

10. Conclusions and recommendations

- 10.1 The site is suitable for development as a township, providing the recommendations given in the report are followed. According to the classification of the NHBRC ^{10,11} the entire site can be classified as an **H/C1** site. It should be noted that the scope of work for this investigation includes the classification of the site for purposes of township establishment; according to the Guidelines for Urban Engineering Geological Investigations (**see Section 11.11**) this investigation is classified as an Urban Development investigation. It does **not** include the NHBRC requirement for classification or certification of **individual stands**.
- 10.2 It should be noted that a non-perennial water course crosses the south-western part of the site, draining in a westerly direction. It is recommended that the Client should appoint a professional engineer to certify the flood lines. No permanent structures should be erected below the flood lines.
- 10.3 The majority of the site is underlain by loose or potentially collapsible sands to depths of up to 0,6 m, and locally to 1,4 m. The implications and recommended treatment of the material and design of the structures are discussed in **Sections 8.5 to 8.7**.
- 10.4 As discussed in **Section 8.3**, problems due to heaving of the materials are not anticipated. However, as discussed in **Section 8.3**, a medium active layer occurs locally at depth, which could result in a heave of probably less than 6 mm. This should be borne in mind in the design of any structures to be constructed in the area.
- 10.5 It should be noted that, although the recommendations given in **Sections 8.5** and **8.6** will reduce the likelihood of cracking of the structures founded in the upper 2,5 m of the soil profile, it is possible that minor cracking of structures founded above this depth could still occur.
- 10.6 Seepage of groundwater into excavations can be anticipated. Therefore provision should be made for the removal of groundwater from excavations.
- 10.7 Problems due to excavatibility of the materials are generally not anticipated to at least 2,0 m depth, providing a machine

equivalent to a Komatsu WB93R or Case 580 Super R back actor is used, although it should be noted that ferricrete hardpan can occur locally at shallower depths, which will probably require the use of power tools and possibly explosives for excavation.

- 10.8 The sides of excavations will tend to be unstable, and should either be shored or else battered back.
- 10.9 pH and conductivity tests carried out on representative samples of the materials underlying the site indicate that they are alkaline and that they are corrosive. Therefore underground services should be treated so as not be prone to alkaline or corrosive attack.
- 10.10 As regards the suitability of the materials on site for founding conditions for roads, reference should be made to the laboratory test results in **Appendix A** and the summary of the results in **Table 1**. These results indicate that the subgrade conditions for roads are fair to reasonably good. In general the GMs are at least 0,75 and the Pls range from 5 to 14. The construction of reasonably economical paved roads is therefore possible. The in situ material should be compacted by means of a heavy vibrator roller prior to the placement of fill and/or pavement layers.

11. Report provisions

The aim of the investigation was to estimate through site investigation, professional judgment and past experience the dolomite stability of the site, different soil horizons with their different geotechnical properties, areas subject to a perched water table, areas of poor drainage, areas underlain by hard rock and to estimate their distribution. However, it is impossible to guarantee that isolated zones of different geotechnical conditions, foundation materials, blanketing layers or any other geotechnical problems have not been missed.

For this reason detailed foundation inspections should be carried out at the time of construction to identify such variances and adjust foundation designs accordingly if need be.

12. References

Geological map
Number and title: 2528CC Lyttelton
Scale: 1:50 000
Date of publication: 1973
Source: Government Printer

Brink, A.B.A and Bruin, R.M.H. (eds.), 2001. Guidelines for Soil and Rock Logging in South Africa. 2nd Impression. Proceedings, Geoterminology Workshop organised by AEG, SAICE and SAIEG, 1990.

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SAICE. 1995. *Code of Practice: Foundations and superstructures for single storey residential buildings of masonry construction*. Joint Structural Division, Johannesburg. First edition.

SAIEG, 1996. *Guidelines for soil and rock logging*. SAICE/SAIEG.

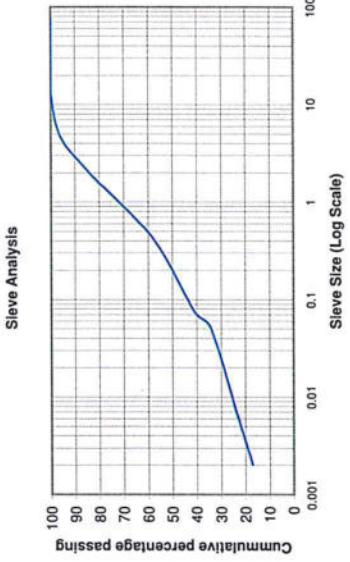
SANS 1936 (2009). Development of dolomite land. Part 1: General principles and requirements.

APPENDIX A: SOIL PROFILE
DESCRIPTIONS

Project no: 1210B-09
 Logged by: SP Kok
 Date excavated: 2010-02-08
 Date profiled: 2010-02-08

Client: Lezmin 1066 CC
 Contractor: WCS
 Operator: Pifer
 Machine: Case 580 Super R

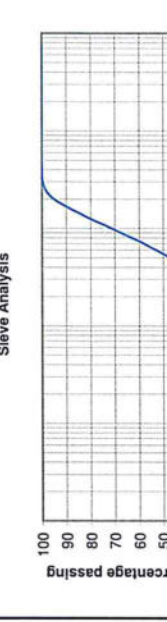
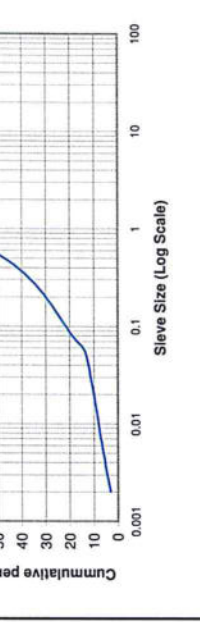

Depth (m)	Sample	Unified
0.00 - 0.20	Moist, light brown, very loose voided fine sand with quartz gravel and abundant fine roots; Colluvium.	
0.20 - 0.70	Very moist, grey brown, very loose boided, silty sand with abundant fine quartz gravel, Poorly developed pebblemarker.	
0.70 - 1.10	Moist, yellow brown and grey white with abundant black blotches, firm to stiff, intact sandy clay/sandy silt; Residual granite.	SC Low Heave
1.10 - 1.80	Moist, grey white and yellow brown, medium dense, relict jointed clayey sand; Residual granite.	
1.80 - 3.50		

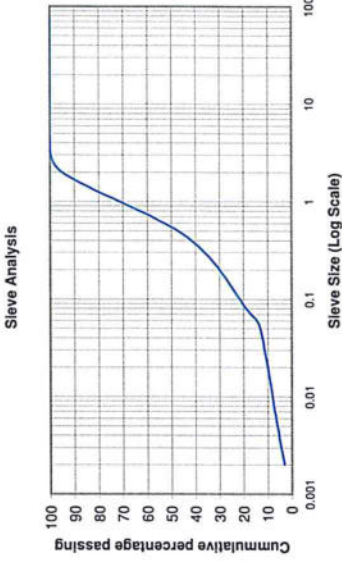


- NOTES:
- 1 Gradual refusal.
 - 2 No water.
 - 3 Sample taken at TPA/0.9m

Project no: 1210B-09
 Logged by: SP Kok
 Date excavated: 2010-02-08
 Date profiled: 2010-02-08

Client: Lezmin 1066 CC
 Contractor: WCS
 Operator: Pieter
 Machine: Case 580 Super R

Sample	Unified
<p>0.00 0.20 0.60</p>  <p>Moist, dark brown, soft, intact silty clay; Colluvium with abundant fine roots.</p> <p>Very moist to wet, light grey and orange brown, very soft, shattered, gravelly clay; residual granite.</p>	
<p>1.30</p>  <p>Moist, grey white, dense, intact sand; Residual granite.</p>	
<p>2.20</p>  <p>Moist, khaki green with fine black speckles, loose to medium dense, relict jointed, silty sand; Residual.</p>	<p>SC Low heave</p>
<p>NOTES: 1 Gradual refusal. 2 Water seepage at 0.3m 3 Sample taken at TPC/1.6m</p>	



APPENDIX B: LABORATORY TEST RESULTS

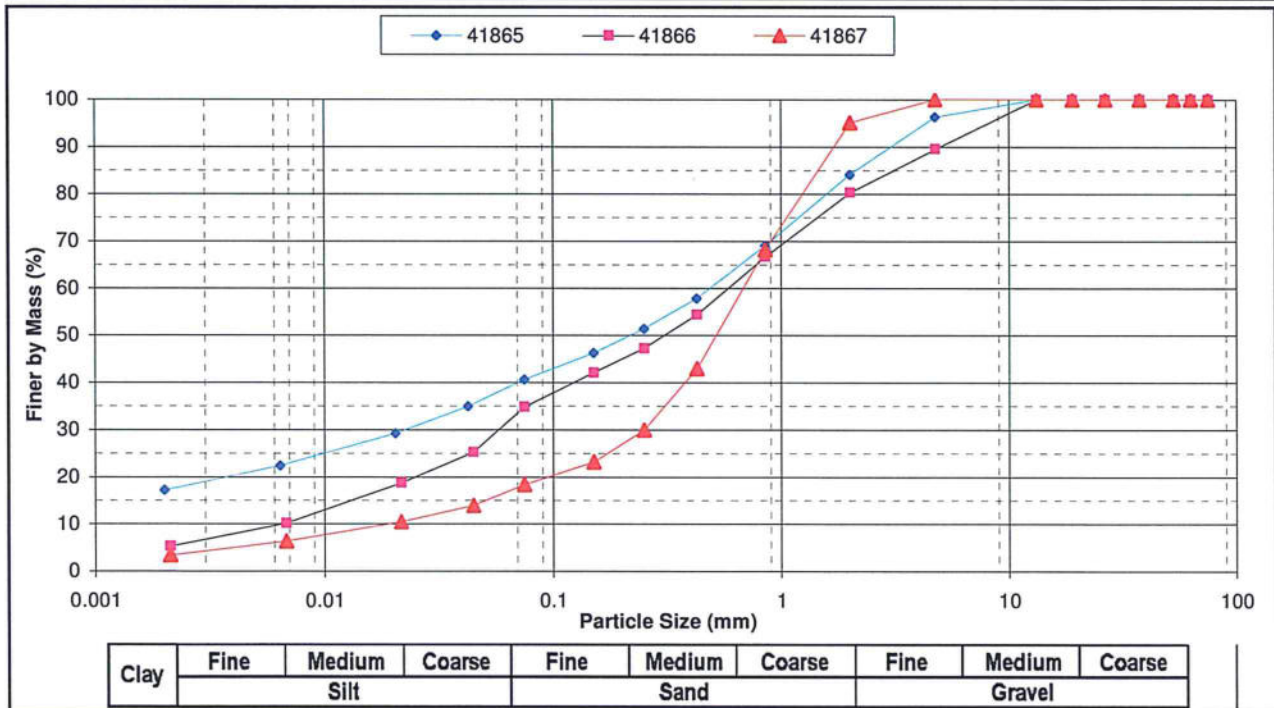
TABLE 1: MATERIAL PROPERTIES - ROOIHUISKRAAL

Sample No.	Hole Nr.	Depth (m)	LL	PI	LS %	GM	%< 0,425 mm	% <0,075 mm	%<0,002 mm	PRA class	U.S class	NMC %	Heave class	pH	Dry density kg/m	Collapse Potential %	Compressibility %		
1	7	0,0-0,5	22	10	5,5	1,41	53	30	12	A-2-4(0)	SC	11,5	L	7,6					
2	7	0,5-0,9	25	8	4,0	2,43	18	10	3	A-2-4(0)	GW-GC	8,8	L	7,7					
3	7	0,9-2,3	24	10	5,5	1,52	42	24	7	A-2-6(0)	SC	8,3	L	8,2					
4	5	0,15-0,6	23	8	4,0	1,77	37	18	4	A-2-4(0)	SC	9,9	L						
5	5	0,6-1,4	32	14	7,0	1,21	56	37	13	A6-(1)	SC	13,5	L						
6	5	1,4-2,3	46	21	11,0	0,86	67	52	21	A-7-6(8)	CL	22,7	M						
7	10	0,0-0,8	46	25	12,0	0,78	72	50	18	A-7-6(9)	CL	24,7	M						
8	10	0,8-1,4	18	7	4,0	1,38	41	23	6	A-2-4(0)	SM-SC	16,8	L	7,8					
9	10	1,4-2,0	50	18	9,0	0,84	67	50	26	A-7-5(7)	OH	19,2	L/M	8,1					
10	12	0,7-1,3	24	11	5,0	1,03	64	41	14	A6-(1)	SC	6,1	L	8,3	1685	0,32	4,12		
11	4	0,0-0,5	20	5	3,0	1,29	59	27	3	A-2-4(0)	SM-SC	3,4	L						
12	4	0,5-1,4	27	11	6,0	1,16	52	35	5	A-2-6(0)	SC	10,1	L						
13	4	1,4-2,2	39	15	7,5	0,94	66	42	12	A6-(3)	SC	17,6	L						
14	4	2,2-3,0	37	16	7,5	1,17	52	33	8	A-2-6(1)	SC	10,0	L						
Samples taken during 2010 investigation																			
41865	A	0,9	35	15	7,5	1,17	58	41	17	A-6-2(2)	SC	-	L						
41866	B	1,2	20	7	2,5	1,3	54	35	5	A-2-4(0)	SC-SM	-	L						
41867	C	1,6	25	7	2,5	1,44	43	18	3	A-2-4(0)	SC	-	L						
41868	D	0,8	33	15	7	1,66	42	27	7	A-2-6(1)	SC	-	L						
LL	:	Liquid Limit															L	:	Low
PI	:	Plasticity Index															M	:	Medium
LS	:	Linear Shrinkage															H	:	High
US class	:	Unified Soil Classification															VH	:	Very High
NMC	:	Natural Moisture Content															CND	:	Could not be determined
																	SP	:	Slightly plastic

Foundation Indicator Test Data

Project	Geo-Buro - #1210 B-09 Rooihuiskraal North x 28,29 & 31		
Project No.	HP/B 258-44	Date	15 February 2010

Sample No.	41865	41866	41867	Sample No.	41865	41866	41867
Field Ref. No.	TP-A	TP-B	TP-C	%Gravel	16	20	5
Depth	0.9m	1.2m	1.6m	%Sand	46	50	79
Sieve size	%Passing	% Passing	% Passing	%Silt	21	26	13
75.00	100	100	100	%Clay	17	5	3
63.00	100	100	100	NMC %	Not Tested	Not Tested	Not Tested
53.00	100	100	100	Liquid Limit	35	20	25
37.50	100	100	100	Plasticity Index	15	7	7
26.50	100	100	100	Linear Shrink.	7.5	2.5	2.5
19.00	100	100	100	Overall P.I.	9	4	3
13.20	100	100	100	Grading Modulus	1.17	1.30	1.44
4.75	96	89	100	H.R.B.	A-6 (2)	A-2-4 (0)	A-2-4 (0)
2.00	84	80	95	Unified	SC	SC-SM	SC
0.85	69	67	68	Weston swell (%) at 1 kPa			
0.425	58	54	43	Analysis as per method D422 of ASTM of 1985 The results reported relate only to the samples tested. Documents may only be reproduced or published in their full context.			
0.25	51	47	30				
0.15	46	42	23				
0.075	41	35	18				
0.04	34	24	13				
0.02	29	18	10				
0.006	22	9	6				
0.002	17	5	3				

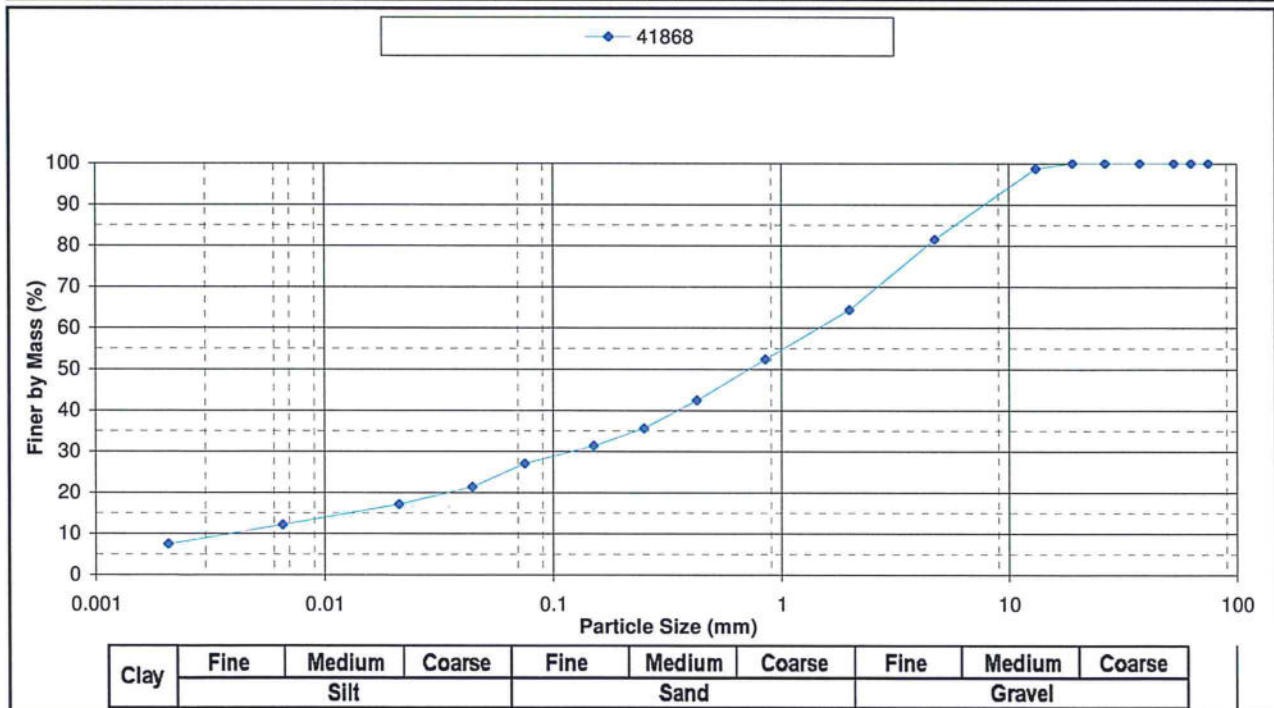


Remarks:

Foundation Indicator Test Data

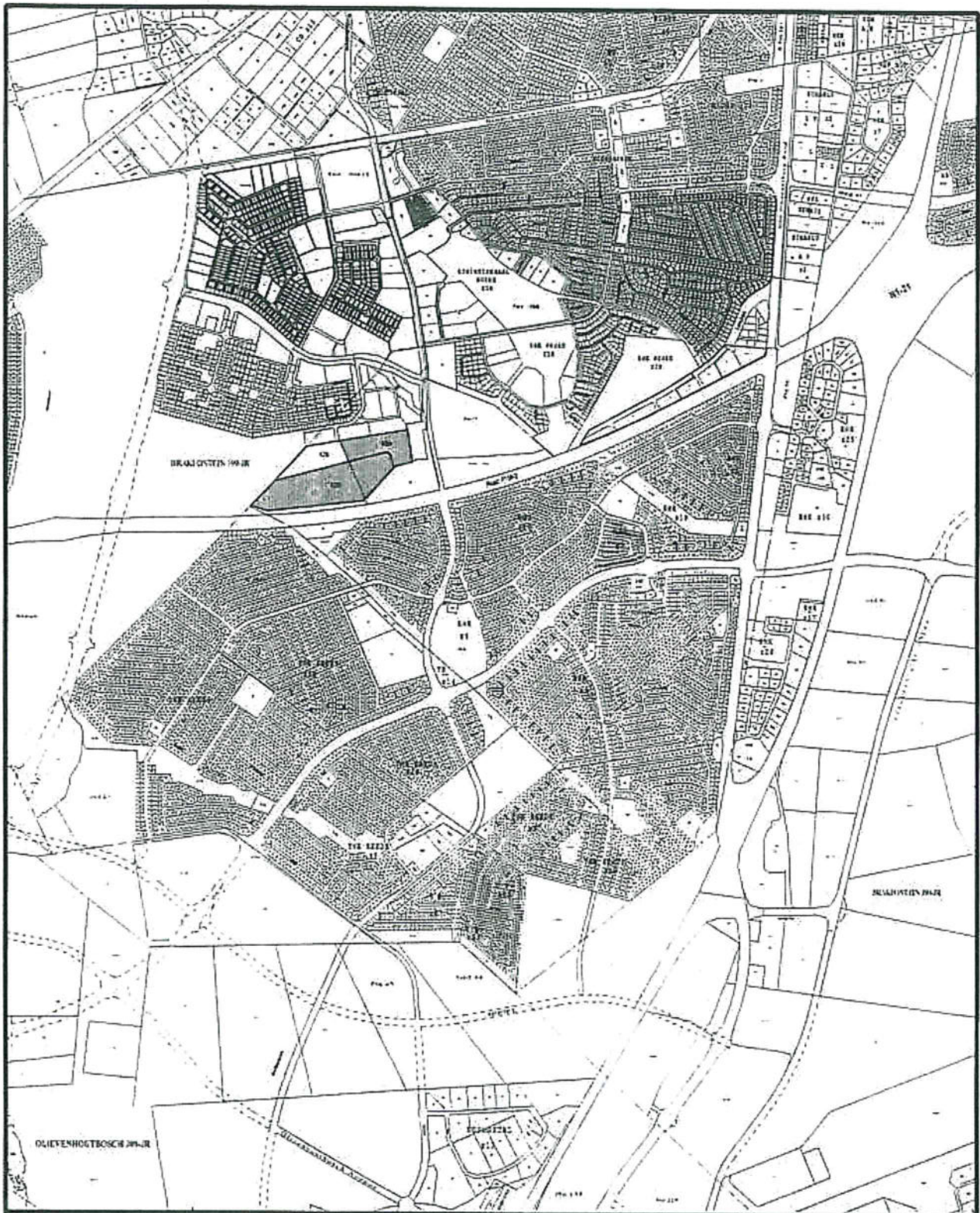
Project	Geo-Buro - #1210 B-09 Rooihuiskraal North x 28,29 & 31		
Project No.	HP/B 258-44	Date	15 February 2010

Sample No.	41868			Sample No.	41868		
Field Ref. No.	TP-D			%Gravel	36		
Depth	0.8m			%Sand	40		
Sieve size	%Passing	% Passing	% Passing	%Silt	17		
75.00	100			%Clay	7		
63.00	100			NMC %	Not Tested		
53.00	100			Liquid Limit	33		
37.50	100			Plasticity Index	15		
26.50	100			Linear Shrink.	7.		
19.00	100			Overall P.I.	6		
13.20	99			Grading Modulus	1.66		
4.75	81			H.R.B.	A-2-6 (1)		
2.00	64			Unified	SC		
0.85	52			Weston swell (%) at 1 kPa			
0.425	42			Analysis as per method D422 of ASTM of 1985 The results reported relate only to the samples tested. Documents may only be reproduced or published in their full context.			
0.25	36						
0.15	31						
0.075	27						
0.04	21						
0.02	17						
0.006	12						
0.002	7						




Remarks:

APPENDIXC: DRAWINGS

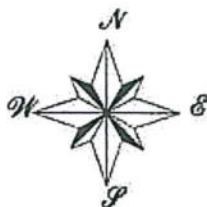


LOCALITY PLAN
ROOIHUISKRAAL NOORD EXTENSIONS 29 AND 31

Legend:

 The Application Site

PLAN NUMBER:	D1210 / 01
COMPILED BY:	S.P. KOK
LOCAL AUTHORITY:	CITY OF TSHWANE



Drawn by Technology Pty Ltd
Aug. 14, 2002 / 2006/18/07

PO Box 1314
LITTLETON
2140

16 Skinnington Avenue
LITTLETON
2140

Tel: (012) 864-2916
Fax: (012) 864-8778
e-mail: info@technology

DOLOMITE



TECHNOLOGY

SCALE: 1 : 30 000

DATE: JANUARY 2007

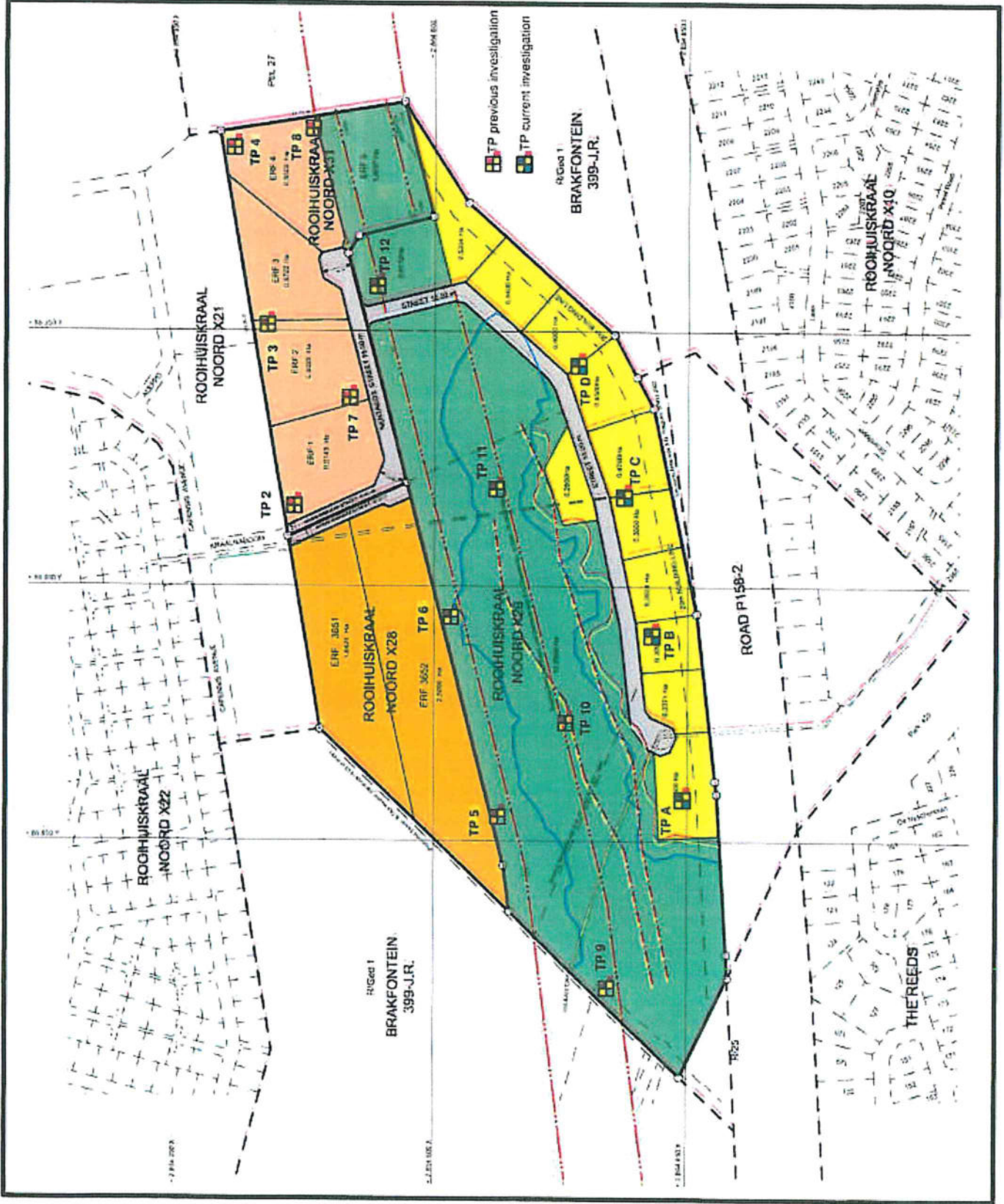


Not to Scale

Client:
Lezmin 1066 CC

Site:
Rooihuiskraal
Noord Extensions
29 and 30

DWG No:
1210B-03
Test Pit Positions





Appendix G13

Civil Engineering Services
Report

ROOIHUISKRAAL NORTH EXT 29:

CIVIL ENGINEERING SERVICES REPORT

MAY 2017

REVISION 2

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



On behalf
of: **LEZMIN 1066 cc.**
PO Box 7657
Centurion
0048
Contact: Mr. Johan Lewis

By: **TELAWIZE PTY LTD**
333 Emus Erasmus Avenue
Pretoria
Contact: Mr. Mfundo Hadebe Pr Tech Eng
Tel: 012 347 6299



SERVICES REPORT:

ROOIHUISKRAAL NOORD EXT 29: PROVISION OF CIVIL ENGINEERING BULK SERVICES

1. CLIENT

Company	LEZMIN 1066 cc.
Contact Person	J. Lewis
Address	Box 7657 Centurion 0046
Telephone No.	012 665 2710
Fax No.	012 665 2711
E-mail	jarch@mweb.co.za

2. COMPILED BY:

Company	GFC Consulting Engineers
Contact Person	G.F. Combrinck Pr Eng
Address	P O Box 11141 ERASMUSKLOOF 0048
Telephone No.	(012) 347 6299
Fax No.	(012) 347 9767
E-mail	gawie@gfc-holdings.co.za

3. FOR SUBMISSION TO:

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	CynthiaN@tshwane.gov.za
Telephone No.	(012) 358 3578
Address	P O Box 1022 Pretoria 0001

SERVICES REPORT:

ROOIHUISKRAAL NOORD EXT 29: PROVISION OF CIVIL ENGINEERING SERVICES

LIST OF CONTENTS

1.	Introduction	3
2.	Professional Team	3
3.	Location of Planned Development	4
4.	Flood Line	4
5.	Land Use	5
6.	Water Services	6
7.	Sanitation	8
8.	Roads	9
9.	Storm Water Drainage	11
10.	Bridge	12
11.	Design Standards	12
12.	Estimated Project Costs	13
13.	Bulk Service Contributions	13

ADDENDUM

Addendum A: Conditions of Establishment

Addendum B: Service Drawings

Addendum C: Deed of Transfer

Addendum D: Letter of Appointment

Addendum E: CES Report

Addendum F: Geotechnical Report

Addendum G: Traffic Impact Study

SERVICES REPORT:

ROOIHUISKRAAL NOORD EXT 29: PROVISION OF CIVIL ENGINEERING SERVICES

1. INTRODUCTION

Telawize(Pty)Ltd was appointed by Lezmin 1066 cc as consultants for the design and provision of civil engineering bulk services for the residential development Rooihuiskraal Noord Ext 29. The construction period will be approximately sixteen (16) weeks.

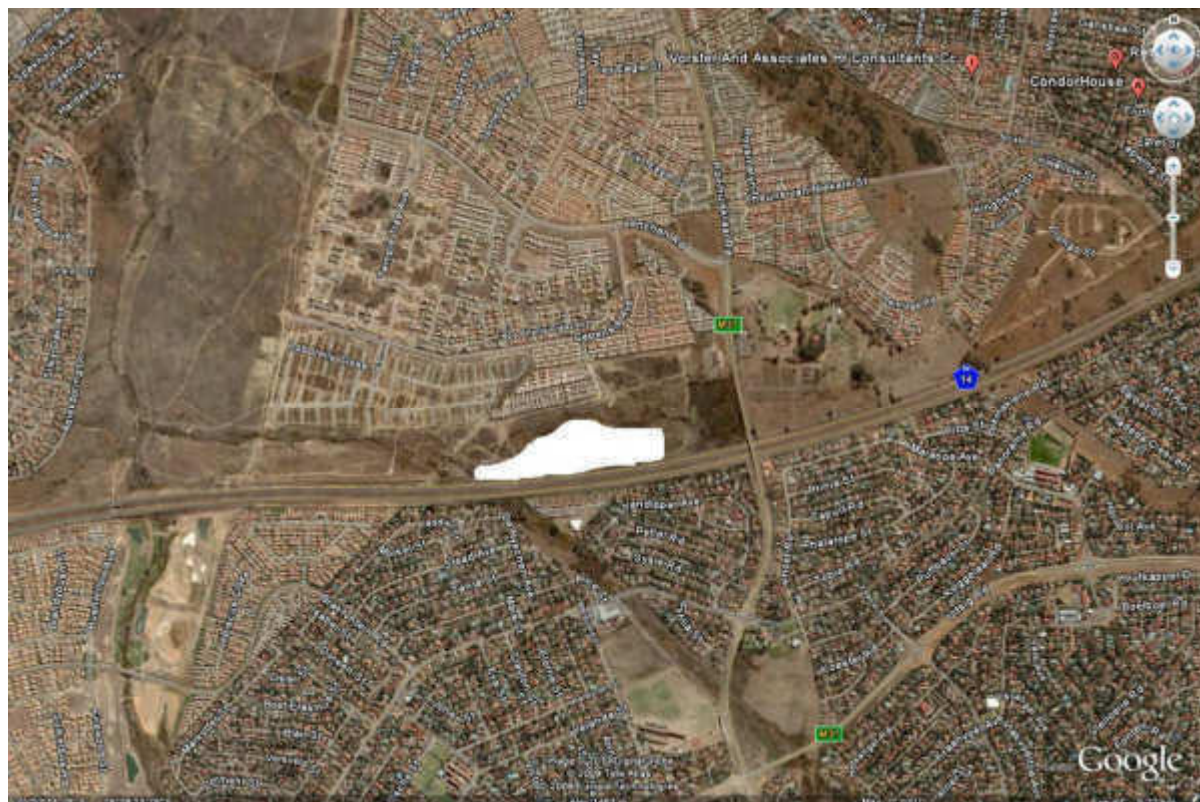
2. PROFESSIONAL TEAM

Item Nr	Description	Name	Contact Person
1	Quantity Surveyor	-	-
2	Town Planning	Plandev Town & Regional Planners	N. Smith
3	Architect	-	-
4	Developer	LEZMIN 1066 cc.	J. Lewis
5	Civil Engineer	GFC Consulting Eng.	G.F. Combrinck
6	Electrical Engineer	Greycon (Electrical)	M. Greyling
7	Traffic Engineer	ITS	G. van der Linde
8	Geotechnical Engineer	Dolomite Technology	E. Kok
9	Surveyor	-	-

3. LOCATION OF PLANNED DEVELOPMENT

The proposed development Rooihuiskraal Noord Ext 29 is situated on a part of portion 145 and a part of the remainder of portion 9 of the farm Brakfontain 399-JR. It is situated on the north of the N14 (Krugersdorp) highway.

The site of the proposed township covers approximately 18.0200 ha.



4. FLOOD LINE

In accordance with the National Water act, 1998 (act 36 of 1998) Section 144, is hereby stated that the township is affected by a flood with an expected frequency of 1 :100 year and 1 : 50 year in any natural stream or water course.

5. LAND USE

Zoning	Erf No's	No of Erf	Areas (ha)	% of Total
Business	-	-	-	-
Special	-	-	-	-
Residential 3	1-4	4	3.3487	18.59
Agricultural	-	-	-	-
Public Open Space	5-6	2	14.0415	77.92
Roads			0.6298	03.49
Total		6	18.0200	100.00

6. WATER SERVICES

6.1 General Design Criteria

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 Residential with or FSR = 0,6.	0,6kl/50m ²
2. Cross Average Annual Daily Demand (GAADD)	Allow for 10% losses
3. Daily Peak Factor (DPF)	4,6
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	HDPE pressure pipes
9. Minimum pipe class	Class 16
10. Fire flow at any one hydrant under the condition of domestic peak flows (one hydrant at a time)	50l/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

6.2 Planned water supply

A 110mm Ø uPVC Pipeline will be constructed running parallel to the proposed road. Each ervens will be provided with a 110mm Ø connection and a valve. It will be connected to the existing water pipe which runs in the middle of the development. It is protected by 3m wide servitude.

Refer to drawing 1012/200/01, Addendum B.

6.3 CES Report

The CES report will be included as soon as it is available.

Estimated Water Demands

Land use rights	Floor area (m²)	Design Criteria (kl/50m²/day)	Total AADD* (kl/day)	Total Demand (l/s)	Peak Factor	Peak Water Demand (l/s)
Residential 3	3.3487	0,6	401.844	4.651	4.6	21.394
Undetermined						-
Streets						-
TOTAL						21.394
Fire (Moderate risk)						25 l/s
TOTAL DEMAND						46.394l/s

7 SANITATION

7.1 Sewer Standards

The detail sewer reticulation analysis shall be done according to the design standards and specifications approved by the City of Tshwane. 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)**", issued by the Department of National Housing will be the design standards for the project. The applicable SANS 1200 Standard Specifications will be used as part of the Project Specification for the contract documentation.

SEWER DESIGN CRITERIA

Design Element	Criteria
1. Average Annual Daily flow for Residential with a FSR =0,6.	0,6 kl/50m ²
2. Peak Factor	2,5
3. Allowance for infiltration	0.012 l/s per 100m of pipe line
4. Capacity of Sewer	Pipes may flow full at the Total Design Flow, which includes the peak and infiltration flows.
5. Sewer pipe type	Structured wall uPVC pipes SABS 1601 Class 400 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

7.2 Planned sanitation services

An existing Municipal Sewer line is running on the western side of the proposed development. It is protected by 3m wide servitude.

A 160mmØ sewer pipe will be provided to serve the development running parallel to the proposed road. It will be connected to the existing 3 sewer line western side of the development.

Refer to drawing 1012/300/01, Addendum B

Table 4: Estimated Sewage Outflows

Land use rights	Erf No (m ²)	Design criteria (kl/50m ² /day)	Total PDDWF (kl/day)
Residential 3	33487	0,6	401.844
TOTAL			401.844
Peak Factor (PF)		2,5	1004.610
Provision for Infiltration		15%	1155.302
DESIGN FLOW		(In l/s):	13.372

8 ROADS

8.1 Standards and Specifications

All roads are designed according to the Tshwane Manual for the Design of Streets and Storm water, issued by the Town Engineer's office of City of Tshwane.

8.2 Traffic Impact Study

The initial Traffic Impact Study was performed by Dhubecon Consulting Engineers on the June 2014. The following is an extract of the most important issues of concern and the recommendations are:

Capensis Ave / Kraalnaboom Ave Intersection: (Drawing No 0213/CL/01)

- Upgrading of the existing priority stop controlled T-intersection to a new traffic circle to provide the necessary flow capacity. An inscribed diameter (i.e. outside diameter) of approximately 20m is proposed with one circulating traffic lane.
- Since this proposed upgrade overlaps with the upgrades also required by other township, it is recommended that the costs of the upgrade be shared with the developers of Rooihuiskraal Noord Extensions 40-42.

Lenchen Ave / Capensis Ave Intersection: (Drawing No 0213/CL/02)

- Upgrading from stop control to signalisation;
- Additional through lane on the Lenchen Avenue western approach;
- Additional right-turn lane on the Capensis Avenue approach.
- Since this proposed upgrade overlaps with the upgrades also required by other townships, it is recommended that the costs of the upgrade be shared with the developer of Rooihuiskraal Noord Extensions 45-49.

Extension of Kraalnaboom Avenue:

- Extension of Kraalnaboom Avenue form where it currently terminates up to the boundaries of the newly proposed erven as indicated in the township layout plan.
- A paved sidewalk of 1.5m wide be constructed along one side of the required Kraalnaboom Avenue extension

8.3 CLASSIFICATION OF INTERNAL TOWNSHIP ROADS

Description	Class No	Function	Reserve Width	Roadway Width
Road in 16 m road Reserve	5a	Residential access collector	16m	5.5m

Table 2 – Classification of Internal Township Roads

8.4 GEOMETRIC DESIGN STANDARDS

The road will be class 5a.

8.4.1 Class 5 – District distributor

Design speed	50 km/h
Minimum centre line radii	150 m
Minimum gradient	0,4%
Favoured maximum gradient	10%
Maximum grade/grade length	1/8 over 70m

8.5 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. A bridge will be built to cross the stream; the designs will follow as soon as this report has been approved.

The following pavement design is proposed:

8.5.1 Road with Road Surface of 5.5 meters

Wearing course:	30 mm medium asphalt wearing course.
Base:	150 mm thick graded crushed stone compacted to 88% of apparent density – G1
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 – C4
Upper selected: Sub grade	150 mm thick natural gravel compacted to 93% of modified AASHTO density. Minimum CBR – 15 at 90% of modified AASHTO density – G7 (in-situ or imported)
Lower selected:	150 mm thick natural gravel compacted to 90% of modified AASHTO Sub grade density. Minimum CBR = 7 at 90% of modified AASHTO 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

9 STORM WATER DRAINAGE

9.1 Standards and Specifications

The storm water management system is designed in accordance with the requirements of the CTMM.

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

9.2 Design Criteria

Flood Return Period:	1:2 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

9.3 Planned Storm Water Drainage

The development will be provided with the minimum diameter of 450mm and the maximum of 750mm diam of spigot and socket pipes concrete pipes and outlet structures through out. The development will discharge its storm water to the stream running in the middle of the development. Each erf will be provided with a 450mmØ connection. The development will accommodate storm water from the National Road N14 with a 675mmØ spigot and socket concrete pipe. The storm water will be discharge at multiple points as shown on the drawing.

Each outlet structure will have a 500mm deep stilling dam. with 100mm diameter outlets. The storm water overflow will flow on the two-meter-long reno mattress. Subsequent to the reno mattress of each storm water outlet, indigenous wetland vegetation, boulders, and vegetated berms should be implemented to further maximise the ecological functioning of the wetland system. This system will help with dispersing the energy of the storm water and at the same time improve the water quality through the wetland vegetation filtration process.

Refer to drawing 1012/500/01, Addendum B.

10 BRIDGE

A concrete bridge structure of 20.3m x 7m and a 2m walkway will be constructed crossing the stream to give access to the development. The bridge will span to the floodlines. The base of the bridge will be supported by concrete piles. The flow of the stream will not be disturbed or changed by the bridge. During construction a temporary diversion of the stream will be done with sandbags.

Attached on Addendum B is the bridge concept layout drawings and sections.

11. DESIGN STANDARDS

All designs and construction will be in accordance with MINIMUM STANDARDS APPLICABLE TO ROAD CONSTRUCTION AND STORMWATER DRAINAGE SYSTEMS (Pretoria Metropolitan Substructure – 14.12.95), the Redbook ("Guidelines for the Provision of Engineering Services and Amenities in Township Development"), General Conditions of Contract for Works of Civil Engineering Construction (Sixth Edition (1990) and STANDARD SPECIFICATION FOR MUNICIPAL CIVILWORKS (1991).

12 ESTIMATED PROJECT COSTS (BULK)

CONSTRUCTION COSTS (Estimated)					
Item	Description	Quantity	Units	Rate	Amount
1	Water	155	m	R 490,00	R 75 950,00
2	Sewers	265	m	R 535,00	R 141 775,00
3	Manholes	7	No	R 8 000,00	R 56 000,00
Sub Total					R 273 725,00
4	Preliminary and General			15%	R 41 058,75
Sub Total					R 314 783,75
5	Contingencies			10%	R 31 478,38
Sub Total					R 346 262,13
6	Professional Fees				R 43 282,77
TOTAL (VAT Excluded)					R 389 544,89
VAT (14%)					R 54 536,28
TOTAL (VAT Included)					R 444 081,18

CONSTRUCTION COSTS (Estimated)					
Item	Description	Quantity	Units	Rate	Amount
1	Roads	2442	m2	R 665,00	R 1 623 930,00
2	Bridge	1	No	R 1 500 000,00	R 1 500 000,00
3	Storm water	250	m	R 1 950,00	R 487 500,00
4	Kerb Inlet	7	No	R 7 800,00	R 54 600,00
5	Manhole	2	No	R 8 000,00	R 16 000,00
6	Outlet Structure	3	No	R 10 500,00	R 31 500,00
Sub Total					R 3 713 530,00
7	Preliminary and General			15%	R 557 029,50
Sub Total					R 4 270 559,50
8	Contingencies			10%	R 427 055,95
Sub Total					R 4 697 615,45
9	Professional Fees				R 587 201,93
TOTAL (VAT Excluded)					R 5 284 817,38
VAT (14%)					R 739 874,43
TOTAL (VAT Included)					R 6 024 691,81

13. BULK SERVICE CONTRIBUTIONS

13.1 Water and sanitation

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.

13.2 Roads and storm water

The Road and Storm water division indicated that they will calculate the bulk contribution.

