessary prior township proclamation.

The feasibility study was commissioned at the request of Izwelisha Town Planners acting on behalf of their client.

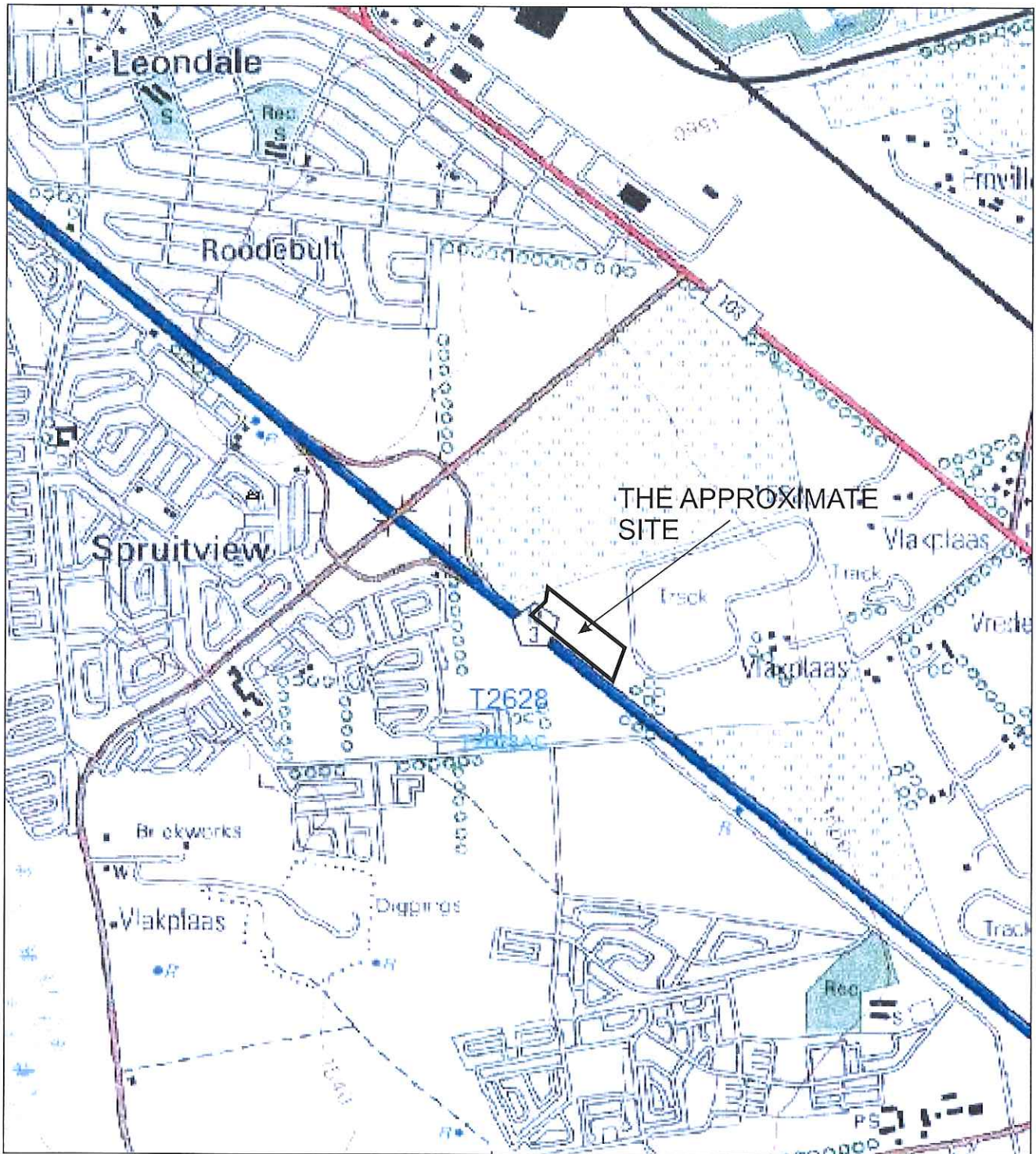
A visit was paid to the site in late May 2016.

## **2. SITE DESCRIPTION**

The site is an elongate area of about 4ha sandwiched between the N3 highway in the west and Luvuyo Street in Mapleton Extension 10 in the east. The site comprises four undeveloped stands in Extension 10.

Access to the site is via Luvuyo Street within Mapleton Extension 10. The road is a municipal, surfaced road within the suburb.