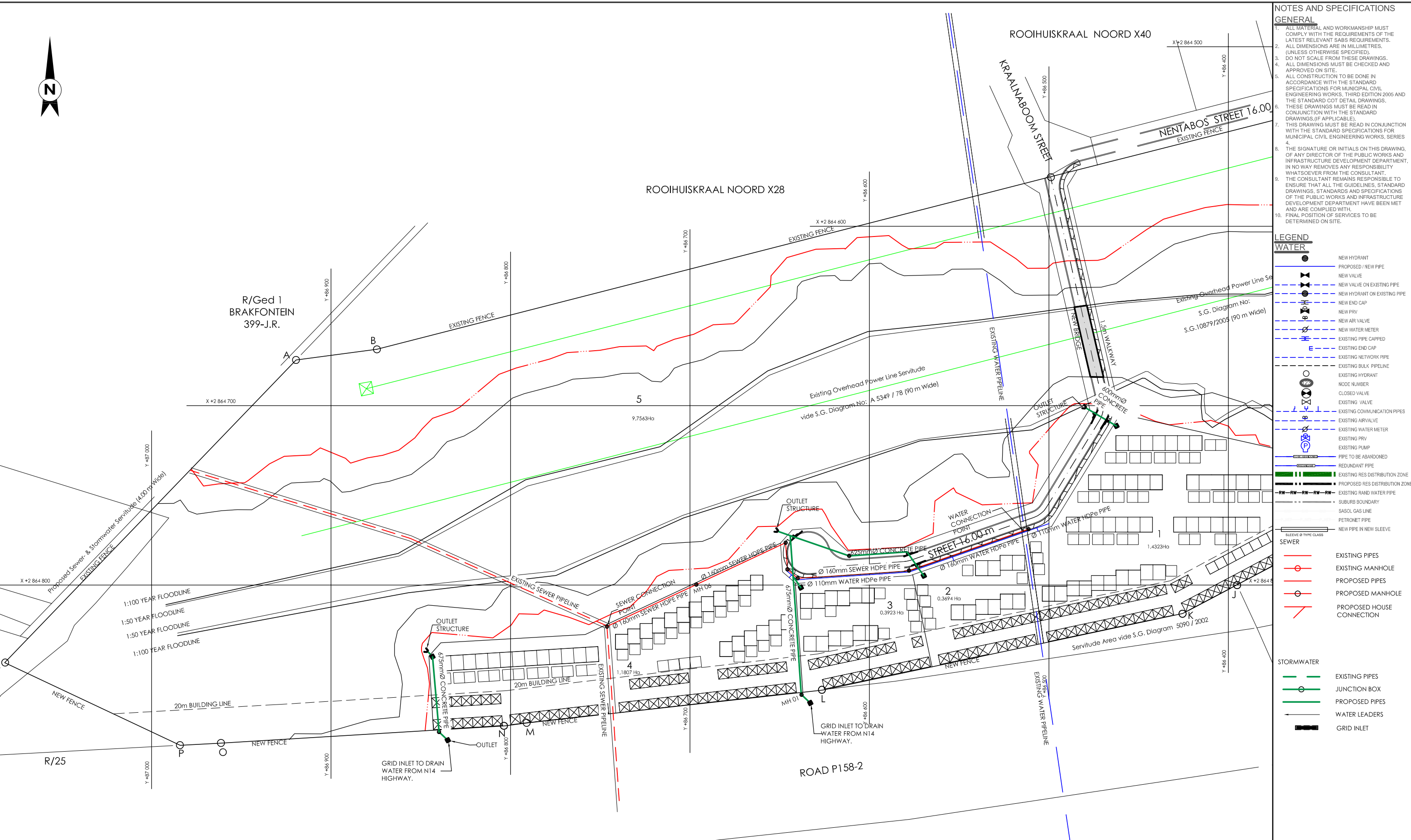
13 SIGNATURE

M. Hadebe
Name

.....
Signature

201570187
Reg No

.....
Date



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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
- EXISTING HYDRANT
- NODE NUMBER
- CLOSED VALVE
- EXISTING VALVE
- EXISTING COMMUNICATION PIPES
- EXISTING AIRVALVE
- EXISTING WATER METER
- EXISTING PRV
- EXISTING PUMP
- PIPE TO BE ABANDONED
- REDUNDANT PIPE
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- EXISTING RAND WATER PIPE
- SUBURB BOUNDARY
- SASOL GAS LINE
- PETRONET PIPE
- NEW PIPE IN NEW SLEEVE

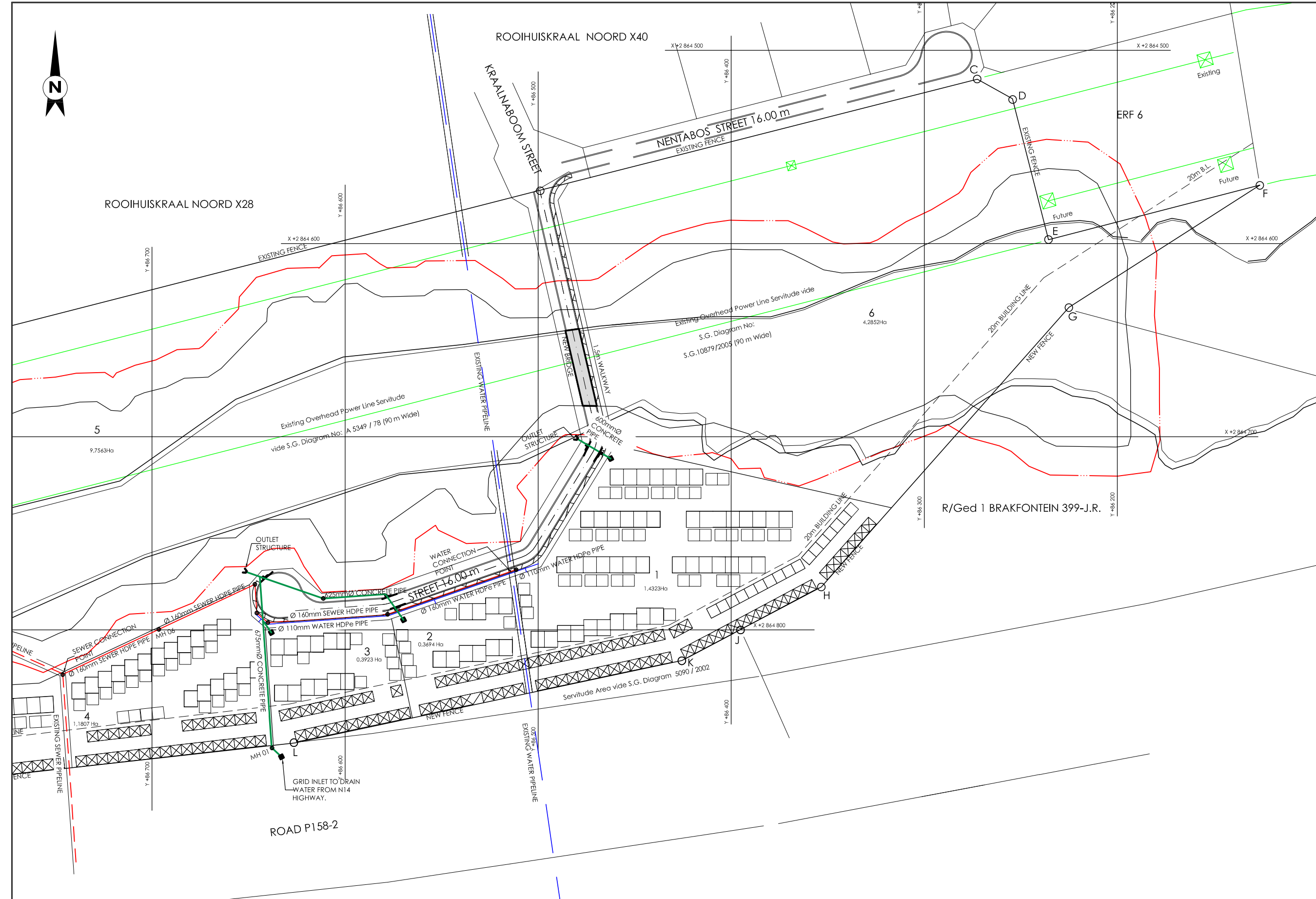
SEWER

- EXISTING PIPES
- EXISTING MANHOLE
- PROPOSED PIPES
- PROPOSED MANHOLE
- PROPOSED HOUSE CONNECTION

STORMWATER

- EXISTING PIPES
- JUNCTION BOX
- PROPOSED PIPES
- WATER LEADERS
- GRID INLET

<p>CITY OF TSHWANE SERVICES INFRASTRUCTURE DEPARTMENT</p>	<p>AMENDMENTS</p> <table border="1"> <thead> <tr> <th>NR</th> <th>DATE</th> <th>APPROVED</th> <th>DESCRIPTION</th> <th>PAR</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>JUN 2017</td> <td></td> <td>FOR APPROVAL</td> <td></td> </tr> </tbody> </table>		NR	DATE	APPROVED	DESCRIPTION	PAR	A	JUN 2017		FOR APPROVAL		<p>MASTERPLAN</p> <table border="1"> <thead> <tr> <th>NAME</th> <th>Prof. Reg. No.</th> <th>SIGNATURE</th> <th>DATE</th> </tr> </thead> <tbody> <tr> <td>DIRECTOR: PLANNING</td> <td></td> <td></td> <td></td> </tr> <tr> <td>REGIONAL DIRECTOR: (1,2,3,4,5,6 or 7)</td> <td></td> <td></td> <td></td> </tr> <tr> <td>DIRECTOR: SYSTEM DEVELOPMENT</td> <td></td> <td></td> <td></td> </tr> <tr> <td>DIRECTOR: WATER AND SANITATION</td> <td></td> <td></td> <td></td> </tr> <tr> <td>DIRECTOR: ROADS</td> <td></td> <td></td> <td></td> </tr> <tr> <td>DIRECTOR: STORMWATER</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>		NAME	Prof. Reg. No.	SIGNATURE	DATE	DIRECTOR: PLANNING				REGIONAL DIRECTOR: (1,2,3,4,5,6 or 7)				DIRECTOR: SYSTEM DEVELOPMENT				DIRECTOR: WATER AND SANITATION				DIRECTOR: ROADS				DIRECTOR: STORMWATER				<p>CONSULTANT DETAIL</p> <p>P. O. BOX 11141 ERASMUSKLOOF 0048 TEL : (012) 347 6299 FAX : (012) 347 9767 CELL : 082 492 0682 gfc@gfc-holdings.co.za</p> <p>I, _____ Prof. Reg. No. _____ HEREBY CERTIFY THAT THE SERVICES WILL HAVE BEEN INSTALLED ACCORDING TO NOTE 9 OF THE ABOVE NOTES AND TO THE DRAWING.</p> <p>SIGNATURE: _____ DATE: _____</p> <p>CONSULTANT DRAWING NUMBER: 1012/000/01</p>		<p>DESIGNED</p> <p>NAME: M. HADEBE Pr. Eng. Prof. Reg. No. _____ SIGNATURE: _____ DATE: _____</p> <p>DRAWN</p> <p>NAME: M. HADEBE Pr. Eng. Prof. Reg. No. _____ SIGNATURE: _____ DATE: _____</p> <p>CHECKED</p> <p>NAME: G. COMBRINCK Pr. Eng. Prof. Reg. No. _____ SIGNATURE: _____ DATE: _____</p> <p>INFORMATION OFFICE CHECKED</p> <p>NAME: _____ Pr. Eng. Prof. Reg. No. _____ SIGNATURE: _____ DATE: _____</p> <p>DESIGN OFFICE APPROVAL</p> <p>NAME: _____ Pr. Eng. Prof. Reg. No. _____ SIGNATURE: _____ DATE: _____</p>		<p>CONTRACT No: 1012</p> <p>PROJECT No.: 1012</p> <p>SHEET No.: 1 OF 1</p> <p>PAPER SIZE: A1</p> <p>SCALE: 1:1000</p> <p>DATE: JUN 2017</p>		<p>PROJECT STATUS</p> <p>CONCEPT DRAWING <input type="checkbox"/> TENDER DRAWING <input type="checkbox"/> APPROVED CONSTRUCTION DRAWING <input checked="" type="checkbox"/> AS BUILT DRAWINGS <input type="checkbox"/></p> <p>PROJECT ENGINEER OF COT:</p> <p>NAME: _____ Pr. Eng. Prof. Reg. No. _____ SIGNATURE: _____ DATE: _____</p> <p>INSPECTOR OF WORKS OF COT:</p> <p>NAME: _____ Pr. Eng. Prof. Reg. No. _____ SIGNATURE: _____ DATE: _____</p>		<p>LOCATION OF PROJECT:</p> <p>ROOIHUISKRAAL NORTH EXT 29</p> <p>DESCRIPTION OF PROJECT:</p> <p>MASTERPLAN LAYOUT</p> <p>GENERAL LAYOUT</p> <p>WBS No.: _____</p> <p>COT DRAWING NUMBER: _____</p>	
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AMENDMENTS			
NR	DATE	APPROVED	DESCRIPTION FOR APPROVAL
A	APR 2017		

MASTERPLAN			
NAME	Prof. Reg. No.	SIGNATURE	DATE
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DIRECTOR: WATER AND SANITATION			
DIRECTOR: ROADS			
DIRECTOR: STORMWATER			

CONSULTANT DETAIL

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 No: _____
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SIGNATURE: _____ DATE: _____

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SIGNATURE: _____ DATE: _____

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CONTRACT No:	1012
PROJECT No.:	1012
SHEET No.:	1 OF 1
PAPER SIZE:	A1
SCALE:	1:1000
DATE:	APRIL 2017

PROJECT STATUS

CONCEPT DRAWING TENDER DRAWING APPROVED CONSTRUCTION DRAWING AS BUILT DRAWINGS

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

LOCATION OF PROJECT:
ROOIHUISKRAAL NORTH EXT 260

DESCRIPTION OF PROJECT:
WATER RETICULATION:
GENERAL LAYOUT

WBS No. : _____

COT DRAWING NUMBER: _____

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NR.	DATE	APPROVED	DESCRIPTION	PAR. TEL.
A	APR 2017		FOR APPROVAL	

DESIGNED BY M. HADEBE	DRAWN BY M. HADEBE
CHECKED BY G. COMBRINCK	INFRASTRUCTURE TECHNICAL INFORMATION MANAGEMENT D.J. CHALMERS

PROJECT STATUS			
CONTRACT APPROVED	DESIGN APPROVED	CONSTRUCTION APPROVED	AS-BUILT APPROVED
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PROJECT ENGINEER (CONSULTANT):			
INITIALS AND SURNAME		SIGNATURE AND P. No.	DATE
INSPECTOR OF WORKS (CITY OF TSHWANE):			
INITIALS AND SURNAME		SIGNATURE AND P. No.	DATE

CONSULTANT DETAIL



TELAMIZE PTY LTD
ENGINEERING & PROJECT MANAGEMENT

CITY OF TSHWANE
ROADS AND TRANSPORT DEPARTMENT

Mr P. L. Lelofane
STRATEGIC EXECUTIVE DIRECTOR

Ms. L. V. Kagakhe-Fika
EXECUTIVE DIRECTOR

P.O. BOX 1409
PRETORIA 0001

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Ms. L. V. Kagakhe-Fika

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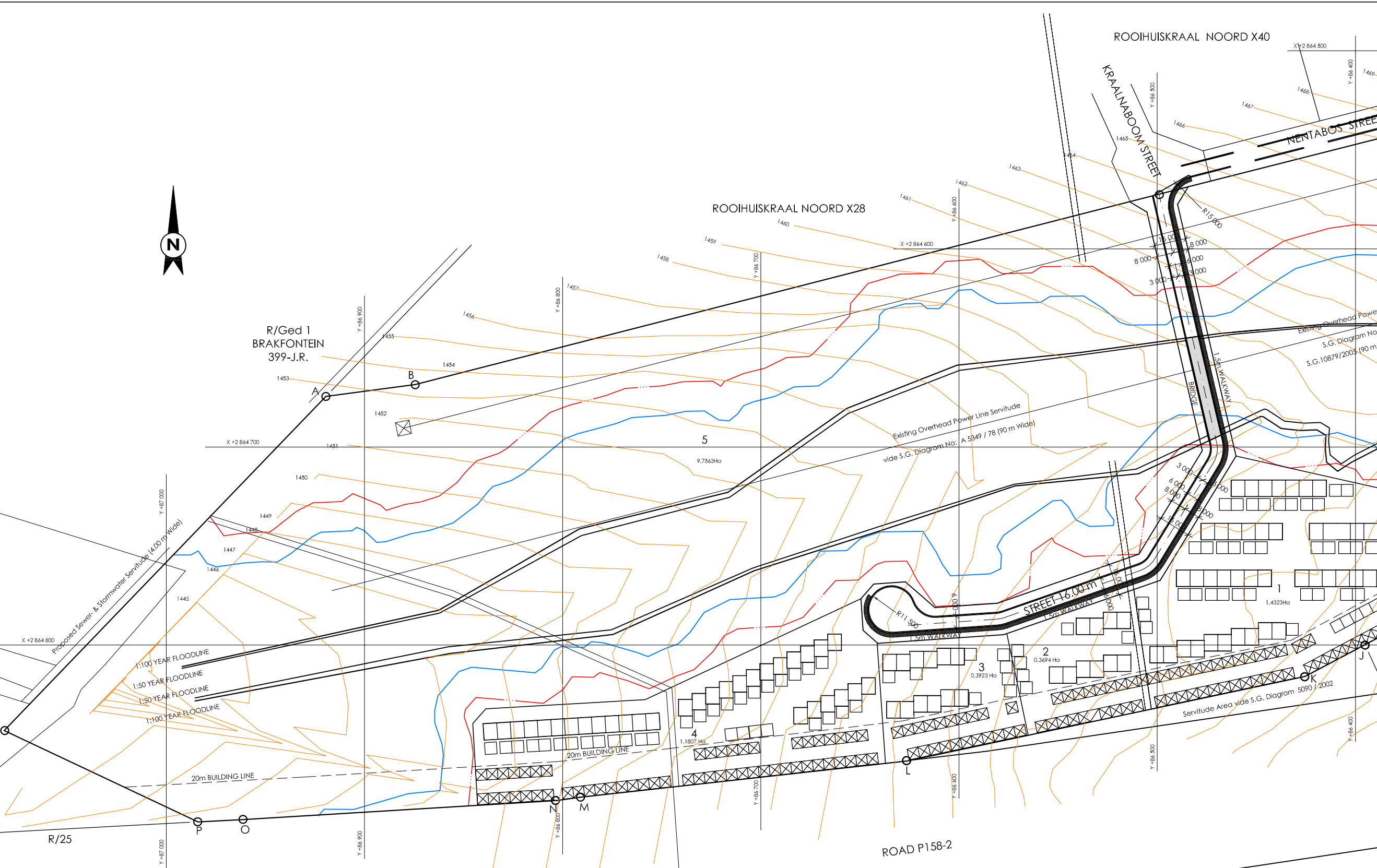
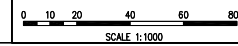
ROOIHUISKRAAL NORTH EXT 29

DESCRIPTION OF PROJECT:

**ROADS:
GENERAL LAYOUT**

CONTRACT No.: 1012	PROJECT No.: 1012
DATE: APRIL 2017	SCALE: 1:1000
DRAWING No.: 1012/400/01	SHEET No.: 1 OF 2
ORIGINAL PAPER SIZE: A1	REVISION

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ROAD INFRASTRUCTURE	
DIRECTOR: TRANSPORT INFRASTRUCTURE PROJECTS	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: _____



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A	APR 2017		FOR APPROVAL	TEL

DESIGNED M. HADEBE	DRAWN M. HADEBE
CHECKED BY G. COMBRINCK	INFRASTRUCTURE TECHNICAL INFORMATION MANAGEMENT D.J. CHALMERS

PROJECT STATUS			
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CONCEPT PLAN	FINAL PLAN	CONSTRUCTION DRAWING	AS-BUILT DRAWING
PROJECT ENGINEER (CONSULTANT)			
INITIALS AND SURNAME		SIGNATURE AND P. No.	DATE
INSPECTOR OF WORKS (CITY OF TSHWANE)		SIGNATURE AND P. No.	DATE
INITIALS AND SURNAME		SIGNATURE AND P. No.	DATE

CONSULTANT DETAIL



TELAMIZE PTY LTD
ENGINEERING & PROJECT MANAGEMENT

CITY OF TSHWANE
ROADS AND TRANSPORT DEPARTMENT

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STRATEGIC EXECUTIVE DIRECTOR

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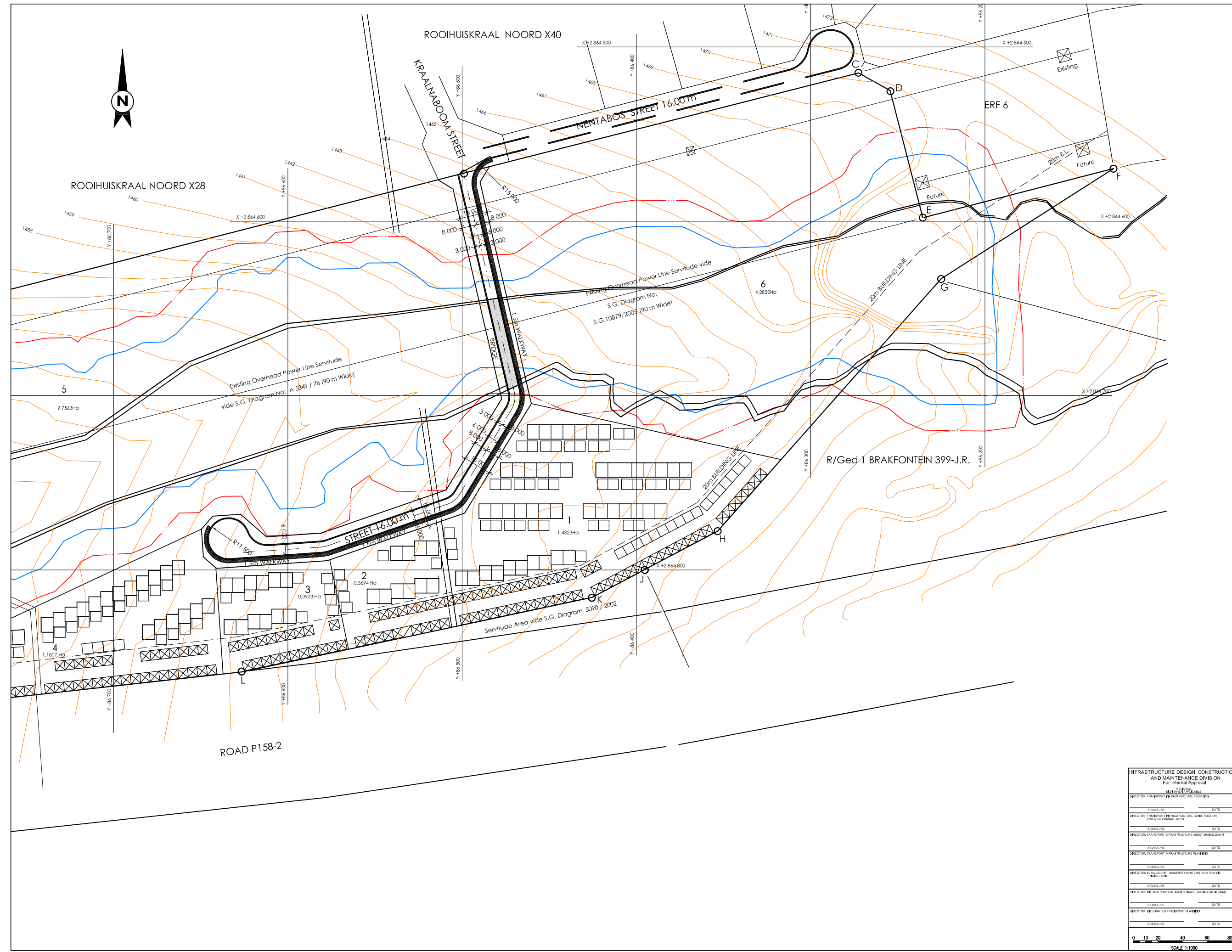
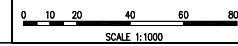
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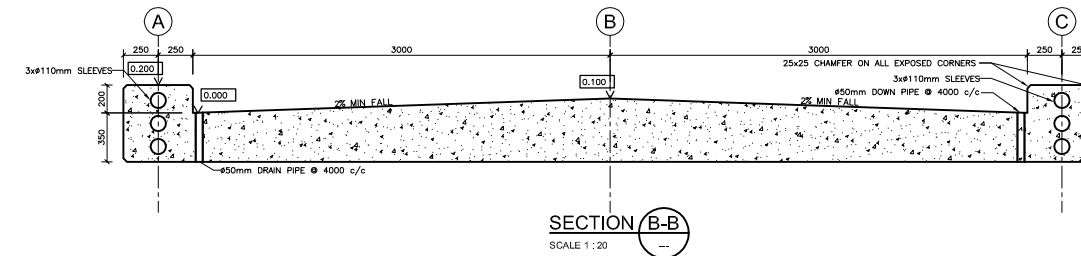
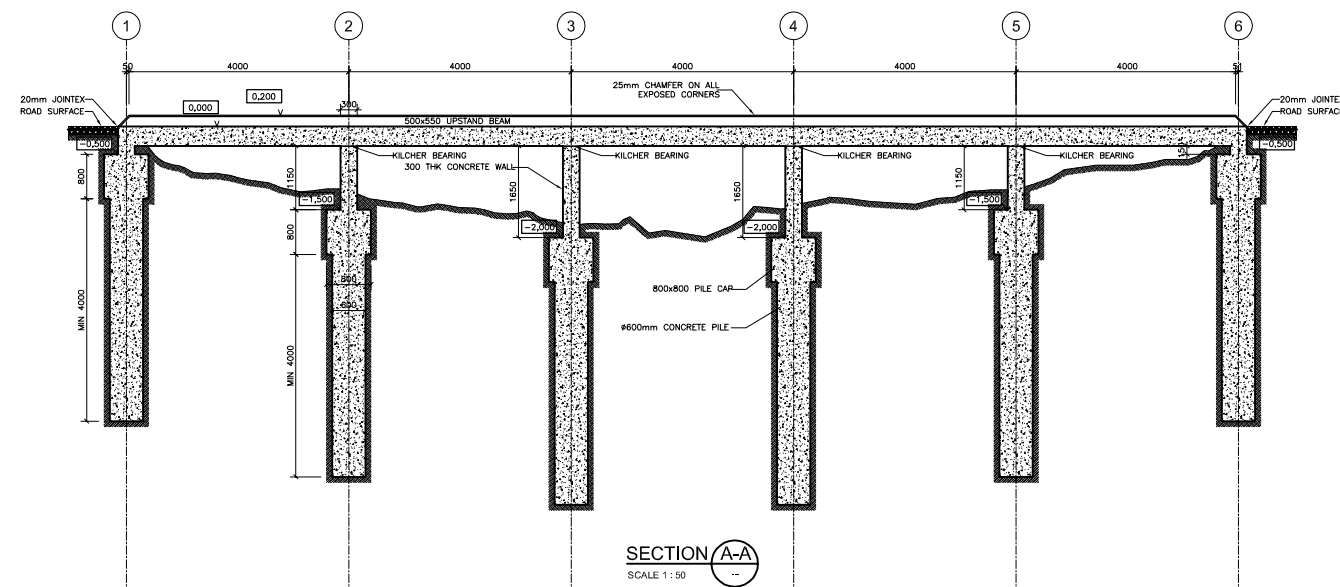
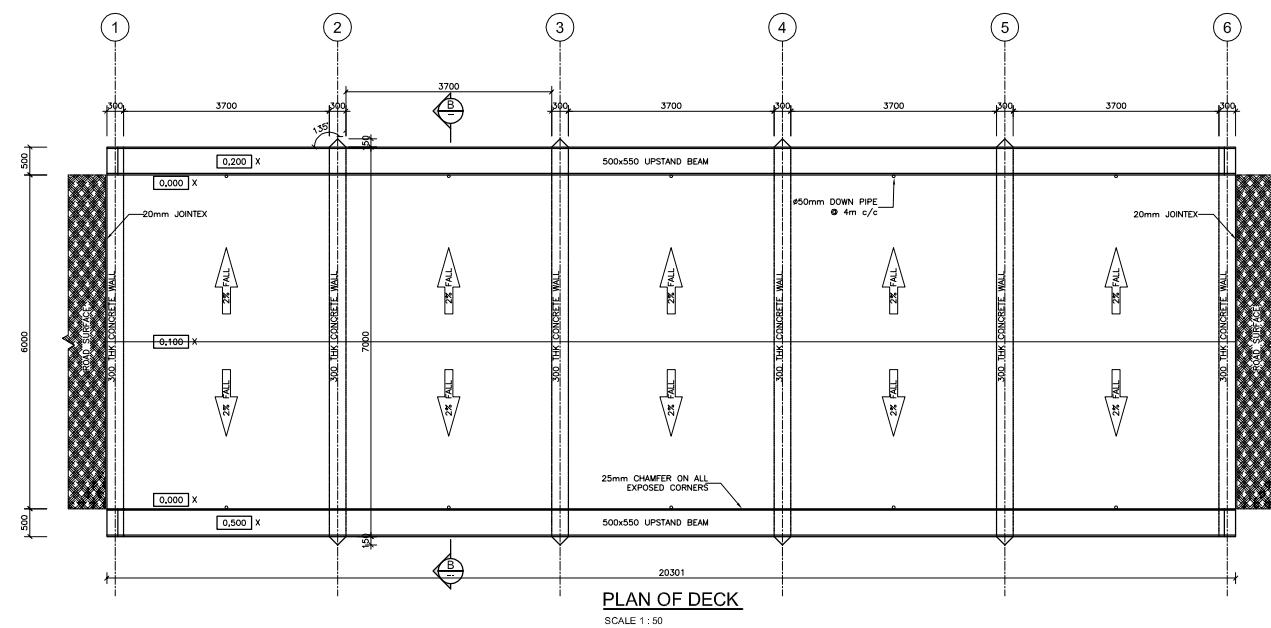
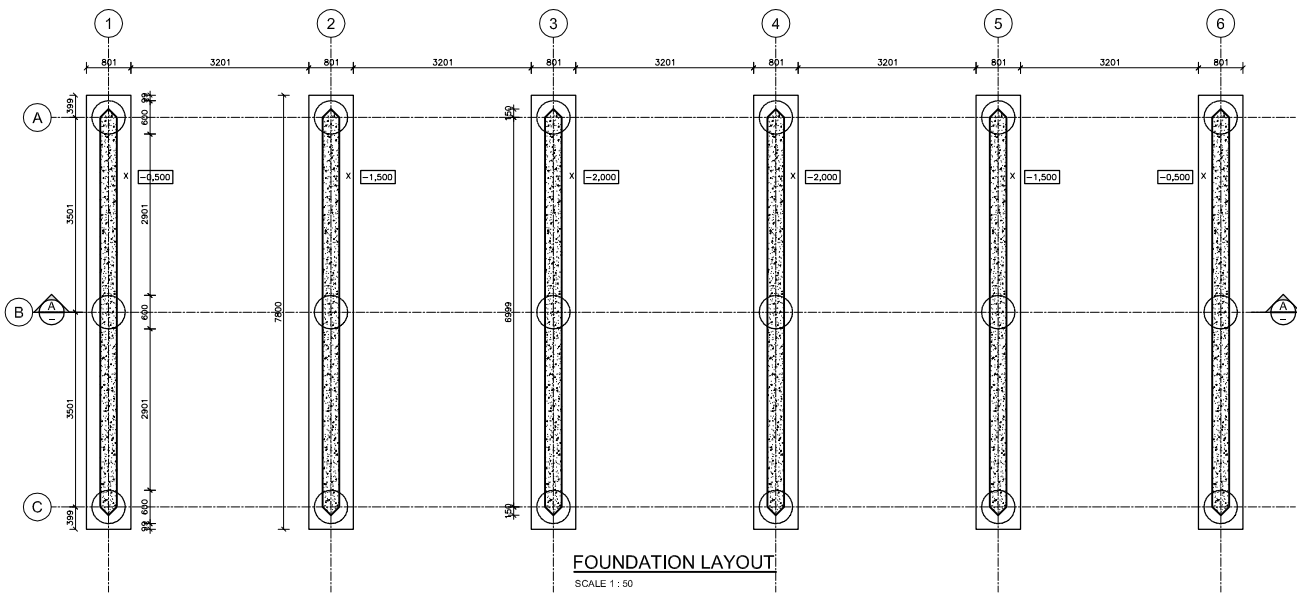
LOCATION OF PROJECT:
ROOIHUISKRAAL NORTH EXT 29

DESCRIPTION OF PROJECT:
**ROADS:
GENERAL LAYOUT**

CONTRACT No.: 1012	PROJECT No.: 1012
DATE: APRIL 2017	SCALE: 1:1000
DRAWING NO.: 1012/400/02	SHEET NO.: 2 OF 2
ORIGINAL PAPER SIZE: A1	REVISION

INFRASTRUCTURE DESIGN, CONSTRUCTION AND MAINTENANCE DIVISION For Internal Approval	
DIRECTOR: TRANSPORT INFRASTRUCTURE PROJECTS	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	SIGNATURE: _____ DATE: _____
DIRECTOR: INTEGRATED TRANSPORT PLANNING	SIGNATURE: _____ DATE: _____





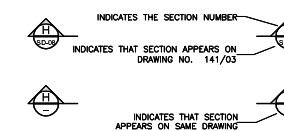
CONSTRUCTION NOTES :

GENERAL :

1. LOADBEARING WALLS TO BE SHOWN AS FOLLOWS :



2. LEGEND INDICATING SECTIONS AND DETAILS :



3. ALL WORK TO BE EXECUTED ACCORDING TO THE NATIONAL BUILDING REGULATIONS AND LOCAL BYE-LAWS.
4. ALL LEVELS ON DRAWINGS REFER TO THE TOP OF CONCRETE UNLESS OTHERWISE INDICATED.
5. DIMENSIONS OF BEAMS ARE SHOWN AS WIDTH x DEPTH.
6. ALL DIMENSIONS TO BE CHECKED ON SITE.

FILLING : SABS 0400 PART J (J 2.3)

1. FILL TO BE WELL COMPACTED IN WETTED LAYERS OF 150mm AND ACCORDING TO ENGINEERS SPECIFICATIONS AND RECOMMENDATIONS.
2. CERTIFICATE OF COMPACTION TO BE SUBMITTED TO THE ENGINEER.

FOUNDATIONS :

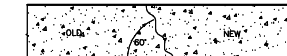
1. LEVELS ACCORDING TO ARCHITECT'S DRAWINGS.
2. FOUNDATIONS TO BE CONSTRUCTED TO ENGINEERS SPECIFICATIONS.
3. FOUNDATION WALLS AND COLUMNS TO BE CONSTRUCTED TO AT LEAST FINAL FLOOR LEVEL BEFORE BACKFILLING TAKES PLACE.
4. SELECTED BACKFILL UNDER FLOORS TO BE 95% MOD ASHTO DENSITY.
5. MAXIMUM THICKNESS OF LAYERS AFTER COMPACTION TO BE 150mm.
6. ALL DIMENSIONS TO BE ACCORDING TO ARCHITECT'S DRAWINGS. IF ANY DISCREPANCIES CONTACT THE ENGINEER IMMEDIATELY.
7. NO BASES ON BACKFILL - USE MASS CONCRETE - ENGINEER TO CONFIRM BASE LEVELS ON SITE.
8. BACKFILL AROUND COLUMNS AND WALLS TO COMMENCE EVENLY.

REINFORCEMENT :

1. REFER TO ARCHITECT'S DRAWINGS FOR CONCRETE FINISHES, GROOVES, CHAMFERS ETC.
2. ALL LEVELS ON DRAWINGS REFER TO THE TOP OF CONCRETE UNLESS OTHERWISE INDICATED.
3. REINFORCEMENT SHALL BE INSPECTED BY THE ENGINEER ONLY AFTER IT HAS BEEN FIXED IN POSITION. SHUTTERING IS CLEAN AND SPACERS ARE PLACED IN POSITION.
4. WELDING OF REINFORCEMENT IS NOT ALLOWED UNLESS IT HAS BEEN APPROVED BY THE ENGINEER IN WRITING.
5. ALL CONCRETE COVER TO BE 25mm MINIMUM.

CONCRETE :

1. MATERIALS AND MIX PROPORTIONS :
 1.1 THE GRADES FOR CONCRETE, UNLESS INDICATED OTHERWISE SHALL BE AS FOLLOWS :
 BASES CLASS 25/19 25 MPa
 RAFT CLASS 30/19 30 MPa
 BEAMS CLASS 30/19 30 MPa
 COLUMNS CLASS 30/19 30 MPa
 SURFACE BEDS CLASS 25/19 25 MPa
 MASS CONCRETE CLASS 10/38 10 MPa
 BLINDING LAYER CLASS 10/19 10 MPa
 NOTE: TYPE OF CEMENT USED TO BE APPROVED BY ENGINEER.
 1.2 WHEN READY MIXED CONCRETE IS USED, TEST CUBES ARE TO BE TAKEN ON SITE WET CASTING.
2. CONCRETE COVER OVER REINFORCEMENT, UNLESS SHOWN OTHERWISE :
 SLABS AND BEAMS 25mm OR # OF BAR WHICH EVER IS GREATER
 40mm COVER TO MAIN REBAR
 COLUMNS 40mm COVER TO MAIN REBAR
 30mm COVER TO STIRRUPS
 WALLS 25mm
 FOUNDATIONS BOTTOM 75mm
 TOP AND SIDES 50mm
3. CASTING OF CONCRETE IN EXCESS OF 3.5m HIGH IS NOT PERMITTED WITHOUT PRIOR APPROVAL OF THE ENGINEER.
4. CASTING SHALL BE INSPECTED BY THE ENGINEER ONLY AFTER IT HAS BEEN COMPLETELY FIXED IN POSITION, FORM WORK IS CLEAN, SPACERS IN POSITION AND AFTER THE CONTRACTOR HAS INSPECTED IT HIMSELF.
5. WELDING OF REINFORCEMENT IS NOT ALLOWED UNLESS IT HAS BEEN APPROVED BY THE ENGINEER.
6. CONSTRUCTION JOINTS IN SLABS AND BEAMS:
 BEFORE COMMENCING TO CAST NEW CONCRETE (AS SHOWN) THE SURFACE OF THE CONCRETE (AS SHOWN) SHALL BE CLEANED AND CHIPPED AWAY TO EXPOSE THE AGGREGATE AND SHALL BE KEPT WET FOR 2 HOURS BEFORE CASTING. THE OLD CONCRETE MUST BE SLUSHED WITH CEMENT BEFORE CASTING NEW CONCRETE.



7. 75mm BLINDING LAYER IS TO BE PROVIDED UNDER ALL BASES UNLESS INDICATED OTHERWISE. (DISCUSS WITH ENGINEER)
8. SHRINKAGE STRIPS IN CONCRETE FLOORS SHALL NOT BE CAST WITHIN 21 DAYS OF CASTING THE LAST SURROUNDING SLAB. THE BAY THAT CONTAINS THE SHRINKAGE STRIP MUST REMAIN PROPPED UNTIL ALL CONCRETE HAS REACHED THE REQUIRED CUBE STRENGTH.
9. CONSTRUCTION JOINTS :
 9.1 NO HORIZONTAL JOINTS SHALL BE ALLOWED IN BASES OR OTHER DEEP ELEMENTS.
 9.2 CONSTRUCTION JOINTS SHALL BE FORMED ACCORDING TO SPECIFICATIONS.
 9.3 NO VERTICAL CONSTRUCTION JOINTS SHALL BE MADE IN ELEMENTS DIRECTLY EXPOSED TO THE WEATHER EXCEPT WHERE INDICATED OTHERWISE.
10. ALL LEVELS ON DRAWINGS REFER TO TOP OF CONCRETE UNLESS OTHERWISE.
11. DIMENSIONS OF BEAMS ARE INDICATED AS WIDTH x DEPTH.
12. PROVIDE 10mm JOINTEX BETWEEN BRICK AND CONCRETE INTERFACES.
13. COLUMNS AND WALLS TO BE CONCRETED BEFORE BEAMS AND SLABS OVER. FORMWORK TO SUSPENDED SLABS AND BEAMS TO REMAIN IN PLACE FOR FULL 10 DAYS - DISCUSS BACKPROPPING WITH ENGINEER.
14. PROVISIONS FOR PROPS UNDER SLABS AND BEAMS:
 THE CONTRACTOR MUST ENSURE THAT BEAMS AND/OR SLABS HAVE SUFFICIENT STRENGTH AND/OR ARE ADEQUATELY PROPPED TO CARRY CONSTRUCTION LOADS FROM ABOVE - DISCUSS WITH ENGINEER.
15. NO BRICKWORK TO BE BUILT ON SUSPENDED AREAS OF SLABS UNTIL SUPPORTING FORMWORK HAS BEEN REMOVED.
16. DO NOT PLACE CONDUITS, PIPES, ETC. IN CONCRETE COVER.
17. CURE CONCRETE BY KEEPING CONSTANTLY DAMP FOR AT LEAST 5 DAYS AFTER CASTING.
18. ALL BEAMS AND STRUCTURAL SLABS MUST BE PROVIDED WITH AN UPWARD CAMBER AS INDICATED BELOW UNLESS INDICATED OTHERWISE :
 GANTLEVEYS SPAN DIVIDED BY 200
 ALL OTHER SPANS SPAN DIVIDED BY 500
19. JOINTS, INDICATED IN SLABS AND BEAMS ARE ALSO TO BE CONSTRUCTED IN BRICK WALLS.
20. THE CONTRACTOR MUST ENSURE THAT ALL EMBEDDED ITEMS FOR SERVICES HAVE BEEN POSITIONED AND PROVIDED FOR ACCORDING TO THE LATEST DRAWINGS, BEFORE CASTING CONCRETE.

REVISIONS/TAGS

NO	DATE	REASON	DESCRIPTION
A	06/11	QCL	FOR INFORMATION

CLIENT/USER:

GFC CONSULTING

333 EMILS ERASMUS STREET
ERASMUSRAND
0181

P. O. BOX 11141
ERASMUSKLOOF
0048

TEL : (012) 347 4299
CELL : 082 492 0682
e-mail : gfc@gfc-holdings.co.za

PROJECT/NO.:

ROOIHUISKRAAL EXT 29

DRAWING TITLE/DESCRIPTION:

BRIDGE
FOUNDATION LAYOUT, DECK LAYOUT
AND SECTIONS

SCALE/DATE:	FILE NO./DRAWING NAME:
AS SHOWN 06/11	1123
ENGINEER/ENGINEER:	G F COMBRNCK
DRAWING/ENGINEER:	G F COMBRNCK
QCL	G F COMBRNCK
DWG NO./FILE NO.:	REV./DRAWING:
1123-S-01	A
	A0

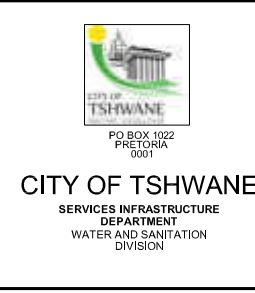
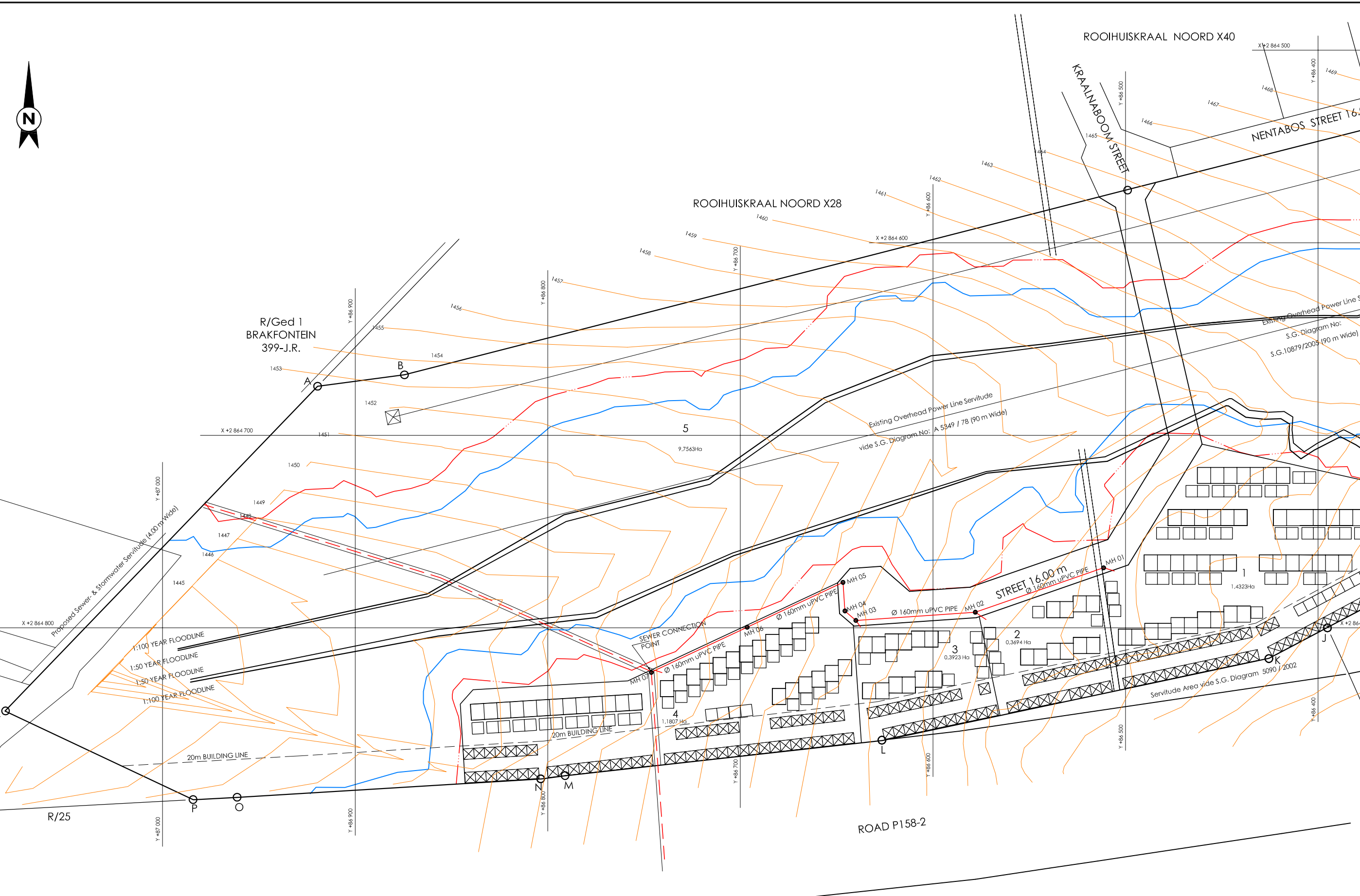


NOTES AND SPECIFICATIONS GENERAL

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. ALL DIMENSIONS MUST BE CHECKED AND APPROVED ON SITE.
4. ALL CONSTRUCTION TO BE DONE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS FOR MUNICIPAL CIVIL ENGINEERING WORKS, THIRD EDITION 2005 AND THE STANDARD COT DETAIL DRAWINGS.
5. THESE DRAWINGS MUST BE READ IN CONJUNCTION WITH THE STANDARD DRAWINGS, IF APPLICABLE.
6. THIS DRAWING MUST BE READ IN CONJUNCTION WITH THE STANDARD SPECIFICATIONS FOR MUNICIPAL CIVIL ENGINEERING WORKS, SERIES 4.
7. THE SIGNATURE OR INITIALS ON THIS DRAWING, OF ANY DIRECTOR OF THE PUBLIC WORKS AND INFRASTRUCTURE DEVELOPMENT DEPARTMENT, IN NO WAY REMOVES ANY RESPONSIBILITY WHATSOEVER FROM THE CONSULTANT.
8. THE CONSULTANT REMAINS RESPONSIBLE TO ENSURE THAT ALL THE GUIDELINES, STANDARD DRAWINGS, STANDARDS AND SPECIFICATIONS OF THE PUBLIC WORKS AND INFRASTRUCTURE DEVELOPMENT DEPARTMENT HAVE BEEN MET AND ARE COMPLIED WITH.
9. 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
- CLOSED VALVE
- EXISTING VALVE
- EXISTING COMMUNICATION PIPES
- EXISTING AIR VALVE
- EXISTING WATER METER
- EXISTING PRV
- EXISTING PUMP
- PIPE TO BE ABANDONED
- REDUNDANT PIPE
- EXISTING RES DISTRIBUTION ZONE
- PROPOSED RES DISTRIBUTION ZONE
- EXISTING RAND WATER PIPE
- SUBURB BOUNDARY
- SASOL GAS LINE
- PETRONET PIPE
- NEW PIPE IN NEW SLEEVE



AMENDMENTS			
NR	DATE	APPROVED	DESCRIPTION
A	APR 2017		FOR APPROVAL

WATER AND SANITATION			
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

P. O. BOX 11141
ERASMUSKLOOF
0048

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

HEREBY CERTIFY THAT THE SERVICES WILL HAVE BEEN INSTALLED ACCORDING TO NOTE 9 OF THE ABOVE NOTES AND TO THE DRAWING.