Vegetation is a mixture of veld grass and dense "khakibos" weeds throughout the site. Access onto the site is severely restricted because of the abundance of waste material that has been dumped on the properties over the years. Illegal dumping is presently continuing on the site.



### LOCALITY PLAN

Stands 862, 863, 865 and 866,  
MAPLETON EXTENSION 10,  
EKURHULENI METRO MUNICIPALITY,  
GAUTENG.

No development had taken place on the site at the time of the site visit in late May 2016.

The relief of the site is low. Elevation contours from the EMM GIS indicate an irregular surface with elevation changes of between 2m and 3m over fairly short distances. The regional slope is towards the south west at a gradient of about 1%.

### **3. GEOLOGY**

According to the 1:250 000 Geological Map, Sheet No 2628 East Rand, the site is underlain by chemical sediments of the Chuniespoort Group of the Transvaal Supergroup. The sediments comprise dolomite and chert.

Drilling information from an investigation for a pipeline indicates the site to be underlain by residual dolomite and residual diabase. Dolomite bedrock is intersected below a depth of about 25m.

Colluvium and residual dolomite blanket the site.

### **4. EXISTING INFORMATION**

A dolomite stability report for a Transnet pipeline that follows the eastern boundary of the site is on file in the CGS databank (CGS file F484).

### **5. GEOTECHNICAL DISCUSSION**

The majority of the site is blanketed by silty/sandy colluvium overlying chert residuum and residual dolomite. Both residual soils consist of chert rubble (coarse, medium and fine gravel and occasional boulders of weathered chert) in a soil matrix. In some instances the residuum may be described as soil with subordinate chert rubble. Two typical shallow, soil profiles encountered in Mapleton Extension 12 have been included in Appendix B.

A typical soil profile in chert rubble may be described as

- 0-0,4m slightly moist, dark reddish brown, firm, intact, slightly clayey, sandy silt (colluvium) overlying
- 0,4-0,6m medium and fine, subrounded, clast supported, friable gravel of ferricrete and manganocrete nodules in a trace matrix of slightly moist, dark reddish brown speckled black, sandy silt with an overall consistency of loose to medium dense (colluvium(?)) overlying
- 0,6-1,4m coarse, medium and fine, subangular, clast supported gravel and small boulders of weathered to highly weathered chert in a trace matrix of slightly moist, dark reddish brown, sandy silt with an overall consistency of medium dense to dense (pebble marker?).

In some localities where chert rubble is less abundant, a typical profile may be described as

- 0-0,3m slightly moist, brown, stiff, fractured, slightly clayey, sandy silt (colluvium) overlying
- 0,3-1,6m slightly moist, dark reddish brown, firm intact, slightly clayey, sandy silt (colluvium) overlying
- 1,6-2,7m slightly moist, dark reddish brown speckled black in places, stiff to very stiff, intact, slightly ferruginised, clayey silt with abundant, hard and soft, ferruginous and manganiferous concretions and scattered chert (residual dolomite?).

The soil profile overlying dolomite land tends to be more irregular than the profiles encountered on Karoo sediments. Pockets of chert rubble may occur adjacent to troughs of deeply weathered, residual soil. Wad, the insoluble residue after dissolution of dolomite rock, may be present at shallow depths. This soil material is highly compressible and easily erodible. Residential development on shallow wad is generally not permitted. Wad is intersected at depth in one of the boreholes drilled on the eastern edge of the site.

The geotechnical conditions that may impact on any residential development are discussed in the following paragraphs. Each geotechnical concern has been classified according to the table presented in Reference 9. A copy of the aforementioned table is included with this report (see Appendix D).

5.1 **Collapsible soils:** The colluvial cover blanketing the site should be regarded as potentially collapsible. In many cases the cover is usually less than a metre thick but as seen in TP 10 the colluvial layer may be up 1,5m thick. A conservative approach would see the site classified as Class C2. *NHBRC soil classification: C2. Geotechnical assessment: 2A.*

5.2 **Seepage (perched water tables):** Perched water tables are not usually a problem on residual dolomite because of the permeability of the material. Isolated perched water tables may be encountered where pedocretes (manganocrete and ferricrete) are well developed. Seepage is likely to be a minor problem. *Geotechnical assessment: 1B.*

5.3 **Active Soil (expansive clay):** Active clay is unlikely to be a problem on this site. The shallow soil profile tends to be a mixture of sand, silt and chert gravel. *NHBRC soil classification: H. Geotechnical assessment: 1C.*

5.4 **Highly compressible soil (normal settlement):** Excessive normal settlement often occurs where structures are placed on loose, moist, sandy soil. These conditions may occur where thick deposits of sandy/silty colluvium or residuum have developed such as seen in TP 10. Excessive differential settlement as a result of founding partly on boulders of solid chert and partly on loose (soft) sand/silt is likely to occur throughout of the site. The abundant waste heaps pose a problem for foundations. The waste should be completely removed before the properties can be considered suitable for development.

Development in a typical karst environment requires that foundations be designed to accommodate a 2m to 5m loss of support. Foundations designed to accommodate these conditions should be capable of overcoming any of the potential geotechnical problems. *NHBRC soil classification: S2. Geotechnical assessment: 2D.*

5.5 **Erodability of soil:** The relatively flat terrain is unlikely to give rise to erosion problems. *Geotechnical assessment: 2E.*

5.6 **Excavation properties:** Excavations to a depth of between 1,0m and 1,5m should be



achieved by a TLB with intermittent pockets of shallow, chert boulders. Most of the site is likely to be classified as intermediate below 1,5m.

The occasional use of power tools may be to be required on this site. *Geotechnical assessment: 1F with pockets of 2F.*

**5.7 Undermining:** Available evidence indicates that the site is not undermined. *Geotechnical assessment: 1G.*

**5.8 Soluble rocks:** The site is located within a karst environment. A comprehensive dolomite stability assessment needs to be undertaken on the property in accordance with the requirements of SANS 1936 [2012] before proclamation is possible. Preliminary information indicates that the site would be suitable for residential development. According to the 2015 NHBRC home building manual, the following types of residential development could be considered: DH2 (full title stands  $\geq 300\text{m}^2$ ), DH 3 (full title stands not less than  $1000\text{m}^2$ ); AHL2 (80 attached homes per hectare [buildings not to exceed 3 storeys]) or AHH3 (160 attached homes per hectare [buildings exceeding 3 storey]). *Geotechnical assessment: 2H.*

**5.9 Steep slopes:** No steep slopes occur on the site. *Geotechnical assessment: 1I.*

**5.10 Unstable natural slopes:** No unstable, natural slopes occur on the site. *Geotechnical assessment: 1J.*

**5.11 Seismicity:** According to Reference 5, the natural seismic intensity of the site lies between V and VI on the modified Mercalli scale (MMS) with a 90% probability of the intensity not being exceeded in a 100 year period. *Geotechnical assessment: 1K.*

**5.12 Flooding:** There is no probability of widespread flooding but the piles of waste may give rise to localised flooding if not removed. A small wetland has been identified by a specialist in the north-western corner. It is possible that the disturbed ground and piles of waste have artificially created the wetland by preventing the natural flow. *Geotechnical*

assessment: 1L.

There are no geotechnical conditions evident that prevent township establishment on this portion of land other than a cover of potentially collapsible soil. A preliminary NHBRC soils classification for the site would be: **H** (total heave <7,5mm); **C2** (total collapse of 5mm-10mm); **S2** (total normal settlement 10mm-20mm); **P**(dolomite, uncontrolled fill). Collapsible soils can be fairly easily overcome by the use of a reinforced concrete raft designed to accommodate a 5m loss of support. The waste heaps pose a serious founding problem unless completely removed. A detailed assessment of the dolomitic conditions is required prior to township proclamation. The possibility that some land may be classified as unsuitable for development cannot be excluded.

The tables below are an attempt to indicate the additional costs the major geotechnical constraints will have on the price of a typical dwelling taking into account the assumed soil classification.

The site classes given below in Table 1 are those recommended and used by the NHBRC.

TABLE 1  
Estimated additional house cost per geotechnical classification

Site Class	Estimated additional house cost (%)
H, C, S	0
C1 (S1) (collapse)	1 to 3
C2 (S2) (collapse)	4 to 6
H1 (heave)	2 to 3
H2 (heave)	4 to 8
H3 (heave)	10 to 15
R(outcrop/suboutcrop)	2 to 4

The values quoted in Table 1 above have been taken from a 2008 feasibility study of an area in the Vaal Triangle.

An estimate of the area covered by the various soil classes indicated above is given in Table 2 on the next page.