CONSULTANT DRAWING NUMBER:
1012/300/01

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

DRAWN
NAME: M. HADEBE Pr Eng. 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:
1012

PROJECT No.
1012

SHEET No.
1 OF 2

PAPER SIZE:
A1

SCALE:
1:1000

DATE:
APRIL 2017

PROJECT STATUS

CONCEPT DRAWING TENDER DRAWING APPROVED CONSTRUCTION DRAWING AS BUILT DRAWINGS

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

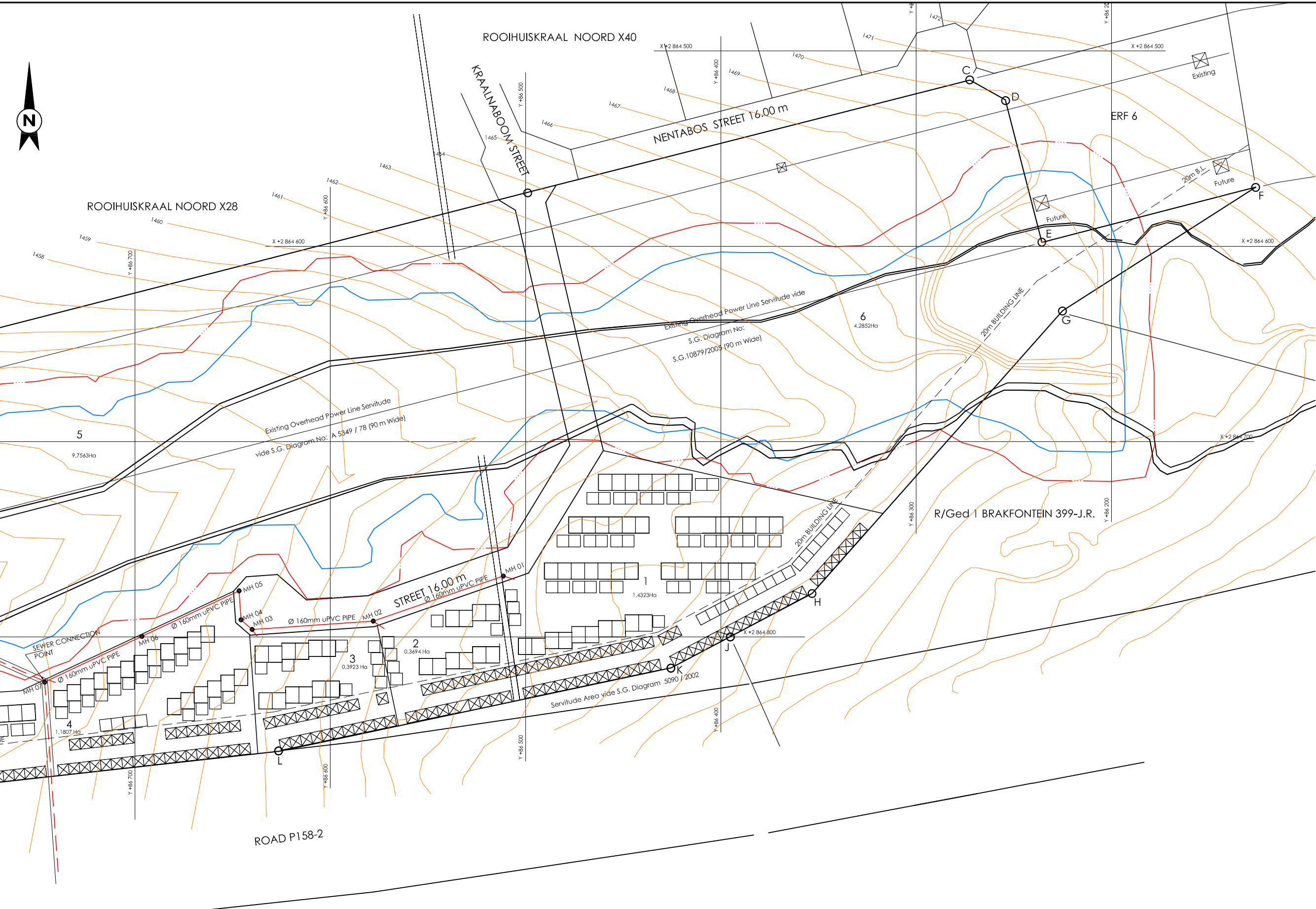
INSPECTOR OF WORKS OF COT:
NAME: _____ Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

LOCATION OF PROJECT:
ROOIHUISKRAAL NORTH EXT 29

DESCRIPTION OF PROJECT:
**SEWER RETICULATION:
GENERAL LAYOUT**

WBS No. : _____

COT DRAWING NUMBER: _____

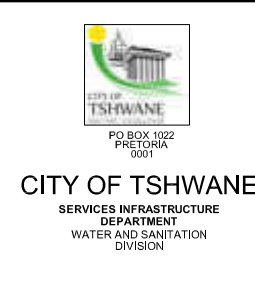


NOTES AND SPECIFICATIONS

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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
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 - EXISTING BULK PIPELINE
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 - EXISTING RAND WATER PIPE
 - SUBURB BOUNDARY
 - SASOL GAS LINE
 - PETRONET PIPE
 - NEW PIPE IN NEW SLEEVE



AMENDMENTS			
NR	DATE	APPROVED	DESCRIPTION
A	APR 2017		FOR APPROVAL

WATER AND SANITATION			
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

P. O. BOX 11141
ERASMUSKLOOF
0048

TEL : (012) 347 6299
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gfc@gfc-holdings.co.za

HEREBY CERTIFY THAT THE SERVICES WILL HAVE BEEN INSTALLED ACCORDING TO NOTE 9 OF THE ABOVE NOTES AND TO THE DRAWING

CONSULTANT DRAWING NUMBER: 1012/300/02

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

DRAWN
NAME: M. HADEBE Pr Eng. 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:	1012
PROJECT No.:	1012
SHEET No.:	2 OF 2
PAPER SIZE:	A1
SCALE:	1:1000
DATE:	APRIL 2017

PROJECT STATUS

CONCEPT DRAWING TENDER DRAWING APPROVED CONSTRUCTION DRAWING AS BUILT DRAWINGS

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:
ROOIHUISKRAAL NORTH EXT 29

DESCRIPTION OF PROJECT:
SEWER RETICULATION:
GENERAL LAYOUT

WBS No.: _____

COT DRAWING NUMBER: _____



NOTES AND SPECIFICATIONS

GENERAL

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- 3 DRAWINGS, (IF APPLICABLE)
- 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
- 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.

LEGEND :

- EXISTING PIPES
- JUNCTION BOX
- PROPOSED MANHOLE
- PROPOSED PIPES
- WATER LEADERS
- GRID INLET
- KERB INLET

AMENDMENTS				
NR.	DATE	APPROVED	DESCRIPTION	PAR. TEL.
A	APR 2017		FOR APPROVAL	

DESIGNED BY M. HADEBE	DRAWN BY M. HADEBE
CHECKED BY G. COMBRINCK	INFRASTRUCTURE TECHNICAL INFORMATION MANAGEMENT D.J. CHALMERS

PROJECT STATUS			
CONTRACT SIGNED	TENDER AWARDED	CONSTRUCTION STARTED	COMPLETE
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PROJECT ENGINEER (CONSULTANT):			
INSPECTOR OF WORKS (CITY OF TSHWANE):		DATE:	

CONSULTANT DETAIL



TELAMIZE PTY LTD
ENGINEERING & PROJECT MANAGEMENT

CITY OF TSHWANE
ROADS AND TRANSPORT DEPARTMENT

Mr P. J. Lelofane
STRATEGIC EXECUTIVE DIRECTOR

Ms. L. V. Kagalwe-Pheko
EXECUTIVE DIRECTOR

P.O. BOX 1409
PRETORIA 0001

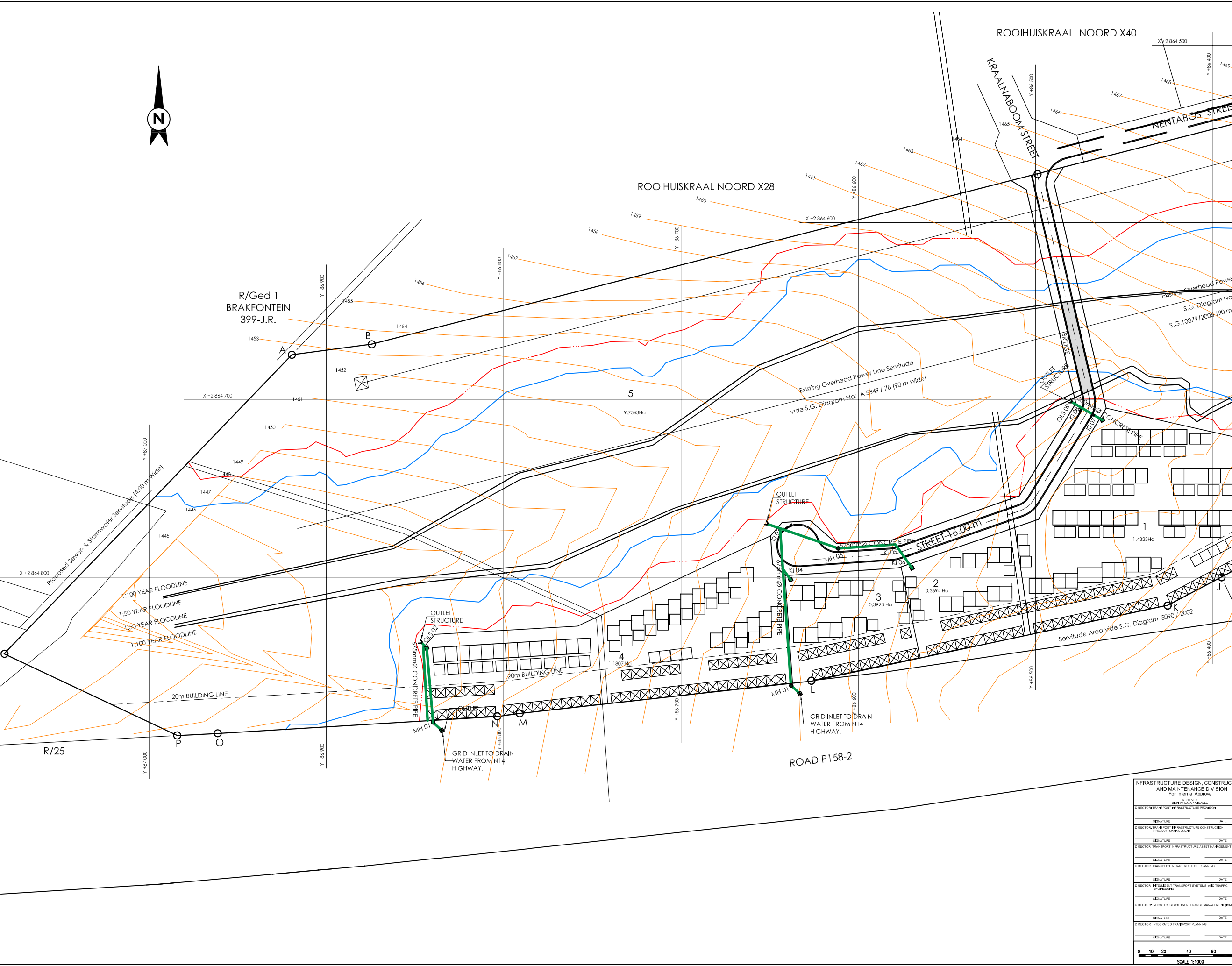
DRAWING APPROVED BY EXECUTIVE DIRECTOR
Ms. L. V. Kagalwe-Pheko

INFRASTRUCTURE DESIGN, CONSTRUCTION AND MAINTENANCE DIVISION For Internal Approval	
DIRECTOR: TRANSPORT INFRASTRUCTURE PROJECTS	
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	

ROOIHUISKRAAL NORTH EXT 29

**STORM WATER:
GENERAL LAYOUT**

CONTRACT No.: 1012	PROJECT No.: 1012
DATE: APRIL 2017	SCALE: 1:1000
SHEET NO: 1 OF 1	ORIGINAL PAPER SIZE: A1
DRAWING NO: 1012/500/01	REVISION





NOTES AND SPECIFICATIONS

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- LEGEND :**
- EXISTING PIPES
 - JUNCTION BOX
 - PROPOSED MANHOLE
 - PROPOSED PIPES
 - WATER LEADERS
 - GRID INLET
 - KERB INLET

AMENDMENTS				
NR.	DATE	APPROVED	DESCRIPTION	PAR. TEL.
A	APR 2017		FOR APPROVAL	

DESIGNED M. HADEBE	DRAWN M. HADEBE
CHECKED BY G. COMBRINCK	INFRASTRUCTURE TECHNICAL INFORMATION MANAGEMENT D.J. CHALMERS

PROJECT STATUS			
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
CONCEPT PHASE	DESIGN PHASE	INFRASTRUCTURE CONSTRUCTION PHASE	AS-BUILT PHASE
PROJECT ENGINEER (CONSULTANT):			
INITIALS AND SURNAME		SIGNATURE AND P. No.	DATE
INSPECTOR OF WORKS (CITY OF TSHWANE):		SIGNATURE AND P. No.	DATE

CONSULTANT DETAIL



CITY OF TSHWANE
ROADS AND TRANSPORT DEPARTMENT

Mr P. J. Lefoane
STRATEGIC EXECUTIVE DIRECTOR

Ms. L. V. Kagakwe-Phe
EXECUTIVE DIRECTOR

P.O. BOX 1409
PRETORIA 0001

P.O. BOX 1409
PRETORIA 0001

DRAWING APPROVED BY EXECUTIVE DIRECTOR
Ms. L. V. Kagakwe-Phe

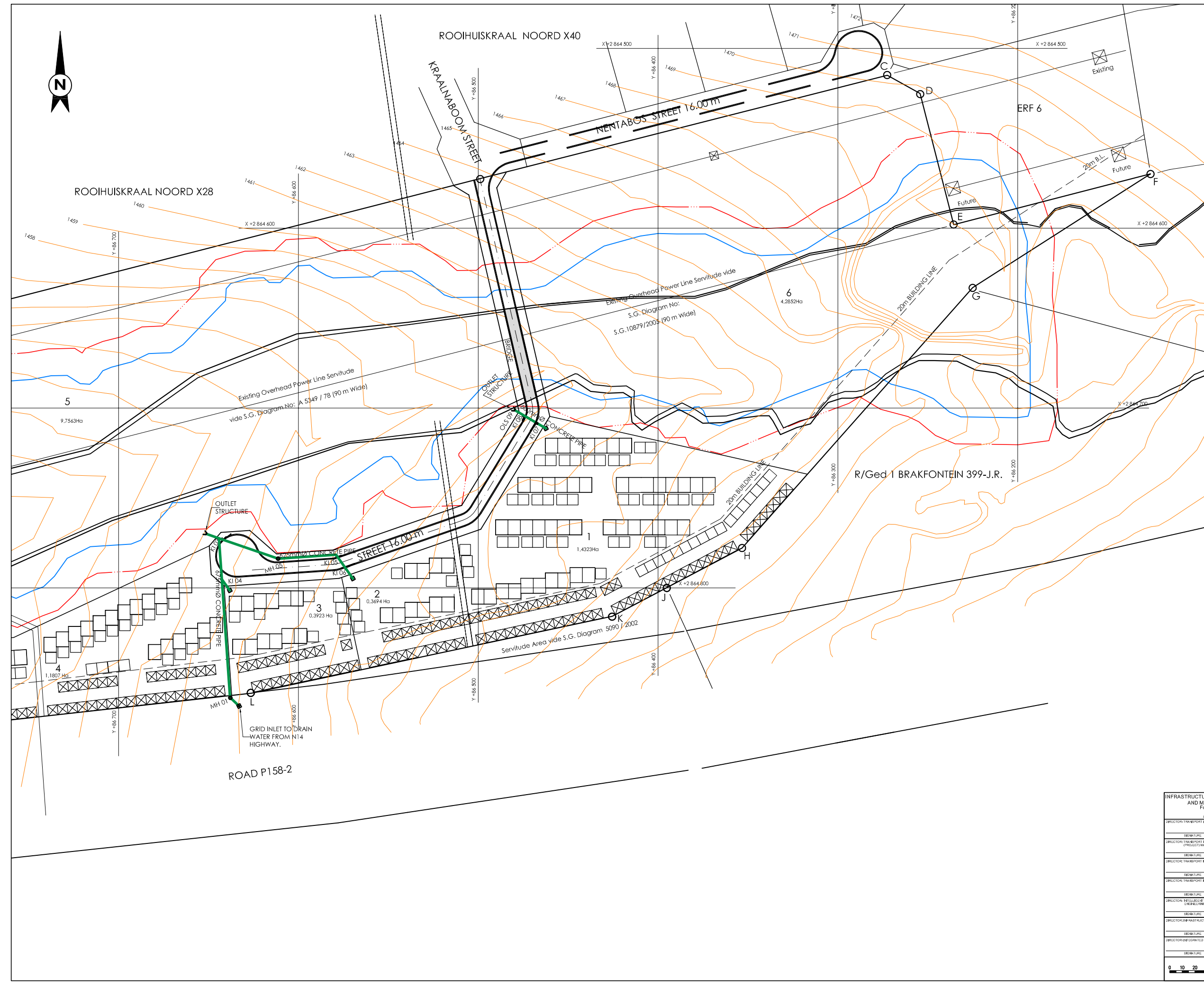
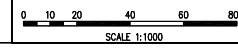
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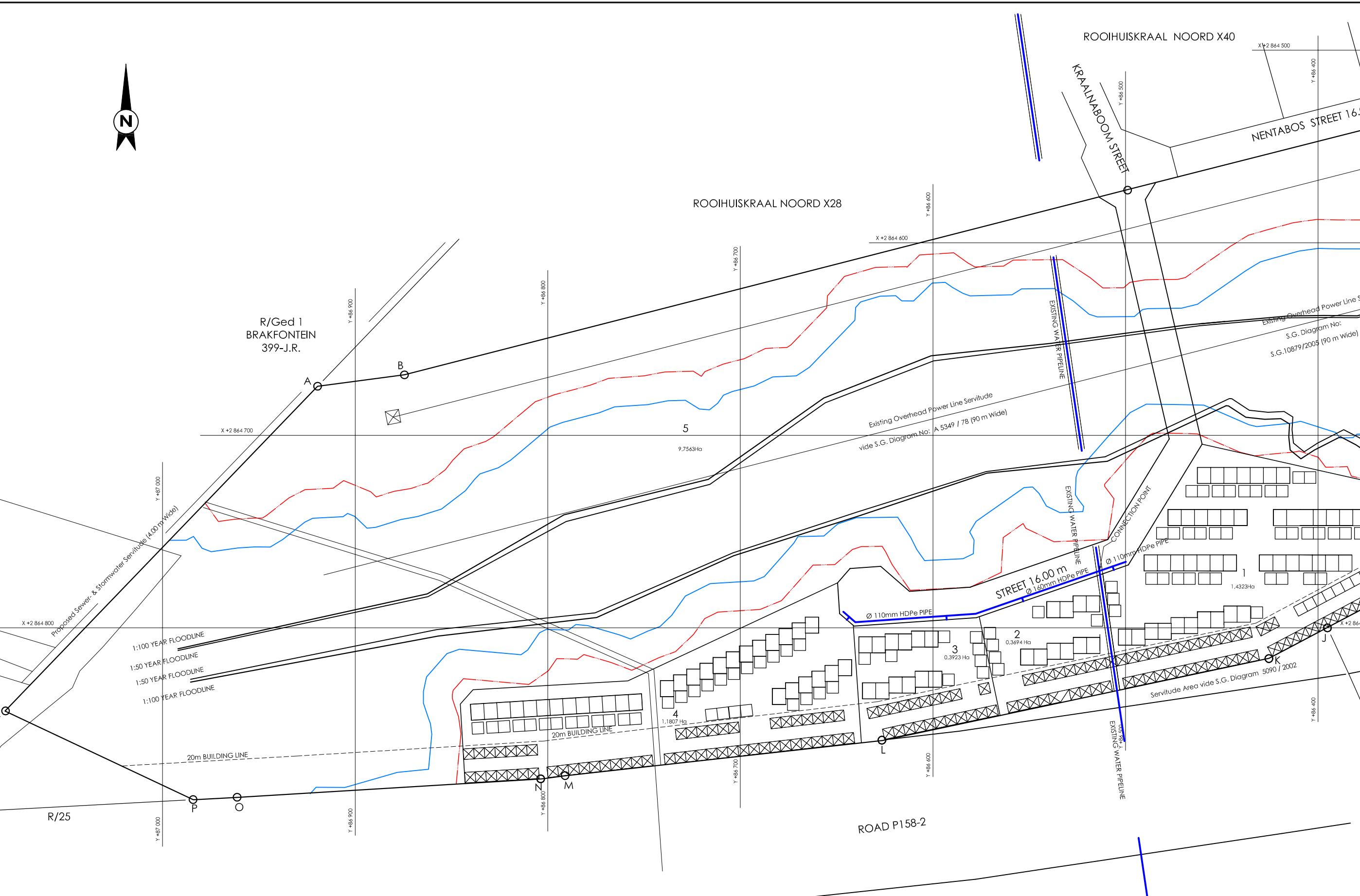
LOCATION OF PROJECT:
ROOIHUISKRAAL NORTH EXT 29

DESCRIPTION OF PROJECT:
**STORM WATER:
GENERAL LAYOUT**

CONTRACT No.: 1012	PROJECT No.: 1012
DATE: APRIL 2017	SCALE: 1:1000
DRAWING NO.: 1012/500/02	SHEET NO.: 2 OF 2
	ORIGINAL PAPER SIZE: A1

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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
	CLOSED VALVE
	EXISTING VALVE
	EXISTING COMMUNICATION PIPES
	EXISTING AIR VALVE
	EXISTING WATER METER
	EXISTING PUMP
	PIPE TO BE ABANDONED
	REDUNDANT PIPE
	EXISTING RES DISTRIBUTION ZONE
	PROPOSED RES DISTRIBUTION ZONE
	EXISTING RAND WATER PIPE
	SUBURB BOUNDARY
	SASOL GAS LINE
	PETRONET PIPE
	NEW PIPE IN NEW SLEEVE



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

CONSULTANT DETAIL

P. O. BOX 11141
ERASMUSKLOOF
0048

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

HEREBY CERTIFY THAT THE SERVICES WILL HAVE BEEN INSTALLED ACCORDING TO NOTE 9 OF THE ABOVE NOTES AND TO THE DRAWING

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LOCATION OF PROJECT:
ROOIHUISKRAAL NORTH EXT 260

DESCRIPTION OF PROJECT:
**WATER RETICULATION:
GENERAL LAYOUT**

WBS No. : _____

COT DRAWING NUMBER: _____

NOTES AND SPECIFICATIONS

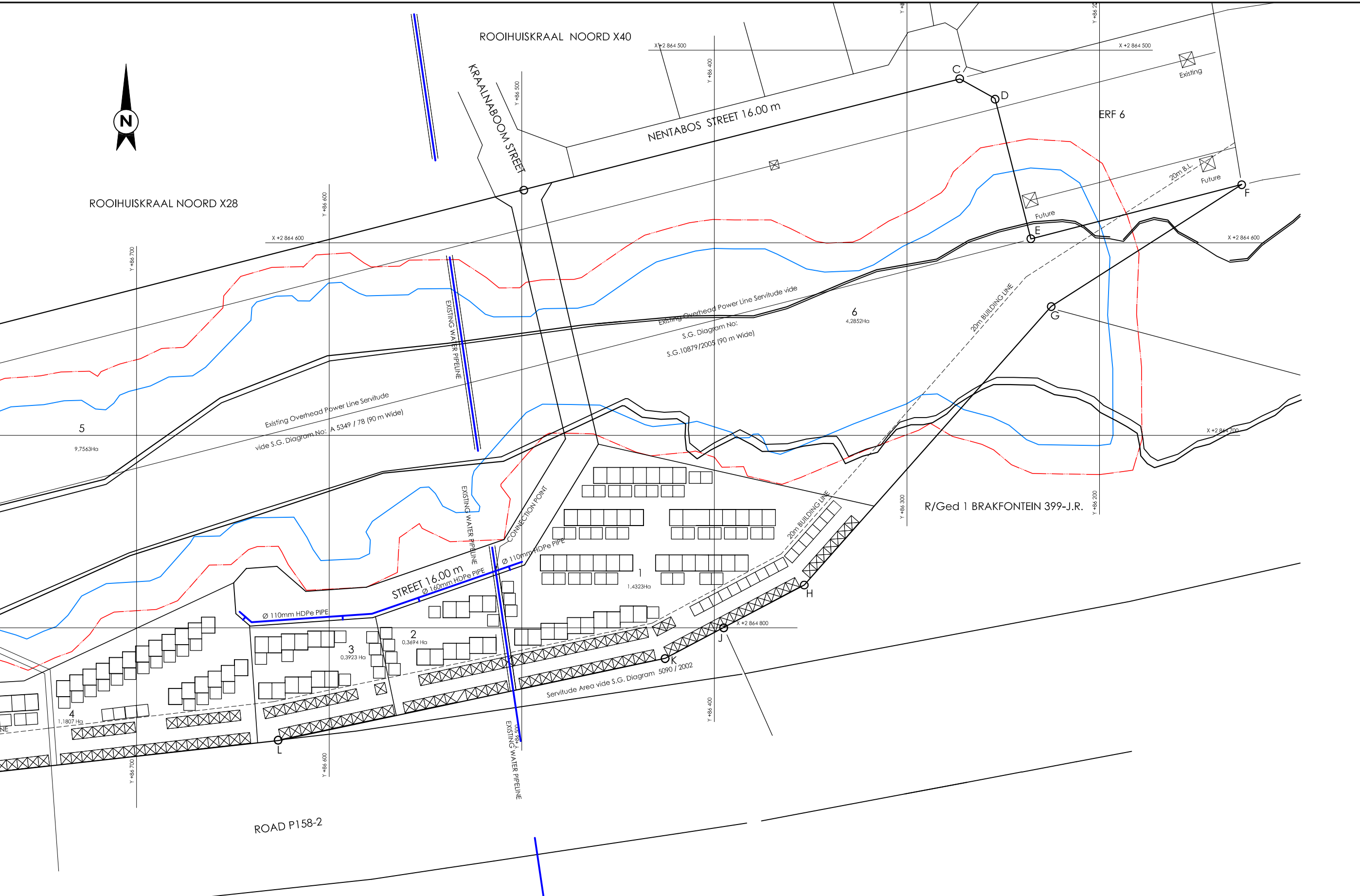
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ERASMUSKLOOF
0048

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

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ROOIHUISKRAAL NORTH EXT 260

DESCRIPTION OF PROJECT:
**WATER RETICULATION:
GENERAL LAYOUT**

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Appendix G14

Electrical Services



GREYCON PROJECTS CC

In association with Voltano Pty (Ltd) Energy Solutions

PO Box 303, Cornwall Hill, 0178

Cellular: 082 575 4708

Fax: 086 674 3424



CK88/13805/23

VAT Number: 489 016 2995

E-mail: martin@voltano.com

Bokamosa Landscape Architects & Environmental Consultant

March 2014

Attention: Me Mientjie Coetzee

ROOIHUISKRAAL NOORD EXTENSION 29

ENVIRONMENTAL INPUT

All electrical services will be installed within the proposed road reserve across the extent of the watercourse that will include 2x 70mm² 3 core 11kV cables and a street light circuit.