TABLE 2

Estimate of areal extent of soil classes

NHBRC Class	% of site area
H, C, S	10
C1/C2;S1/S2/P(dolomite, uncontrolled fill)	90

**6. ADDITIONAL WORK**

A comprehensive dolomite stability assessment and geotechnical investigation must be undertaken over the area to be considered for development. The dolomite stability assessment must comply with the requirements set out in Parts 1 and 2 of SANS 1936 [2012]. A geotechnical investigation must take into account the requirements of the 2015 NHBRC Home building manual and the 2002 GFSH 2 publication

**7. GENERAL**

The nature of a feasibility study requires that certain generalisations be made without the benefit of invasive fieldwork. Certain variant conditions, not mentioned in this feasibility report, may become evident only after a geotechnical investigation is initiated.



E Shedden (Pr Sci Nat)

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**MAY 2016**

## REFERENCES/BIBLIOGRAPHY

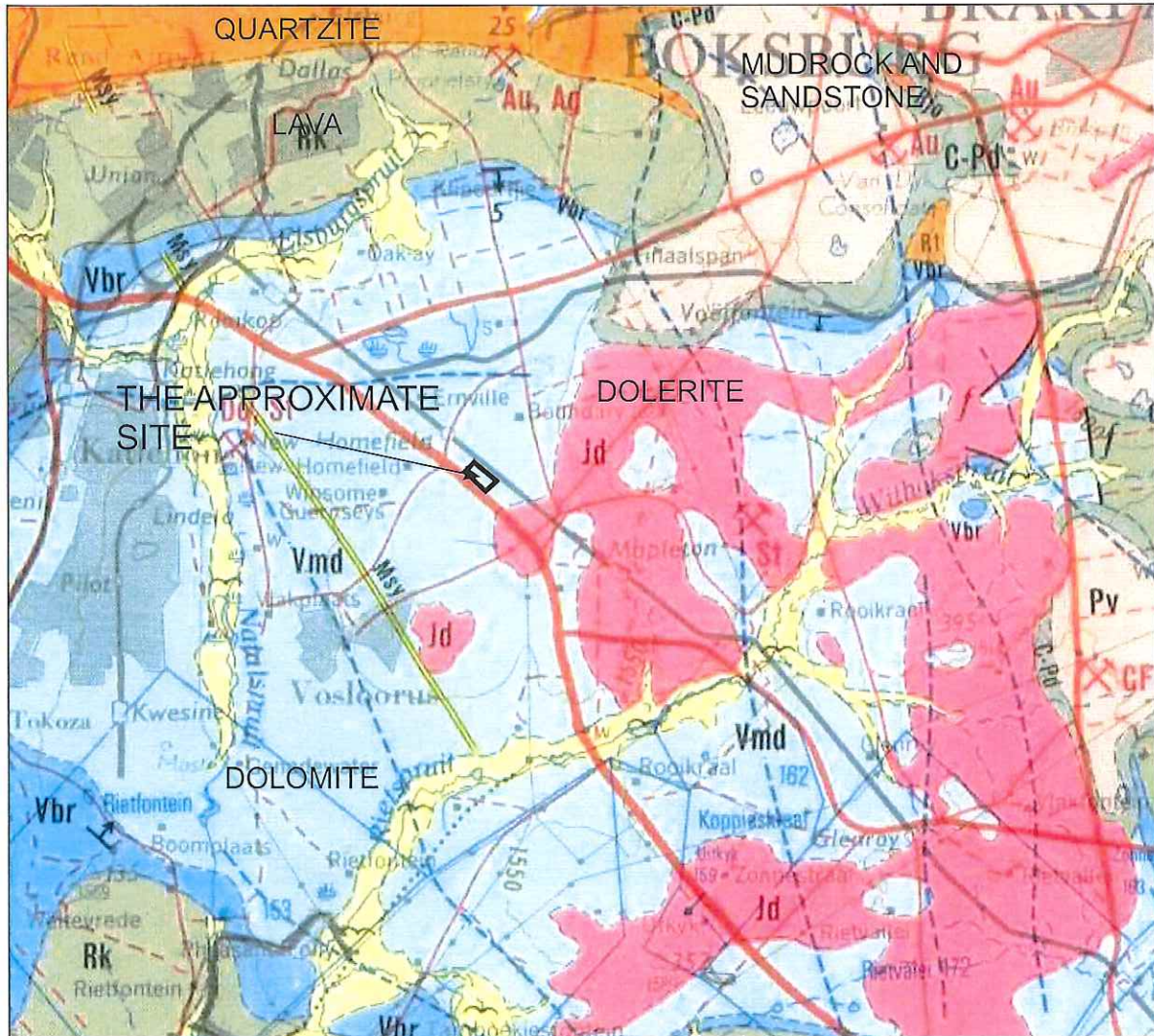
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**APPENDIX A**

REGIONAL GEOLOGY

## REGIONAL GEOLOGY

Stands 862, 863, 865 and 866,  
 MAPLETON EXT 10,  
 Ekurhuleni Metro Municipality,  
 Gauteng.



Excerpt from 1:250 000 Geological Series,  
 Sheet No: 2628 East Rand.  
 [Not to scale]

### LEGEND

Vmd = Dolomite and  
 chert

Malmani  
 Subgroup

Chuniespoort  
 Group

Transvaal  
 Supergroup

**APPENDIX B**

SOIL PROFILES  
(Typical examples)

### SOIL PROFILE

**PROJECT:** MAPLETON EXT 12, (Pm 153, VLAAPLAATS 138-IR)



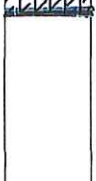
**TEST PIT No.:** TP 10

**MACHINE:** CAT 580 SK

**JOB No.** 06171vlak **PROFILED By:** es

**CONTRACTOR:** TJ PLANT HIRE

**DATE:** 04/12/2006

UNIFIED/ TRB CLASS.	SAMPLE No.	LEGEND	DE PT H (m)	DESCRIPTION	POTENTIAL EXPANSIVENESS
			0,3	Slightly moist, brown, stiff, fractured, slightly clayey, sandy SILT; colluvium.	(LOW)
CL A-6(6)	10/1		1,6	Slightly moist, dark reddish brown, firm, intact, slightly clayey sandy SILT; colluvium.  Thin horizon of fine gravel of ferricrete and manganocrete nodules at 1,6m; pebble marker.	LOW
CL A-7-6(7)	10/2		2,7	Slightly moist, dark reddish brown speckled black in places, stiff to very stiff, slightly ferruginised, clayey SILT with abundant, hard and soft rock ferricrete and manganocrete concretions and scattered chert; residual dolomite?  Some khaki blotching below 2m. Tends to fine ferricrete gravel in places.	LOW
		EOH			

**NOTES:**

- 1) Hole stopped at 2,7m in ferricrete gravel. No refusal.
- 2) Ground water not encountered.
- 3) Fine roots in top 1,5m.
- 4) Undisturbed at 0,8m to 1,0m.

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**SOIL PROFILE**

**PROJECT:** MAPLETON EXT 12 (Ptn 153, VLAKPLAATS 138-IR)




**TEST PIT No.:** TP 3

**MACHINE:** Case 580 SK      **JOB No.** 06171vlak

**PROFILED By:** es

**CONTRACTOR:** TJ PLANT HIRE

**DATE:** 04/12/2006

UNIFIED/ TRB CLASS.	SAMPLE No.	LEGEND	DE PT H (m)	DESCRIPTION	POTENTIAL EXPANSIVENESS
				Slightly moist, dark reddish brown, firm, intact, slightly clayey, sandy <b>SILT</b> ; colluvium.	(LOW)
			0,4	Medium and fine, subrounded, closely packed, friable <b>GRAVEL</b> of hard, ferricrete and manganocrete nodules in a trace matrix of slightly moist, dark reddish brown speckled black, sandy silt; overall consistency is loose to medium dense; colluvium.	
			0,6	Coarse, medium and fine, subangular, closely packed <b>GRAVEL</b> and small <b>BOULDERS</b> of weathered to highly weathered chert in a trace matrix of slightly moist, dark reddish brown, sandy silt; overall consistency is medium dense to dense; pebble marker horizon?	
		<b>EOH</b>	1,4		
				<p>NOTES:</p> <ul style="list-style-type: none"> <li>1) Machine refusal at 1,4m in chert boulders.</li> <li>2) Ground water not encountered.</li> <li>3) Fine roots in top 800mm.</li> </ul>	