The Telkom services will be accommodated by means of 2x 110mm sleeves, also installed in the road reserve; however no manhole are anticipated within the extent of the watercourse.

Both the electrical and Telkom reticulation will be accommodated in the road reserve across the extent of the watercourse through sleeves that will be incorporated in the bridge to be designed and build buy others.

The co-ordinates for both infrastructure is based on the centre of the watercourse and is 25°53'14.37"S and 28° 8'13.41"E.

Neither the electrical and Telkom reticulations will have an effect on the cause impedance or a diversion to the flow of water in a watercourse. The length of the Rietspruit River and the wetland will therefore not be affected by the electrical and Telkom infrastructure.

Thank you

On behalf of Greycon Projects CC

Per.: Martin Greyling Pr. Eng. (Electrical) ECSA 880448

Attached: Drawing RHKN29-EL-01.pdf



Appendix G15

Noise Study

PLANDEV Town and Regional Planners

NOISE STUDY FOR ENVIRONMENTAL IMPACT ASSESSMENT

Proposed Rooihuiskraal North Ext. 17 Residential Development on
portion 9 and part of portion 145 of the farm Braakfontein 399-JR,
City of Tshwane



Study done for:

<p>Plandev House Highveld Office Park Charles de Gaulle Crescent Highveld CENTURION</p> <p>7718, Centurion, 0046</p> <p>Tel: (012) 845-2330 / 3 / 2 Fax: (012) 845-2333 e-mail: plandev@tsrta.com</p>	<h2>PLANDEV</h2> <p>Town and Regional Planners Stads- en Streekbeplanners</p>	
----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------	--

Prepared by:



P.O. Box 2047, Garsfontein East, 0060
Tel: 012 – 993 2165, Fax: 086 – 621 0292, E-mail: info@eares.co.za

EXECUTIVE SUMMARY

Enviro-Acoustic Research (EARES) was contracted by PLANDEV to determine the potential noise impact on the proposed Rooihuiskraal North Ext. 17 residential development due to the existing N14 Road traffic. PLANDEV has been contracted to administer the town planning of the mentioned development, based south-west of Centurion, City of Tshwane. The project is planned on portion 9 and part of portion 145 of the farm Braakfontein 399-JR. The request for the Environmental Noise Impact Assessment was requested from the Head of Department (HOD) of the Department of Health, Ref.: CPD9/1/1/1 – RHKN X 29 571.

This report describes the noise Rating Levels and potential noise impact that the operation of the existing N14 Highway may have on the proposed township, highlighting the methods used, potential issues identified, findings and recommendations. The Terms of Reference (TOR) for this study is based on the National/International guidelines and regulations such as: SANS 10103:2008, SANS 10210:2004, SANS 10328, SANS 10357, GN R154 and IFC: General EHS Guidelines (Equator Principal).

The boundary of this project will be based directly adjacent to the National N14 Highway. The noise emitted from the road was calculated, making use of measured data for reference purpose to determine the potential Noise Rating Level at houses directly facing and adjacent to the route. The developer has indicated that dwellings will be designed with bedrooms on opposite façade to the N14 Highway. The design of the dwellings are to be double or more stories high.

Ambient sound levels were measured at approximately 90 m from the N14 Highway and at one location from the 09th April – 10th April 2014. One class-1 Sound Level Meter (SLM) as well as a portable weather station was used for measurements. The sound level meters would measure “average” sound levels over 10 minutes periods, save the data and start with a new 10 minute measurement till the instrument was stopped. The measurement location was selected to be reflective of the typical environmental ambient sound levels within close proximity of the N14. As a result a SLM was erected in a relatively open field at the Thatchfield golf course. This location was also chosen as it was a safe area for the equipment to be left overnight. The closest location that could be sourced with a direct line of sight and with a safe location was at approximately 90 m from the road under investigation. No locality within 15 m of the road could be sourced due to safety limitations.

Road traffic movement on the N14 was the dominant contributor to all measured data. During the evening cricket or cicada (likely cricket) contributed to the sound levels. On the second day some measurements were influenced by lawn services on the surrounding golf course.

L_{A90} measured statistical levels indicate that the day and night-time background ambient soundscape was generally very high. There were consistent sounds in the area with the 90th percentile value very rarely dropping below the 44 dBA90 level. Equivalent daytime ambient sound levels ($L_{Aeq,I}$ – South African Legislation) ranged between 47.9 and 69.0 dBA during all 10-minute measurement periods.

Daytime ambient sound measurements indicated sound levels that are slightly higher than the rating levels for a busy urban district, yet lower than a central business district. Night-time data reflected sound levels that are slightly higher than the rating levels for a typical busy urban district, yet lower than an central business district

There is a high confidence in the ambient sound levels measured and the subsequent Rating Levels ($L_{Req,T}$) determined at 90 m from the N14 Road.

With the input data as used, this assessment indicated that there is a potential noise impact of moderate significance during the night-time periods. There is always the likelihood that a degree of over-engineering or precautionary principals are adhered to in environmental assessments, and this may be the case with the night-time assessment.

As mentioned the developer has decided to design the complex dwellings with bedrooms on the opposite façade to the N14 Road. Calculations did consider the screening effect of a single/double *et al* effect of dwelling enclosure. As calculations are based on the exterior of the dwellings, the implementation of bedrooms on opposite façade to N14 Road will definitely see a reduction in the calculated Rating Levels.

It should be noted that this does not suggest that the sound from the N14 Road will be inaudible - this is an unrealistic expectation that is not required or expected from any other agricultural, commercial, industrial or transportation related noise source, but rather that the sound due to the road traffic should be at a reasonable level as per regulations.

Report should be sited as:

De Jager, M. (2014). "Noise Study for Environmental Impact Assessment: Proposed Rooihuiskraal North Ext. 17 Residential Development on portion 9 and part of portion 145 of the farm Braakfontein 399-JR, City of Tshwane", Enviro-Acoustic Research cc, Pretoria

Client:

PLANDEV Town and
Regional Planners

Highveld Office Park
Charles de Gaule Crescent
7710

Report no:

PLANTDEV-RK/ENIA/201404-Rev 0

Author:

M. de Jager (B. Ing (Chem))

Review:

Shaun Weinberg

Date:

April 2014

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GLOSSARY OF ABBREVIATIONS

AZSL	Acceptable Zone Sound Level (Rating Level)
AADT	Annual Average Daily Traffic
ADDTT	Annual Average Daily Truck Traffic
dB	Decibel
EARES	Enviro-Acoustic Research cc
EAP	Environmental Assessment Practitioner
ECA	Environment Conservation Act (Act 78 of 1989)
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
Ext	Extension
Ha	Hectare
HOD	Head of Department
IAPs	Interested and Affected Parties
i.e.	that is
IEM	Integrated Environmental Management
km	kilometres
LHD	Load haul dumper
m	Meters (measurement of distance)
m ²	Square meter
m ³	Cubic meter
mamsl	Meters above mean sea level
NEMA	National Environmental Management Act, 1998 (Act 107 of 1998)
NCR	Noise Control Regulations (under Section 25 of the ECA)
NGO	Non-government Organisation
NSD	Noise-sensitive Development
PPP	Public Participation Process
RMS	Root Mean Square
SABS	South African Bureau of Standards
SANS	South African National Standards
SLM	Sound Level Meter
TOR	Terms of Reference
UTM	Universal Transverse Mercator
UTFC	Ultra-Thin Frictional Course
WHO	World Health Organisation

1 INTRODUCTION

1.1 INTRODUCTION AND PURPOSE

Enviro-Acoustic Research (EARES) was contracted by PLANDEV to determine the potential noise impact on the proposed Rooihuiskraal North Ext. 17 residential development due to the existing N14 Road traffic. PLANDEV has been contracted to administer the town planning of the mentioned development, based south-west of Centurion, City of Tshwane. The project is planned on portion 9 and part of portion 145 of the farm Braakfontein 399-JR. The request for the Environmental Noise Impact Assessment was requested from the Head of Department (HOD) of the Department of Health, Ref.: CPD9/1/1/1 – RHKN X 29 571.

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1.2 BRIEF PROJECT DESCRIPTION¹

1.2.1 Project Overview

The boundary of this project will be based directly adjacent to the National N14 Highway. The noise emitted from the road will be calculated, making use of measured data for reference purpose, to determine the potential Noise Rating Level at houses directly facing and adjacent to the route. The developer has indicated that dwellings will be designed with bedrooms on opposite façade to the N14 Highway. The design of the dwelling is also likely to be double or more stories high. Refer to [Appendix E.1](#) for the layout used for assessment in this report.

The relevant authority with executive powers falls under is the City of Tshwane municipality. The project boundary in its regional setting is presented **Figure 1-1**.

1.3 STUDY AREA

The study area (refer to **Figure 1-2**) is described in terms of environmental components that may contribute or change the sound character in the area.

¹ Information obtained from PLANDEV.

1.3.1 Topography

ENPAT² (1998) describes the topography as “strongly undulating plains”, with the project located on a relatively flat geographical section. Due to the macro size of the project (in terms of acoustics) there are little local features that could act as noise barriers considering practical distances at which sound propagates.

1.3.2 Surrounding Land Use

The area in the vicinity of the proposed operation is currently classified as “Urban / built-up land: residential” or “Unimproved grassland”³ with residential communities prevalent in the study area. It is unsure for the purpose of this report what the local authority classifies the surrounding land capability use as.

1.3.3 Roads

The only important road (in terms of calculable acoustics at a receptors dwelling) is the study area is the N14 (presumably urban principal arterial) provincial main road⁴. The route is double lane alternative direction carriageway.

1.3.4 Potential Sensitive Receptors (Noise-Sensitive Developments)

The proposed Rooihuiskraal North Ext. 17 residential development boundaries are illustrated in **Figure 1-2**. Only dwellings directly adjacent and facing the N14 Highway will be investigated.

1.3.5 Ground conditions and vegetation

The area falls within the Carletonville Dolomite Grassland biome, with the vegetation type being Carletonville Dolomite Grassland⁵. Due to anthropogenic development in the study area, it is likely this vegetation type has been cleared away.

² Van Riet, W. Claassen, P. van Rensburg, J. van Viegen & L. du Plessis, “*Environmental Potential Atlas for South Africa*”, Pretoria, 1998.

³ Van Riet, W. Claassen, P. van Rensburg, J. van Viegen & L. du Plessis, “*Environmental Potential Atlas for South Africa*”, Pretoria, 1998.

⁴ Committee of Transport Officials. “*TRH 26, South African Road Classification and Access Management Manual*”. Version 1.0.2012.

⁵ Musina L. & Rutherford. “*The vegetation of South Africa, Lesotho and Swaziland*”. *Strelitzia 19*, South African National Biodiversity Institute, Pretoria. 2006.P.g. 460.

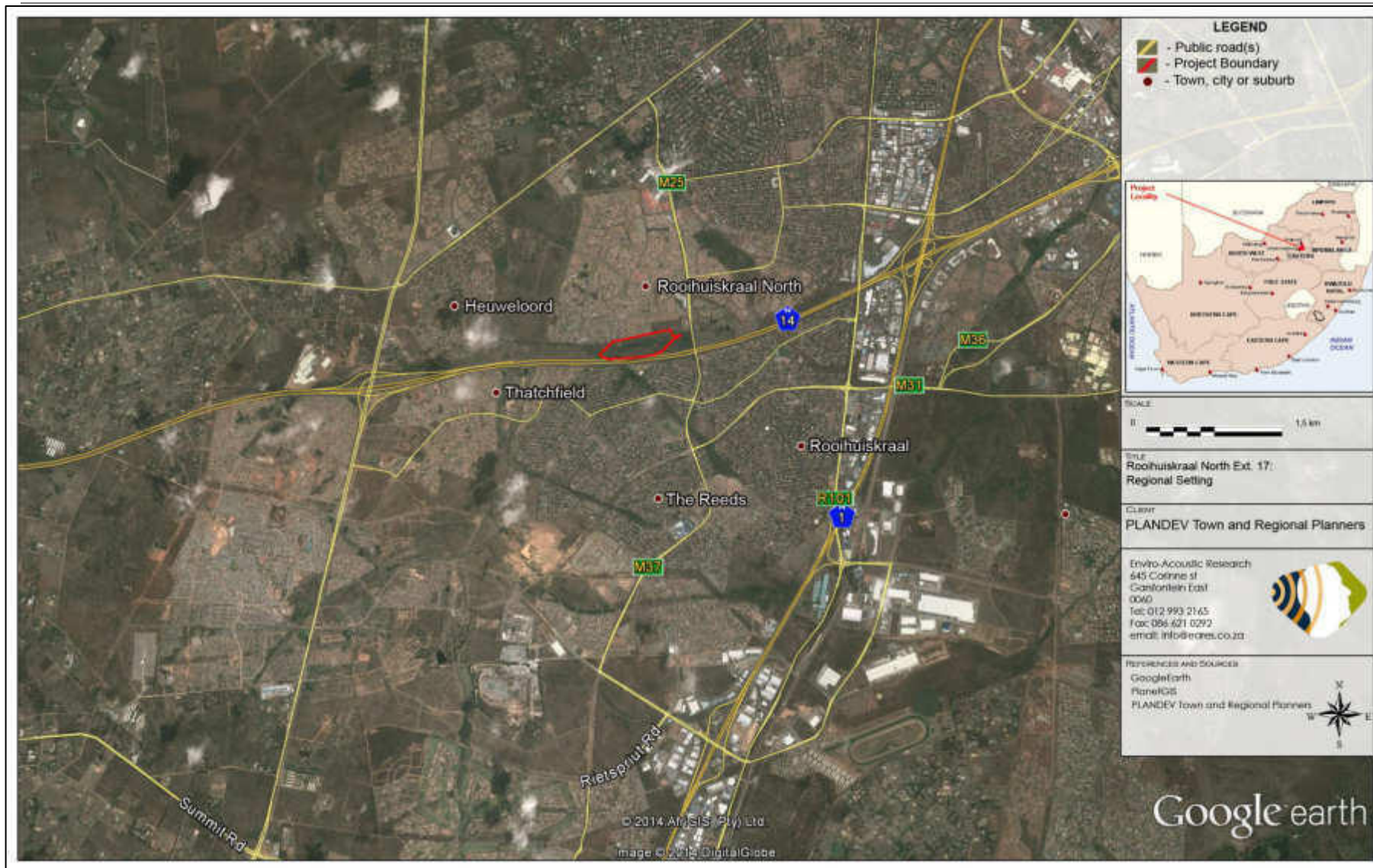


Figure 1-1: Site map indicating the project boundary



Figure 1-2: Noise-Sensitive Development boundary layout

1.4 AVAILABLE INFORMATION

Available information includes the traffic volumes provided courtesy of:

- Syntell Group Company. Mikros Traffic Monitoring (N14 Road traffic monitoring); and
- Layout as supplied by the consulting specialists ([Appendix E.1](#)).

1.5 TERMS OF REFERENCE (TOR)

SANS 10328:2008 (Edition 3) specifies the methods to be used to assess the noise impacts from an existing road onto a proposed development. It highlights the need for studies to be conducted if:

- *Section 5.4 - Examples of situations that could have acoustical implications:*
 - d) *if a noise-sensitive development is to be established within 500 m of a road or railway line.*

The standard also stipulates the minimum requirements to be assessed for an EIA. These minimum requirements are:

1. the purpose of the investigation;
2. a brief description of the planned *or* existing development or the changes that are being considered;
3. a brief description of the existing environment including, where relevant, the topography, surface conditions and meteorological conditions during measurements;
4. the identified noise sources together with their respective sound pressure levels or sound power levels (or both) and, where applicable, the operating cycles, the nature of sound emission, the spectral composition and the directional characteristics;
5. the identified noise sources that were not taken into account and the reasons as to why they were not assessed;
6. the identified noise-sensitive developments and the noise impact on them;
7. where applicable, any assumptions, with references, made with regard to any calculations or determination of source and propagation characteristics;
8. an explanation, either by a brief description or by reference, of all measuring and calculation procedures that were followed, as well as any possible adjustments to existing measuring methods that had to be made, together with the results of calculations;
9. an explanation, either by description or by reference, of all measuring or calculation methods (or both) that were used to determine existing and predicted

- rating levels, as well as other relevant information, including a statement of how the data were obtained and applied to determine the rating level for the area in question;
10. the location of measuring or calculating points in a sketch or on a map;
 11. quantification of the noise impact with, where relevant, reference to the literature consulted and the assumptions made;
 12. alternatives that were considered and the results of those that were assessed;
 13. a list of all the interested or affected parties that offered any comments with respect to the environmental noise impact investigation;
 14. a detailed summary of all the comments received from interested or affected parties as well as the procedures and discussions followed to deal with them;
 15. conclusions that were reached;
 16. proposed recommendations;
 17. whether remedial measures will provide an acceptable solution which would prevent a significant impact, these remedial measures should be outlined in detail and included in the final record of decision if the approval is obtained from the relevant authority. If the remedial measures deteriorate after time and a follow-up auditing or maintenance programme (or both) is instituted, this programme should be included in the final recommendations and accepted in the record of decision if the approval is obtained from the relevant authority; and
 18. any follow-up investigation which should be conducted at completion of the project as well as at regular intervals after the commissioning of the project so as to ensure that the recommendations of this report will be maintained in the future.

2 LEGAL CONTEXT, POLICIES AND GUIDELINES

2.1 THE REPUBLIC OF SOUTH AFRICA CONSTITUTION ACT (“THE CONSTITUTION”)

The environmental rights contained in section 24 of the Constitution provide that everyone is entitled to an environment that is not harmful to his or her well-being. In the context of noise, this requires a determination of what level of noise is harmful to well-being. The general approach of the common law is to define an acceptable level of noise as that which the reasonable person can be expected to tolerate in the particular circumstances. The subjectivity of this approach can be problematic which has led to the development of noise standards (see **Section 2.6**).

“Noise pollution” is specifically included in Part B of Schedule 5 of the Constitution, which means that noise pollution control is a local authority competence, provided that the local authority concerned has the capacity to carry out this function.

2.2 THE ENVIRONMENT CONSERVATION ACT (ACT 73 OF 1989)

The Environment Conservation Act (“ECA”) allows the Minister of Environmental Affairs and Tourism (“now the Ministry of Water and Environmental Affairs”) to make regulations regarding noise, among other concerns. See also **section 2.2.1**.

2.2.1 National Noise Control Regulations (GN R154 of 1992)

In terms of section 25 of the ECA, the national Noise Control Regulations (GN R154 in *Government Gazette* No. 13717 dated 10 January 1992) were promulgated. The NCRs were revised under Government Notice Number R. 55 of 14 January 1994 to make it obligatory for all authorities to apply the regulations.

Subsequently, in terms of Schedule 5 of the Constitution of South Africa of 1996 legislative responsibility for administering the noise control regulations was devolved to provincial and local authorities. Provincial Noise Control Regulations exist in the Free State, Gauteng and Western Cape provinces.

The National Noise Control Regulations (GN R154 1992) defines:

"controlled area" as:

a piece of land designated by a local authority where, in the case of--

- c) industrial noise in the vicinity of an industry-
- i. the reading on an integrating impulse sound level meter, taken outdoors at the end of a period of 24 hours while such meter is in operation, exceeds 61 dBA; or

- ii. the calculated outdoor equivalent continuous "A"-weighted sound pressure level at a height of at least 1,2 meters, but not more than 1,4 meters, above the ground for a period of 24 hours, exceeds 61 dBA;

"disturbing noise" as:

Noise level which exceeds the zone sound level or, if no zone sound level has been designated, a noise level which exceeds the ambient sound level at the same measuring point by 7 dBA or more.

"zone sound level" as:

A derived dBA value determined indirectly by means of a series of measurements, calculations or table readings and designated by a local authority for an area. This is the same as the Rating Level as defined in SANS 10103.

In addition:

In terms of Regulation 2 -

"A local authority may -

(d): before changes are made to existing facilities or existing uses of land or buildings, or before new buildings are erected, in writing require that noise impact assessments or tests are conducted to the satisfaction of that local authority by the owner, developer, tenant or occupant of the facilities, land or buildings or that, for the purposes of regulation 3(b);

(c), reports or certificates in relation to the noise impact to the satisfaction of that local authority are submitted by the owner, developer, tenant or occupant to the local authority on written demand".

In terms of Regulation 3 -

"No person shall -

(a): establish a new township unless the lay-out plan concerned, if required by a local authority, indicates in accordance with the specifications of the local authority., the existing and future sources of noise, with concomitant dBA values which are foreseen in the township for a period of 15 years following the date on which the erection of the buildings in and around the township commences"

2.2.1.1 Noise Control Regulations: Gauteng Province (GN 5479 Act No.73 of 1989)

The Gauteng Noise Control Regulations (GN 5479 Act No.73 of 1989) defines:

"disturbing noise" as:

means a noise level that causes the ambient noise level to rise above the designated zone level, or if no zone level has been designated, the typical rating levels for ambient noise in districts, indicated in table 2 of SABS 0103 (now SANS 10103).