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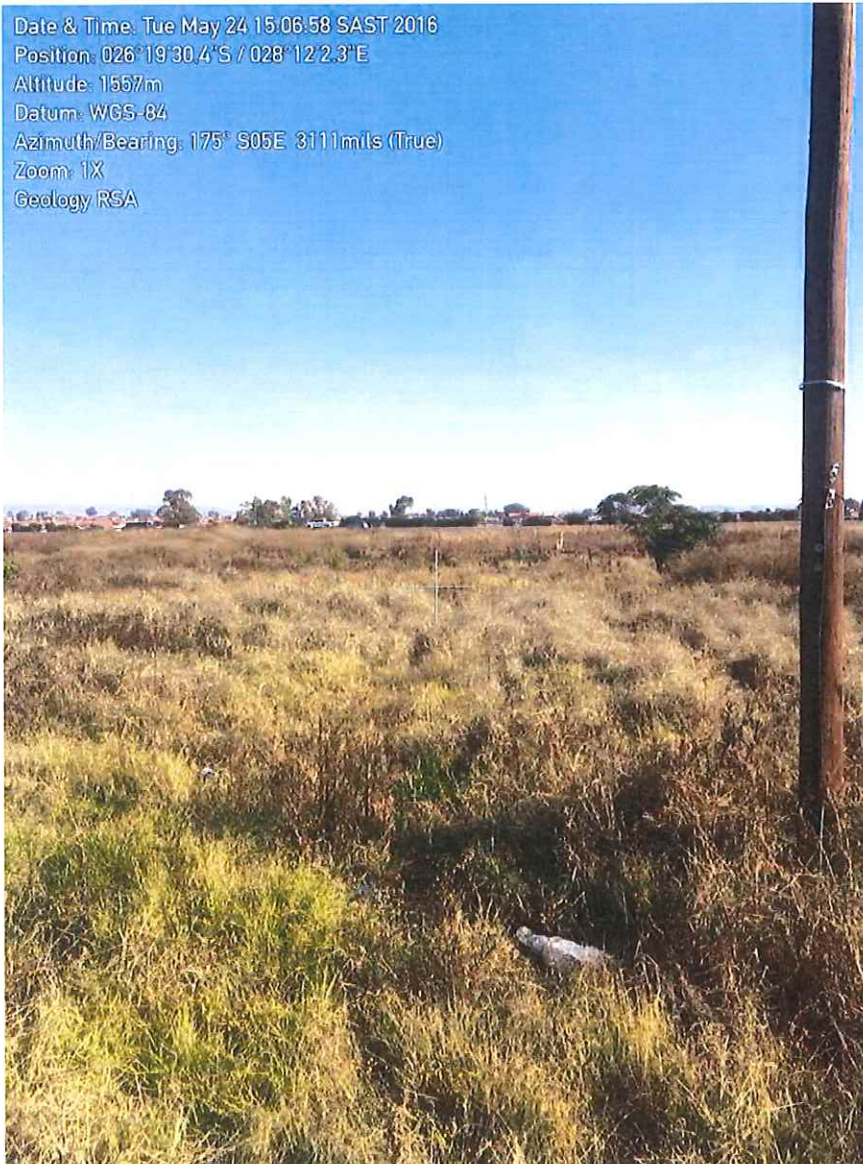
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**APPENDIX C**