“ambient sound level”

means the reading on an integrating impulse sound level meter taken at a measuring point in the absence of any alleged disturbing noise at the end of a total period of at least 10 minutes after such meter was put into operation”

“noise nuisance”

Means any sound which disturbs or impairs or may disturb or impair the ' convenience or peace of any person.

In addition:

In terms of Regulation 10 (1):

“No person shall –

establish a new township unless the lay-out plan concerned, if required by a local authority, indicates in accordance with the specifications of the local authority., the existing and future sources of noise, with concomitant dBA values which are foreseen in the township for a period of 15 years following the date on which the erection of the buildings in and around the township commences”.

2.3 THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT (ACT 107 OF 1998)

The National Environmental Management Act (“NEMA”) defines “pollution” to include any change in the environment, including noise. A duty therefore arises under section 28 of NEMA to take reasonable measures while establishing and operating any facility to prevent noise pollution occurring. NEMA sets out measures which may be regarded as reasonable.

They include the following measures:

1. to investigate, assess and evaluate the impact on the environment
2. to inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed to avoid causing significant pollution or degradation of the environment
3. to cease, modify or control any act, activity or process causing the pollution or degradation
4. to contain or prevent the movement of the pollution or degradation
5. to eliminate any source of the pollution or degradation
6. to remedy the effects of the pollution or degradation

2.4 NATIONAL ENVIRONMENTAL MANAGEMENT: AIR QUALITY ACT (“AQA” – ACT 39 OF 2004)

Section 34 of the National Environmental Management: Air Quality Act (Act 39 of 2004) makes provision for:

- (1) the Minister to prescribe essential national noise standards -
 - (a) for the control of noise, either in general or by specified machinery or activities or in specified places or areas; or
 - (b) for determining -
 - (i) a definition of noise
 - (ii) the maximum levels of noise
- (2) When controlling noise the provincial and local spheres of government are bound by any prescribed national standards.

This section of the Act is in force, but no such standards have yet been promulgated. Draft regulations have however, been promulgated for adoption by Local Authorities.

An atmospheric emission licence issued in terms of section 22 may contain conditions in respect of noise.

2.4.1 Model Air Quality Management By-law for adoption and adaptation by Municipalities (GN 579 of 2010)

Model Air Quality Management By-Laws for adoption and adaptation by municipalities was published by the Department of Water and Environmental Affairs in the Government Gazette of 2 July 2010 as Government Notice 579 of 2010. The main aim of the model air quality management by-law is to assist municipalities in the development of their air quality management by-law within their jurisdictions. It is also the aim of the model by-law to ensure uniformity across the country when dealing with air quality management challenges. Therefore, the model by-law is developed to be generic to deal with most of the air quality management challenges. With Noise Control being covered under the Air Quality Act (Act 39 of 2004), noise is also managed in a separate section under this Government Notice.

- **IT IS NOT** the aim of the model by-law to have legal force and effect on municipalities when published in the Gazette; and
- **IT IS NOT** the aim of the model by-law to impose the by-law on municipalities.

Therefore, a municipality will have to follow the legal process set out in the Local Government: Municipal Systems Act, 2000 (Act No. 32 of 2000) when adopting and adapting the model by-law to its local jurisdictions.

2.5 ROAD TRAFFIC ACT, 1996 (ACT NO 93 OF 1996)

The Road Traffic Act of 1996 provides, *inter alia*, that *no person shall operate or permit to be operated on a public road and vehicle causing noise in excess of the prescribed noise level*. The Act, however, does not prescribe noise levels, but empowers the Minister of Transport to issue regulations prescribing them. The consolidated Road Traffic Regulations in terms of the Act do not prescribe any such noise levels, although the noise levels specified in the South African National Standard SANS 10181 (SABS 0181) have been specified as control standards.

2.6 NOISE STANDARDS

There are a few South African scientific standards (SABS) relevant to noise from mines, industry and roads. They are:

- SANS 10103:2008. 'The measurement and rating of environmental noise with respect to annoyance and to speech communication'.
- SANS 10210:2004. 'Calculating and predicting road traffic noise'.
- SANS 10328:2008. 'Methods for environmental noise impact assessments'.
- SANS 10181:2003. 'The Measurement of Noise Emitted by Road Vehicles when Stationary'.
- SANS 10205:2003. 'The Measurement of Noise Emitted by Motor Vehicles in Motion'.

The relevant standards use the equivalent continuous rating level as a basis for determining what is acceptable. The levels may take single event noise into account, but single event noise by itself does not determine whether noise levels are acceptable for land use purposes. With regards to SANS 10103:2008, the recommendations are likely to inform decisions by authorities, but non-compliance with the standard will not necessarily render an activity unlawful *per se*.

2.7 NATIONAL TRANSPORT POLICY (SEPTEMBER 1996)

The White Paper sets the vision for transport in South Africa that provides for "*safe, reliable, effective, efficient and fully integrated transport operations and infrastructure which are environmentally and economically sustainable*". The White Paper further states that "*the provision of transportation infrastructure and the operation of the transportation system have the potential for causing damage to the physical and social environment, inter alia, through atmospheric and noise pollution, ecological damage and severance. ...*

The Department of Transport is committed to an integrated environmental management approach in the provision of transport". It is also stated that "As part of the overall long-term vision for the South African transport system, transport infrastructure will, inter alia, be structured to ensure environmental sustainability and internationally accepted standards". One of the strategic objectives for transport infrastructure to achieve this vision is to promote environmental protection and resource conservation.

2.8 CITY OF TSHWANE NOISE MANAGEMENT POLICY (DRAFT)

Tshwane has for many years been aware of the increasing problems of noise in the metropolitan area and several years before the consolidation of the Metropolitan Municipality many of its component municipalities implemented the National and later the Gauteng Noise Control Regulations. The Council's approach has, however, been on an *ad hoc* basis generally reacting to problems as they occur. A stage was reached where a comprehensive pro-active approach to noise management and control is required with the first step being the development of Noise Management Policy. The purpose of this policy was to set out the basic framework to guide subsequent legislation in the form of by-laws and for establishing enabling procedures. The Policy takes into account, inter alia, the requirements of the Gauteng Provincial Government's Noise Control Regulations which were promulgated in August 1999.

2.9 INTERNATIONAL GUIDELINES

While a number of international guidelines and standards exists, those selected below are used by numerous countries for environmental noise management.

2.9.1 Guidelines for Community Noise (WHO, 1999)

The World Health Organization's (WHO) document on the *Guidelines for Community Noise* is the outcome of the WHO- expert task force meeting held in London, United Kingdom, in April 1999. It is based on the document entitled "Community Noise" that was prepared for the World Health Organization and published in 1995 by the Stockholm University and Karolinska Institute.

The scope of WHO's effort to derive guidelines for community noise is to consolidate actual scientific knowledge on the health impacts of community noise and to provide guidance to environmental health authorities and professionals trying to protect people from the harmful effects of noise in non-industrial environments. It discusses the specific effects of noise on communities including:

- Interference with communication, noise-induced hearing impairment, sleep disturbance effects, cardiovascular and psychophysiological effects, mental health effects, effects on performance, annoyance responses and effects on social behavior.

It further discusses how noise can impact (and propose guideline noise levels) on specific environments such as:

- Residential dwellings, schools and preschools, hospitals, ceremonies, festivals and entertainment events, sounds through headphones, impulsive sounds from toys, fireworks and firearms, and parklands and conservation areas.

To protect the majority of people from being affected by noise during the daytime, it propose that sound levels at outdoor living areas should not exceed 55 dB L_{Aeq} for a steady, continuous noise. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound pressure level should not exceed 50 dB L_{Aeq} . At night, equivalent sound levels at the outside façades of the living spaces should not exceed 45 dBA and 60 dBA L_{Amax} so that people may sleep with bedroom windows open.

It is critical to note that this guideline requires the sound level measuring instrument to be set on the “fast” detection setting.

2.9.2 Night Noise Guidelines for Europe (WHO, 2009)

Refining previous Community Noise Guidelines issued in 1999, and incorporating more recent research, the World Health Organization has released a comprehensive report on the health effects of night time noise, along with new (non-mandatory) guidelines for use in Europe. Rather than a maximum of 30 dB inside at night (which equals 45-50 dB max outside), the WHO now recommends a maximum year-round outside night-time noise average of 40 db to avoid sleep disturbance and its related health effects. The report notes that only below 30 dB (outside annual average) are “*no significant biological effects observed,*” and that between 30 and 40 dB, several effects are observed, with the chronically ill and children being more susceptible; however, “*even in the worst cases the effects seem modest.*” Elsewhere, the report states more definitively, “*There is no sufficient evidence that the biological effects observed at the level below 40 dB (night, outside) are harmful to health.*” At levels over 40 dB, “*Adverse health effects are observed*” and “*many people have to adapt their lives to cope with the noise at night. Vulnerable groups are more severely affected.*”

The 184-page report offers a comprehensive overview of research into the various effects of noise on sleep quality and health (including the health effects of non-waking sleep arousal), and is recommended reading for anyone working with noise issues. The use of an outdoor noise standard is in part designed to acknowledge that people do prefer to leave windows open when sleeping, though the year-long average may be difficult to obtain (it would require longer-term sound monitoring than is usually budgeted for by either industry or neighbourhood groups).

While recommending the use of the average level, the report notes that some instantaneous effects occur in relation to specific maximum noise levels, but that the health effects of these “cannot be easily established.”

2.9.3 Equator Principles

The **Equator Principles** (EPs) are a voluntary set of standards for determining, assessing and managing social and environmental risk in project financing. Equator Principles Financial Institutions (EPFIs) commit to not providing loans to projects where the borrower will not or is unable to comply with their respective social and environmental policies and procedures that implement the EPs.

The Equator Principles were developed by private sector banks and were launched in June 2003. The banks chose to model the Equator Principles on the environmental standards of the World Bank (1999) and the social policies of the International Finance Corporation (IFC). Sixty-seven financial institutions (October 2009) have adopted the Equator Principles, which have become the de facto standard for banks and investors on how to assess major development projects around the world. The environmental standards of the World Bank have been integrated into the social policies of the IFC since April 2007 as the International Finance Corporation Environmental, Health and Safety (EHS) Guidelines.

2.9.4 IFC: General EHS Guidelines – Environmental Noise Management

These guidelines are applicable to noise created beyond the property boundaries of a development that conforms to the Equator Principle.

It states that noise prevention and mitigation measures should be applied where predicted or measured noise impacts from project facilities/operations exceed the applicable noise level guideline at the most sensitive point of reception. The preferred method for controlling noise from stationary sources is to implement noise control measures at source.

It goes as far as to proposed methods for the prevention and control of noise emissions, including:

- Selecting equipment with lower sound power levels;
- Installing silencers for fans;
- Installing suitable mufflers on engine exhausts and compressor components;
- Installing acoustic enclosures for equipment casing radiating noise;
- Improving the acoustic performance of constructed buildings, apply sound insulation;
- Installing acoustic barriers without gaps and with a continuous minimum surface density of 10 kg/m² in order to minimize the transmission of sound through the barrier. Barriers should be located as close to the source or to the receptor location to be effective;
- Installing vibration isolation for mechanical equipment;
- Limiting the hours of operation for specific pieces of equipment or operations, especially mobile sources operating through community areas ;
- Re-locating noise sources to less sensitive areas to take advantage of distance and shielding;
- Placement of permanent facilities away from community areas if possible;
- Taking advantage of the natural topography as a noise buffer during facility design;
- Reducing project traffic routing through community areas wherever possible;
- Planning flight routes, timing and altitude for aircraft (airplane and helicopter) flying over community areas; and
- Developing a mechanism to record and respond to complaints.

It sets noise level guidelines (see **Table 2-1**) as well as highlighting the certain monitoring requirements pre- and post-development. It adds another criterion in that the existing background ambient noise level should not rise by more than 3 dBA. This criterion will effectively sterilize large areas of any development. It is therefore the considered opinion that this criterion was introduced to address cases where the existing ambient noise level is already at, or in excess of the recommended limits.

Table 2-1: IFC Table .7.1-Noise Level Guidelines

Receptor type	One hour L _{Aeq} (dBA)	
	Daytime 07:00 - 22:00	Night-time 22:00 – 07:00
Residential; institutional; educational	55	45
Industrial; commercial	70	70

The document uses the L_{Aeq,1 hr} noise descriptors to define noise levels. It does not determine the detection period, but refers to the IEC standards, which requires the fast detector setting on the Sound Level Meter during measurements in Europe.

2.9.5 International Paper – Future Noise Policy European Commission Green Paper (1996)

The 1996 Green Paper highlighted the need for better mitigation measures to be implemented in the European Union regarding transport air-borne vibration and recognises the need for a harmonization methodology of assessment of noise exposures⁶. It is stressed that noise relating to road, rail and other transport modes in the European Union needed to be addressed.

2.9.6 National and International Guidelines - Appropriate limits for game parks and wilderness

The United States National Park Services identifies that “intrusive” un-natural sounds are concern for the National Park Services (United States⁷) as many visitors go to parks to enjoy the soundscape (interpreted as natural soundscape). Naturally quiet places will not mean (as per interpretation of the author and available information) that the noise levels in the area will be low but rather that the soundscape contributors are of a natural origin (faunal communication, wind shear, water etc.).

These natural events could include the dawn chorus when songbirds start to sing at the start of a new day or frogs croaking after a rainfall event. Although game park visitors, receptors in “natural” areas and hospitality industries may not seek intrusive un-natural sounds, the operation of the game park/hospitality industry or receptors dwelling itself is source of anthropogenic noise (vehicles, game park electrical and mechanical infrastructure etc.). National Parks do though implement their own guidelines/rules regarding noise created by park visitors.

Natural sounds can contribute a meaningful magnitude⁸ to the ambient soundscape depending on season, time, faunal species, habitat and habitat fragmentation etc. Although the magnitude may be loud, natural sounds may contain harmonics⁹ and other pleasant sounds that visitors seek when going to parks or wilderness areas.

Certain International states have tried implementing laws regarding external environmental “un-natural” noise sources into areas with natural sounds. In USA there exists numerous state and local laws to encourage industries near parks to keep within limits set out by the local authorities¹⁰. The United States National Park Service’s efforts

⁶ European Commission Green Paper (Com (96) 540).1996.

⁷ National Park Services, “Soundscape Preservation and Noise Management”, 2000, p. 1.

⁸ Environ. We Int. Sci. Tech, “Ambient noise levels due to dawn chorus at different habitats in Delhi”, 2001, p. 134.

⁹ Panatcha Anusasananan, Suksan Suwanarat, Nipon Thangprasert, “Acoustic Characteristics of Zebra Dove in Thailand”, p. 4.

¹⁰ E.g. State of Oregon’s Environmental Standards for Wilderness Areas

include attempts to reduce the flights over the Grand Canyon due to the introduction of non-natural impulsive noise events at the park.

3 CURRENT ENVIRONMENTAL SOUND CHARACTER

3.1 MEASUREMENT PROCEDURE

Ambient (background) noise levels were measured at appropriate times in accordance with the South African National Standard SANS 10103:2008 "***The measurement and rating of environmental noise with respect to land use, health, annoyance and to speech communication***". The standard specifies the acceptable techniques for sound measurements including:

- type of equipment (Class 1);
- minimum duration of measurement;
- microphone positions and height above ground level;
- calibration procedures and instrument checks; and
- supplementary weather measurements and observations.

3.2 LIMITATIONS - ACOUSTICAL MEASUREMENTS AND ASSESSMENTS

Limitations due to environmental acoustical measurements include the following:

- Ambient sound levels are the cumulative effects of innumerable sounds generated at various instances both far and near. A high measurement may not necessarily mean that the area is always noisy. Similarly, a low sound level measurement will not necessarily mean that the area is always quiet, as sound levels will vary over seasons, time of day, dependant on faunal characteristics (mating season, dawn chorus¹¹ early hours of the morning, temperature etc.), vegetation in the area and meteorological conditions (especially wind). This excludes the potential effect of sounds from anthropogenic origin;
- Defining ambient sound levels using the result of one 10-minute measurement may be very inaccurate (very low confidence level in the results) relating to the reasons mentioned above;
- Determination of noise sources of environmental significance are important factor to consider when compiling an environmental acoustical report;
- Measurements over wind speeds of 3 m/s could provide data influenced by wind-induced noises;
- Ambient sound levels recorded near rivers, streams, wetlands, trees and bushy areas can be high due to faunal activity which can dominate the sound levels around the measurement point (specifically during summertime, rainfall event or during dawn chorus of bird songs). This generally is still considered naturally quiet and understood

¹¹ Environ. We Int. Sci. Tech. *Ambient noise levels due to dawn chorus at different habitats in Delhi*. 2001. Pg. 134.

and accepted as features of the natural soundscape, and in various cases sought after and pleasing;

- Considering one or more sound descriptor or equivalent can improve an acoustical assessment. Parameters such as $L_{A\text{Min}}$, $L_{A\text{eq},I}$, $L_{A\text{eq},F}$, $L_{C\text{eq}}$, $L_{A\text{Max}}$, L_{A10} , L_{A90} and spectral analysis forms part of the many variables that can be considered. The South African Legislation however is the $L_{A\text{eq},I}$ setting, and must at all times be considered;
- It is technically difficult and time consuming to improve the measurement of spectral distribution of large equipment in an industrial setting. This is due to the many correction factors that need to be considered (e.g. other noise sources active in the area, adequacy of average time setting, surrounding field non-uniformity etc.¹² as per SANS 9614-3:2005);
- Exact location of a sound level meter in an area in relation to structures, infrastructure, vegetation, wetlands and external noise sources will influence measurements. It may determine whether you are measuring anthropogenic sounds from a receptors dwelling, or environmental ambient soundscape contributors of significance (faunal, roads traffic, railway traffic movement etc.); and
- As a residential area develops the presence of people will result in increased dwelling related sounds. These are generally a combination of traffic noise, voices, animals and equipment (incl. TV's and Radios). The result is that ambient sound levels will increase as an area matures.

3.3 AMBIENT SOUND LEVEL MEASUREMENTS: N14 HIGHWAY

Ambient sound levels were measured at approximately 90 m from the N14 Highway and at one location from the 09th April – 10th April 2014. One class-1 SLMs as well as a portable weather station was used for measurements. The internal clocks were set to GMT+2. The sound level meters would measure “average” sound levels over 10 minutes periods, save the data and start with a new 10 minute measurement till the instrument was stopped.

The measurement location was numbered as A01 (see [Appendix C.1](#) for measurement location in UTM, latitude and longitude). This measurement was conducted over a period of at least 24 hours.

¹² SANS 9614-3:2005. “Determination of sound power levels of noise sources using sound intensity – Part 3: Precision method for measurement by scanning”.



Figure 3-1: Localities of ambient sound level measurements

3.3.1 Measurement Point A01: Receptor NSD01 – Thatchfield Golf Course

A number of 10 minute measurements were taken over a day/night period from 09th April – 10th April 2014. The equipment defined in **Table 3-1** was used for gathering data. Measured sound levels are presented in **Figure 3-2** and **Figure 3-3**.

Table 3-1: Equipment used to gather data (SVAN 955)

Equipment	Model	Serial no	Calibration Date
SLM	Svan 977	34160	17 May 2013
Microphone	ACO 7052E	54645	17 May 2013
Calibrator	NC-74	34494286	7 February 2014
Weather Station	WH3081PC	-	-

* Microphone fitted with the RION WS-03 outdoor all-weather windshield.

The measurement location was selected to be reflective of the typical environmental ambient sound levels within close proximity of the N14. As a result a SLM was erected in a relatively open field at the Thatchfield golf course. This location was also chosen as it was a safe area for the equipment to be left overnight. The closest location that could be sourced with a direct line of sight and with a safe location was at 90 m from the road under investigation. No locality within 15 m of the road could be sourced due to safety limitations.

Numerous other localities were investigated, including other dwellings or areas further down the N14 Road. These localities either had issues with equipment security, or measurements locations would be obscured by a property boundary wall (in relation to the N14 Road). Refer to [Appendix B.1](#) for a photo of this measured location.

Sounds heard during the period the instrument was deployed and collected (approximately 60 – 80 minutes): Refer to **Table 3-2** indicating sounds heard at the measurement point by the acoustical consultant.

Table 3-2: Noises/sounds heard during site visits at receptor A01

Ambient Sound Character - Sounds of Significance	
Magnitude Scale Code: Barely Audible Audible Dominating	Faunal and Natural Bird song (first day only).
	Residential and other Anthropogenic Lawn services (second day only).
	Industries, Commercial and Road Traffic Road traffic on N14 Highway.

Impulse equivalent sound levels (South African legislation): **Figure 3-2** illustrates the impulse 10 minute equivalent values. Equivalent (average) sound levels for the day and night-time periods are shown on **Figure 3-2**. During the daytime $L_{Aeq,I}$ values ranged between 57.5 to 69.0 dBA. The night-time $L_{Aeq,I}$ values ranged between 47.9 to 60.8 dBA. The average value of the 99 10-minute equivalent daytime sound level measurements were calculated at 64.5 dBA, while the average for the 48 night-time measurements were calculated at 53.9 dBA.

At most times the $L_{Aeq,I}$ levels were influenced by maximum noise events (both magnitude and number events) during both day and night-times. Calculated 16 hour day $L_{Aeq,16 h}$ values were calculated each day in chronological order as 64.8 and 61.7 dBA. Calculated 8 hour night $L_{Aeq,8 h}$ value was calculated as 55.3 dBA.

Fast equivalent sound levels (International guidelines): illustrates the equivalent fast values. Equivalent (average) sound levels for the day and night-time periods are shown on **Figure 3-2**. During the daytime $L_{Aeq,F}$ values ranged between 56.8 to 68.1 dBA. The night-time $L_{Aeq,F}$ values ranged between 47.2 to 60.1 dBA. The average value of the 99 10 min. equivalent daytime measurements were calculated at 63.7 dBA, while the average for the 48 night-time measurements were calculated at 53.1 dBA. $L_{Aeq,F}$ values are illustrated in this document for reference purpose.

The day/night 10 minute values ($L_{Aeq,F}$) remained below the impulse ($L_{Aeq,I}$) correspondent values, very closely mimicking its contours (less impulsive noise events, more continuous noise).

Statistical sound levels ($L_{A90,I}$): The L_{A90} level is presented in this report as it is used to define the “background ambient sound level”, or the sound level that can be expected if there were little single events (loud transient noises) that impacts on the average sound level. It is also illustrated on **Figure 3-3**. L_{A90} daytime values ranged from 52.5 to 66.1 dBA₉₀. The night-time L_{A90} values ranged from 44.2 to 57.1 dBA₉₀. The average value of the 99 10 min. equivalent daytime measurements was calculated at 59.7 dBA₉₀, while the average for the 48 night-time measurements were calculated at 48.0 dBA₉₀.

The L_{A90} levels were influenced by maximum noise events, amount and magnitude. Besides maximum noise events, the subsequent L_{A90} levels indicate that there were no times during the day and night-times when the background ambient soundscape became silent. Generally the ambient soundscape had consistent continuous sounds in the area, pierced on occasion by higher magnitude noise events ($L_{Amax,F}$). The L_{A90} statistical value remained above the 44.0 dBA₉₀, during the day breaking above the 60 dBA₉₀ plain

frequently. L_{A90} data also increased at roughly 4:30 – 05:00 on the morning, and would most likely be attributed to the surrounding area awakening during the dawn period preparing for their daily routine (e.g. bird dawn chorus, increased traffic flow on N14 Road etc.). During the night the quietest period was measured roughly between 02:00 and 03:00, when a peaceful period is likely sought in the area (sleeping etc.).