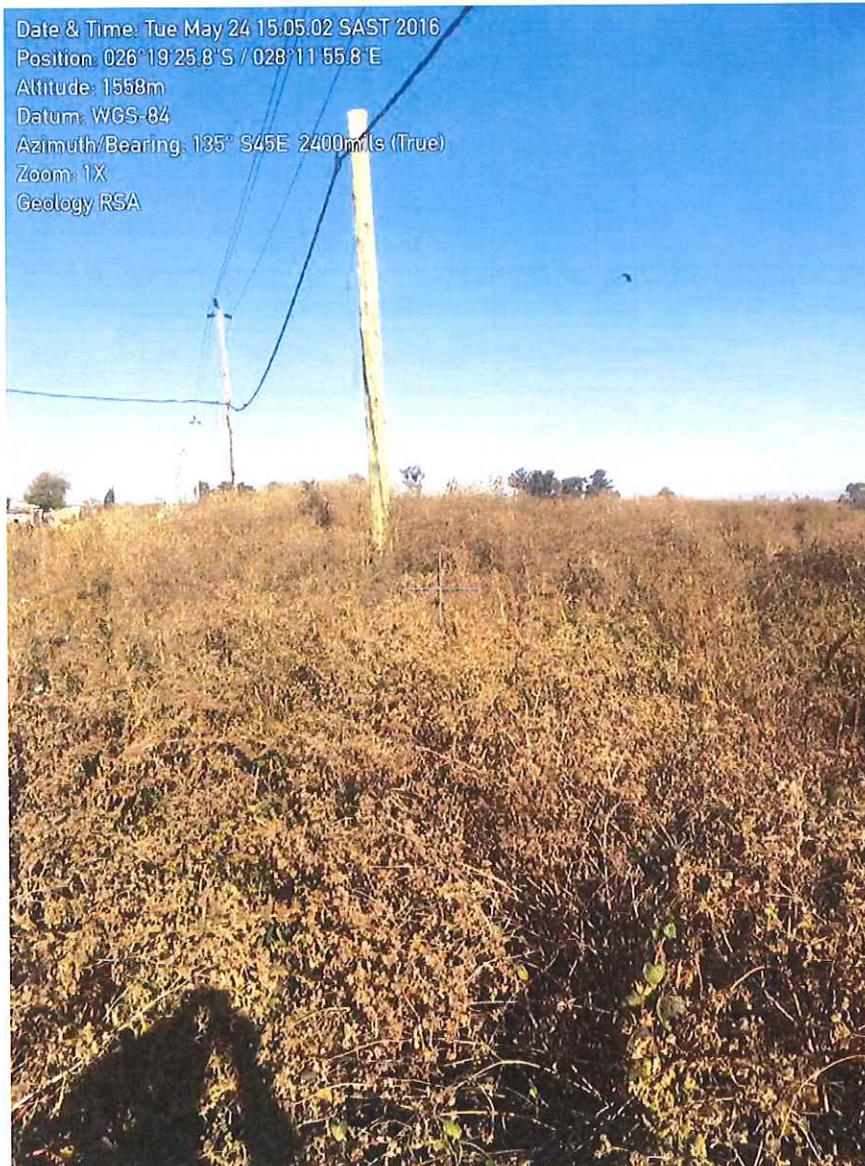
PHOTOGRAPHS



Photograph 1: View diagonally across site to the south. Vehicle in distance is on the N3 highway.



Photograph 2: View diagonally across the site to the south from a different position on Luvuyo Street.  
Weed covered waste heaps.



Photograph 3: View along edge of Luvuyo Street. Prolific growth of weeds on waste heaps.

**APPENDIX D**

GEOTECHNICAL CLASSIFICATION TABLE AND MAP

### Geotechnical Classification for Urban Development (after Partridge, Wood and Brink)

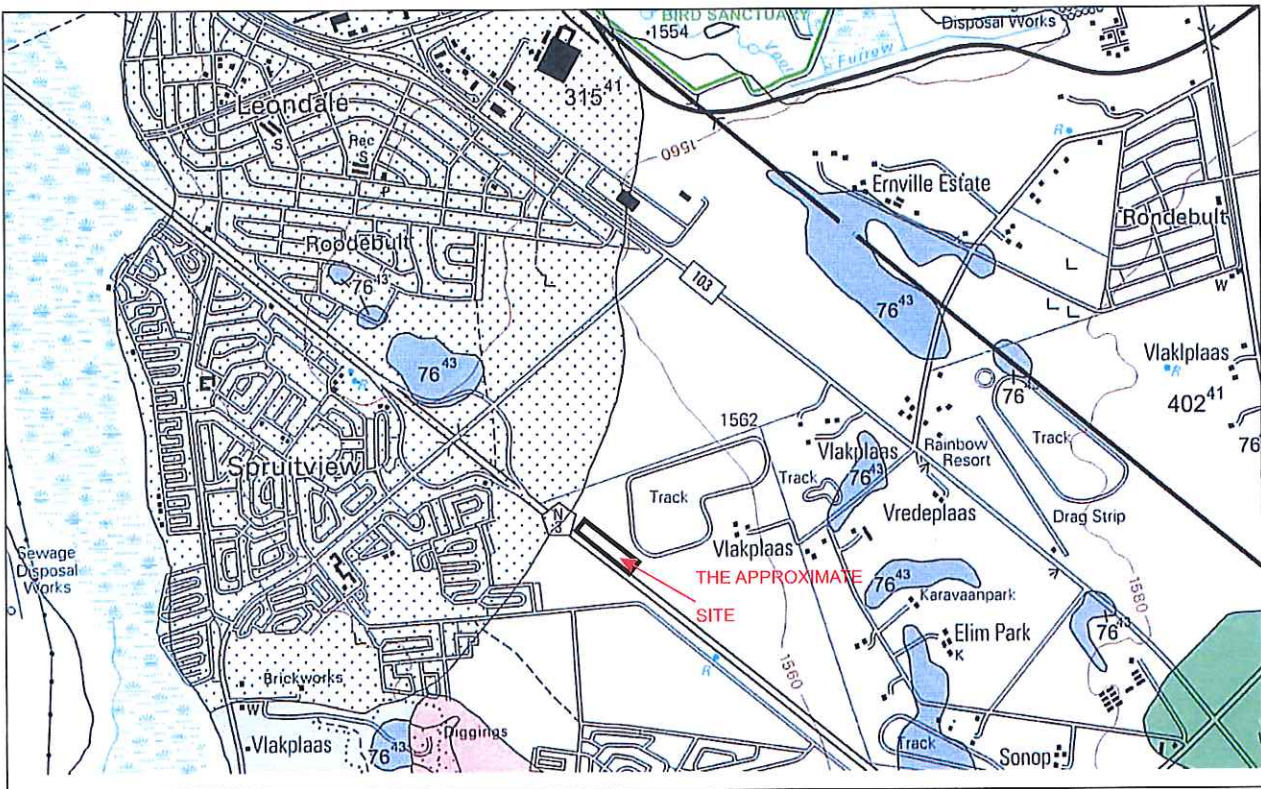
CONSTRAINT		Most favourable (1)	Intermediate (2)	Least favourable (3)
A	Collapsible Soil	Any collapsible horizon or consecutive horizons totaling a depth of less than 750mm in thickness*	Any collapsible horizon or consecutive horizons with a depth of more than 750mm in thickness	A least favourable situation for this constraint does not occur
B	Seepage	Permanent or perched water table more than 1,5m below ground surface	Permanent or perched water table less than 1,5m below ground surface	Swamps and marshes
C	Active Soil	Low soil-heave potential anticipated*	Moderate soil heave potential anticipated	High soil-heave potential anticipated
D	Highly compressible soil	Low soil compressibility anticipated*	Moderate soil compressibility anticipated	High soil compressibility anticipated
E	Erodability of soil	Low	Intermediate	High
F	Difficulty of excavation to 1,5m 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 the total volume
G	Undermined ground	Undermining at a depth greater than 240m below surface (except where total extraction mining has not occurred)	Old undermined areas to a depth of 90-240 m below surface where slope closure has ceased	Mining within less than 90-240 m of surface or where total extraction mining has taken place
H	Stability: (Dolomite & Limestone)	Possibly stable. Areas of dolomite overlain by Karoo rocks or intruded by sills. Areas of Black Reef rocks. Anticipated Inherent Risk Class I	Potentially characterised by instability. Anticipated Inherent Risk Classes 2 – 5.	Known sinkholes and dolines. Anticipated Inherent Risk Classes 6 – 8.
I	Steep slopes	Between 2 and 6 degrees (all regions)	Slopes between 6 and 18 degrees and less than 2 degrees (Natal and Western Cape) Slopes between 6 and 12 degrees and less than 2 degrees (all other regions)	More than 18 degrees (Natal and Western Cape) More than 12 degrees (all other regions)
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 <sup>2</sup> within 50 years	Mining-induced seismic activity more 100 cm/s <sup>2</sup>	Natural seismic activity more than 100 cm/s <sup>2</sup>
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

\* These areas are designated as 1A, 1C, 1D, or 1F where localised occurrences of the constraint may arise.

**Example:**

A sub-area designated as Zone 2BF would be an intermediate class with anticipated seepage and excavation problems. A sub-area designated as Zone 3B would be designated as least favourable and not recommended for development due to surface water inundation.

Stands 862, 863, 865 and 866,  
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## GEOTECHNICAL MAP (Sheet 2628AC Alberton).

Geotechnical classification: 402<sup>41</sup> = Sin2; Act3; Exc3; Col2; Con2.

Interpretation: Act2 = Active or expansive soil is present.  
Col2 = Settlement potential is present (decrease in soil volume unknown).  
Con2 = Area has poorly consolidated soil  
Exc3 = Severe excavatability problems (blasting and/or power tools are required).  
Sin2 = Area is susceptible to sinkhole formation.



APPENDIX E

GOOGLE EARTH™ IMAGE



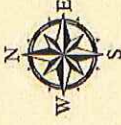
Approximate extent of area under discussion in feasibility report.

**APPENDIX F**

REPORT INFORMATION AVAILABLE AT COUNCIL FOR GEOSCIENCE

**MAP SHOWING  
AVAILABLE DATA  
IN  
CGS DATABANK**

**VLAKPLAATS  
SITE 5**



**Legend**

- Borehole Positions
- Dolomite stability reports



L HEATH MAY 16



28°12'20"E 28°12'10"E 28°12'0"E 28°11'50"E 28°11'40"E  
26°19'20"S 26°19'30"S 26°19'40"S 26°19'50"S 26°19'50"S