Statistical sound levels ($L_{A10,f}$): The L_{A10} level is presented in this report as reference to International guidelines such as the CRTN methodology. No measurements were conducted within 15 m of the road due to safety concerns of oncoming vehicles. L_{A10} is also illustrated on **Figure 3-3**. L_{A90} daytime values ranged between 59.6 and 69.8 dBA₁₀. The night-time L_{A10} values ranged from 48.4 to 62.3 dBA₁₀. The average value of the 99 10 min. equivalent daytime measurements was calculated at 66.0 dBA₁₀, while the average for the 48 night-time measurements were calculated at 56.2 dBA₁₀.

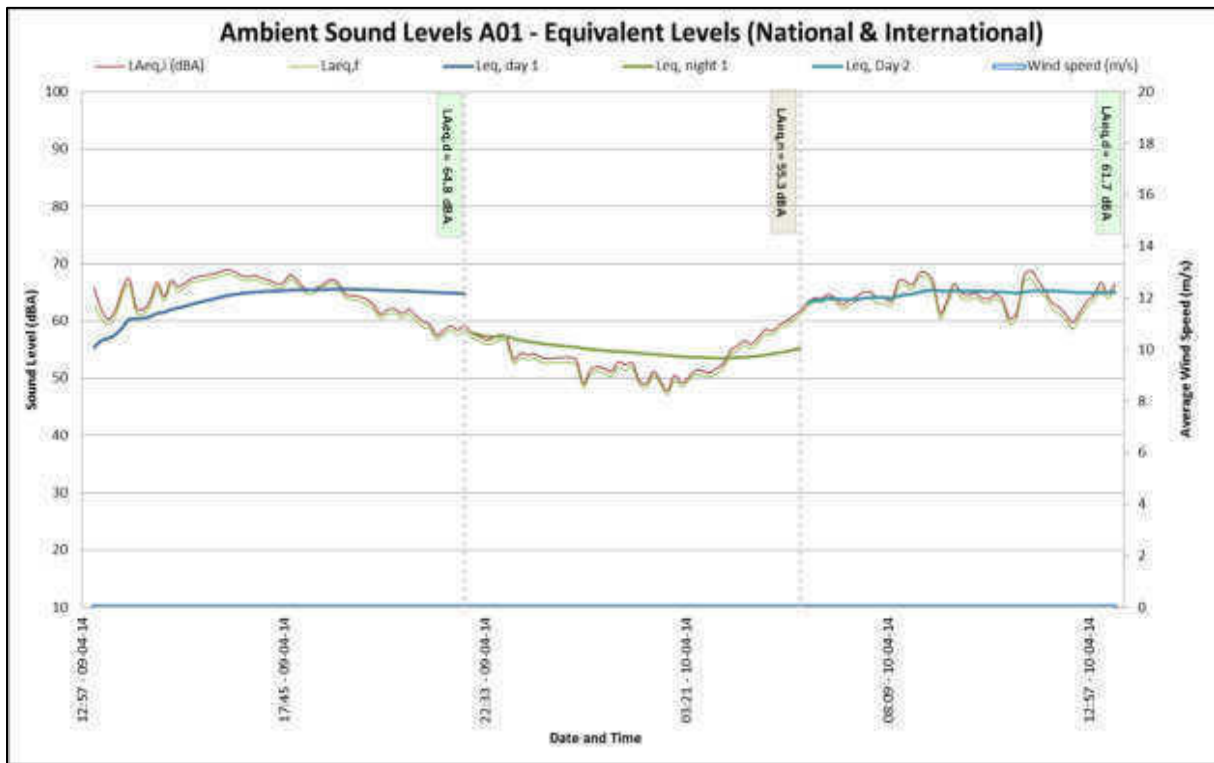


Figure 3-2: Ambient Sound Levels at A01

Maximum noise levels ($L_{Amax,F}$) RMS: Maximum sound levels are illustrated on **Figure 3-3** with the loudest day sound measured at 78.4 dBA (averaged 70.4 dBA), while night-time loudest sound measured at 67.8 dB (averaged 63.3 dBA). L_{Amax} levels exceeded 55 dBA on very few occasions during the night-times (during the 10 minute measurements) where noise events may become an annoyance.¹³

¹³ World Health Organization, 2009, 'Night Noise Guidelines for Europe.

Maximum sound events were of sufficient duration (or a number of short events) and/or magnitude to impact on L_{Aeq} graphs and 90th percentile statistical values. Most noise events recorded was due to vehicles traversing the adjacent N14 Road traffic.

Minimum noise levels ($L_{Amin,I}$) RMS: Minimum noise levels are illustrated on **Figure 3-3** with the quietest sounds measured during the day at 47.7 dBA (averaged 56.1 dBA), while night-time quietest was measured at 43.6 (averaged 46.5 dBA).

It illustrates an area that rarely becomes quiet with both the $L_{Amin,I}$ and L_{A90} values remaining for the most part above 40 dBA/90 plain. L_{A90} statistical and L_{Amin} values illustrated simultaneously as seen in **Figure 3-3** indicated that the measured ambient 90th percentile statistical equivalent values almost mimicked the RMS (root mean square) minimum 10 minute values during most measured periods.

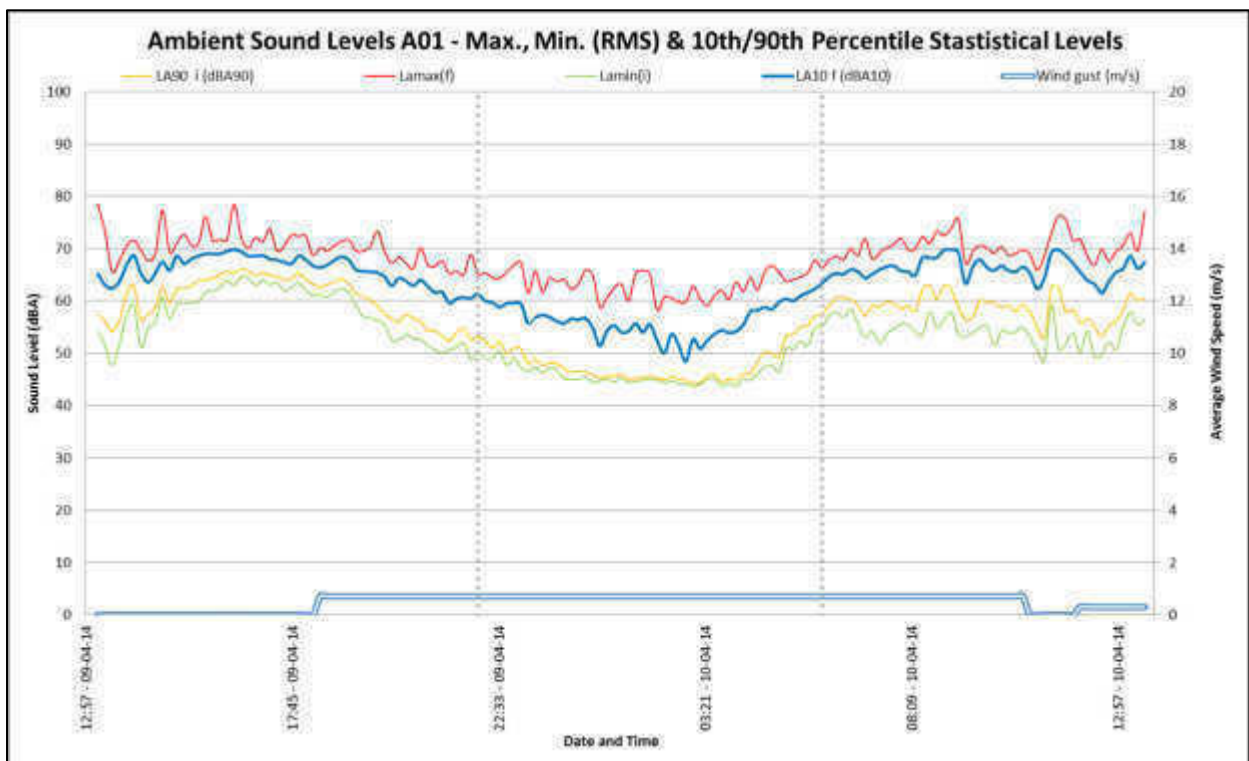


Figure 3-3: Maximum, minimum and statistical values at A01

Third octave spectral analysis (Figure 3-4 to Figure 3-6):

Lower frequencies (20 – 250 Hz): This frequency band is generally dominated by noises originating from anthropogenic activities (vehicles idling and driving, pumps and motors, etc.) as well as certain natural phenomena (wind shear, ocean surf splash etc.). Motor

vehicle engine revolutions per minute (1000 - 6000 rpm¹⁴) mostly convert to this range of frequency (not considering other motor car acoustical sources e.g. tyre to road interaction pumping and "horn effect")¹⁵. Faunal communication may contribute to this level (elephant infrasound), although faunal (smaller species i.e. insecta family) generally communicate with dominant frequencies at much higher levels (see further below). Lower frequencies (above infrasound etc.) also have the potential to propagate much further than the higher frequencies. Most day and night 10 min. measurements illustrate moderate to high peaks at the 25 - 50 Hz range.

Third octave surrounding 1000 Hz: This range contains energy mostly associated with dominant frequencies of human speech (dominant frequencies mostly between 350 Hz – 2,000 Hz, other voice frequencies can range between 20 – 16,000 Hz), dwelling related sounds, dogs barking, and road to tyre interaction from road traffic¹⁶. The frequency band surrounding this band had moderate to high energy in measured data, specifically at the 800 Hz range, most likely due to road traffic.

Higher frequencies (2,000 Hz upwards until ultrasound range): Most smaller faunal species, including animals, birds, frogs, crickets and cicada would use this range as the dominant frequency to communicate, hunt with etc.¹⁷ This could include male grasshoppers chirping at higher frequencies due to increased surrounding temperatures, mating season of a specific faunal species (and competition for territory - domination), insects near a wetland or before/during a drizzle/rain shower, cicada chirping or dawn chorus from birds during early morning hours etc. Natural faunal noise fluctuates depending on seasonal changes. During measurements there were predominant peaks in and around the 10, 000 Hz frequency band. On the second day the graphs had a more broadband character due to an increase in most third octave data above 2,000 Hz. This source of noise will be investigated below.

Summary: Spectral Analysis (Figure 3-4 to Figure 3-6):

Refer to above mentioned figure inserts (in red) illustrating a basic interpretation of data by removing certain measured data with potentially unwanted spectral signatures (e.g. a time when grass is cut, extraneous noises sources etc.). The criterion used to illustrate these spectral profiles was the amount of occurrences or repetitiveness of frequency timbres.

During the evenings the peaks at 8, 000 Hz was either crickets or cicada (likely cricket). Due to the lack of trees, shrubs or thickets no other faunal communication was measured.

¹⁴ Mechanical Engineering Conversion Factors, Dr. K. Clark Midkiff

¹⁵ SILVIA. "Guidance Manual for the Implementation of Low Noise Road Surface". 2nd ed. P.g 19.

¹⁶ SILVIA. "Guidance Manual for the Implementation of Low Noise Road Surface". 2nd ed. P.g 19.

¹⁷ A Paradoxical Problem. Can bush crickets discriminate frequency?, J.C Hartley, University of Nottingham. An Automatic Monitoring System for Recording Bat Activity, Colin O' Donnell and JAnd Sedgeley. Short Communication. The Scaling of song Frequency in Cicadas, H.C Bennet-Clark (1994).

On the second day some measured data was influenced by lawn services on the golf course.

The spectral contributors to the mid and low frequencies were predominantly road vehicle movement on the N14 Highway. The area surrounding the 1,000 Hz range had a medium/high magnitude, the contributor was the road tyre interaction on the paved road. It also likely indicates the speeds of vehicles at a medium to high pace, as the measurement locality was within 100 m of the road (the further the locality the less energy measured at peaks). At speeds below 60 km/h engine noise (fan belt, piston revolutions etc.) would dominate over road tyre interaction (and of course aerodynamic noise). Peaks at the lower frequency measured at the same time at peaks around the 1,000 Hz are dual frequency timbres which could be associated with vehicle movement on N14 Road. The road tyre interaction would contribute to the 1,000 Hz while the lower frequency would be mechanical motor vehicle related. These dual frequencies was measured during all times, indicating the road to be active during all hours.

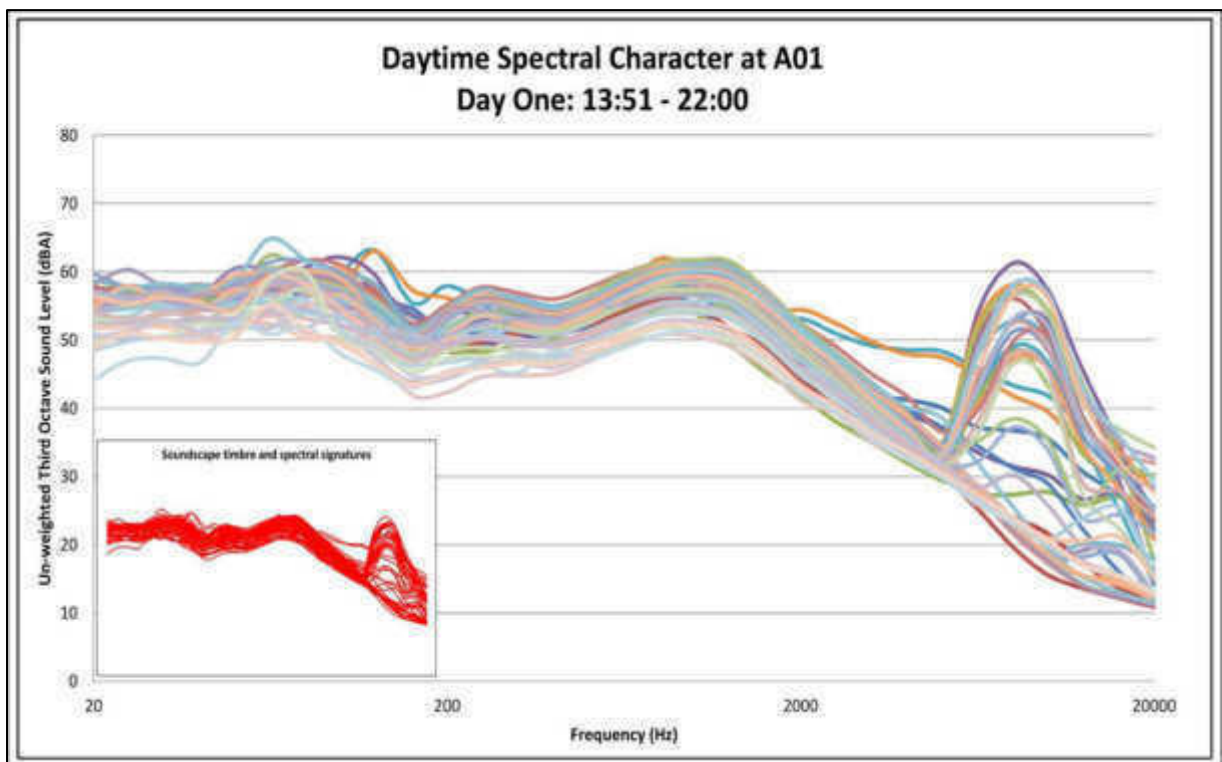


Figure 3-4: Daytime spectral frequency distribution at A01, 1st day

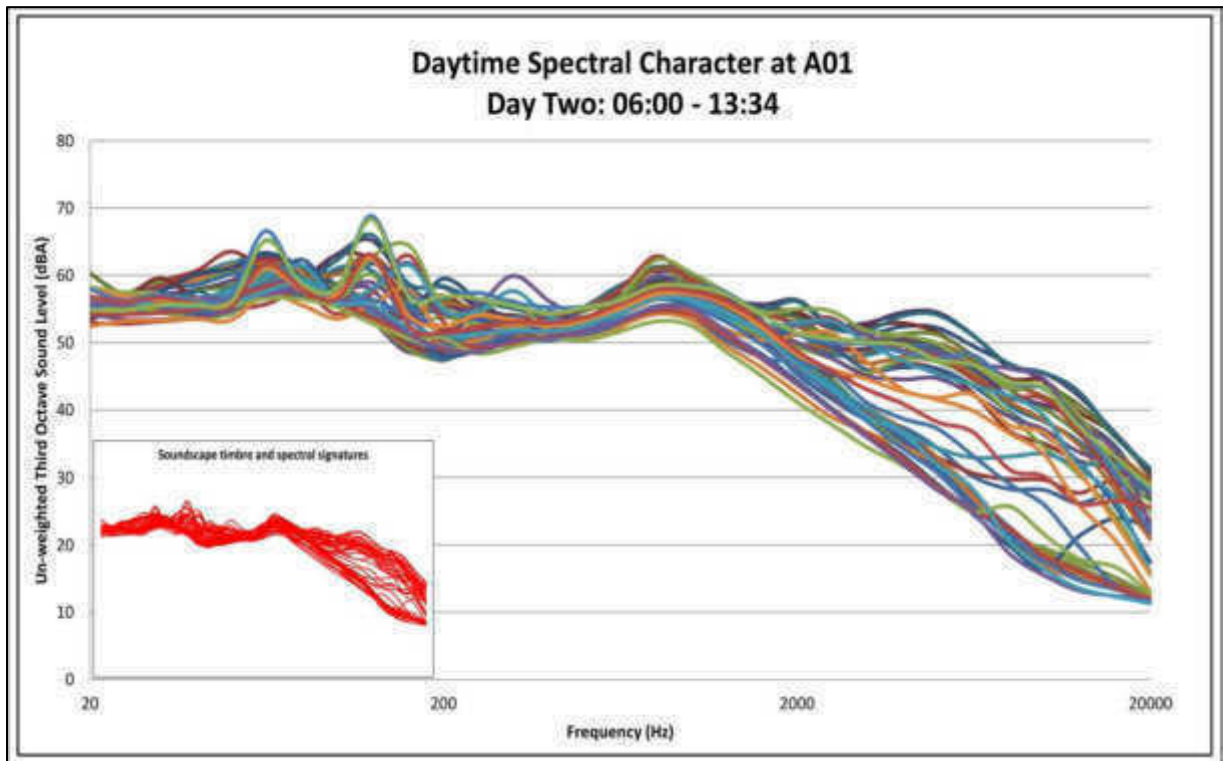


Figure 3-5: Daytime spectral frequency distribution at A01, 2nd day

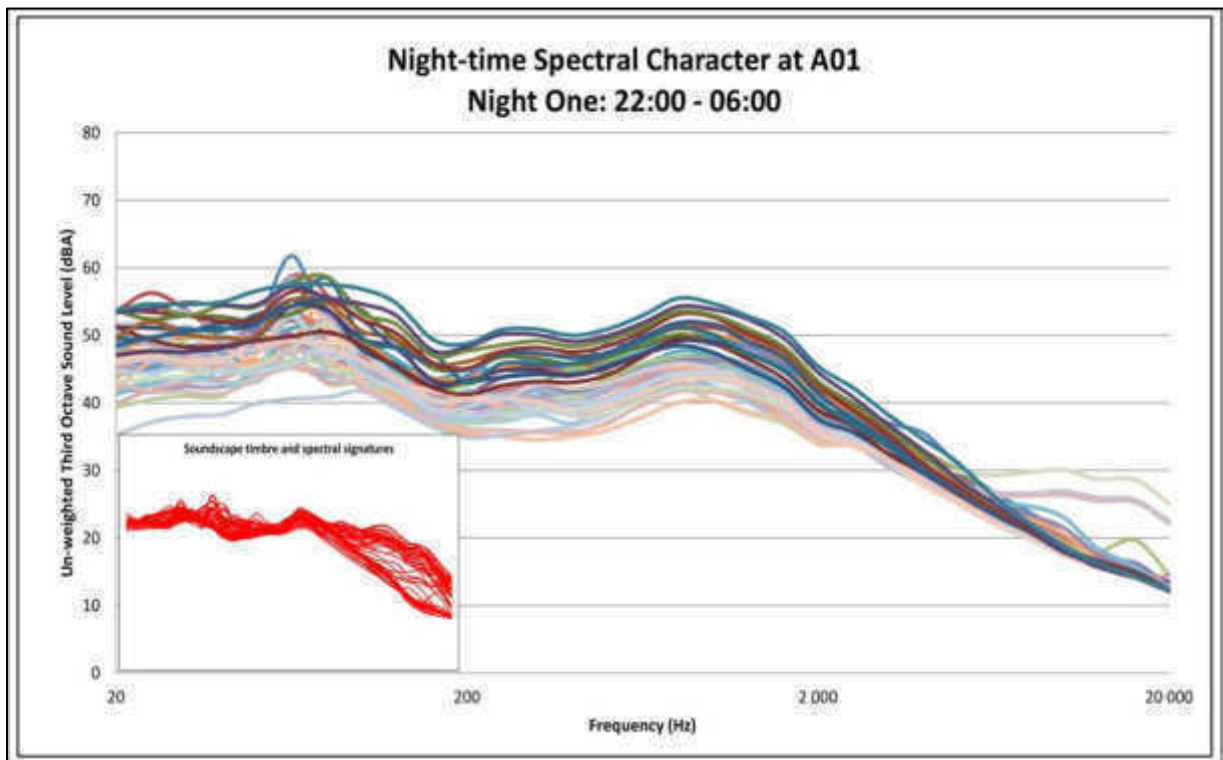


Figure 3-6: Night-time spectral frequency distribution at A01, 1st night

Metrological conditions: The highest measured wind speed was “light air” on the Beaufort Scale¹⁸.

SANS 10103:2008 Rating Level: Considering the $L_{Aeq,I}$ measured daytime data ambient sound indicated many sound levels slightly higher busy urban district, yet lower than a central business district. Night-time data reflected a slightly higher busy urban district, yet lower than an central business district. Refer to **Table 3-3** comparing each measured $L_{Req,T}$ based on $L_{Aeq,I}$ measurements. All 10 minute $L_{Aeq,F}$ levels measured during the day and night did not conformed to the recommendation of 55 and 45 dBA respectively set out by the World Health Organization (**Section 2.9.1**), World Bank (**Section 2.9.3**) and International Finance Corporation (**Section 2.9.4**) for a residential area.

3.4 AMBIENT SOUND LEVELS – SUMMARY

Road traffic movement on the N14 was the dominant contributor to all measured data. During the evening cricket or cicada (likely cricket) contributed to some measured data. On the second day some measurements were influenced by lawn services on the surrounding golf course. A summary of the SANS 10103:2008 noise districts rating levels at 90 m from the N14 Road is provided in **Table 3-3** below.

L_{A90} measured statistical levels indicate that the day and night-time background ambient soundscape was generally very high. There were consistent sounds in the area with the 90th percentile value very rarely dropping below 44 dB90 plain. Equivalent daytime ambient sound levels ($L_{Aeq,I}$ – South African Legislation) ranged between 47.9 and 69.0 dBA during all 10-minute measurement periods.

Table 3-3: Summary of Noise district Rating Levels

Point name	Noise district rating based on $L_{Aeq,I}$ measurement data (Day / Night)	Noise district rating based on all data and character of area	Existing ambient sound levels conforming to international recommended levels? (day / night)
A01	Busy urban – central business district.	Busy urban	No

There is a high confidence in the ambient sound levels measured and the subsequent Noise Rating Levels ($L_{Req,T}$) determined (at 90 m from the N14 Road).

¹⁸ Met Office, “National Meteorological Library and Archive Fact sheet 6 – The Beaufort Scale”, Version 1, Crown copyright 2010, p.4.

4 INVESTIGATED NOISE SOURCES

4.1 INVESTIGATED NOISE SOURCES

4.1.1 N14 Road Traffic

Noise propagation due road traffic depends on various acoustical factors. The most important are briefly discussed below.

4.1.1.1 Road tyre interaction and other vehicle noise sources¹⁹

The most significant noise contributor above 60 km p/h is the tyre interaction with the road surface. Tyre road impacts and shocks as well as tyre to road pumping (during standard rolling conditions, pumping is the compression of air under tyre tread) can contribute mainly below and above 1000 Hz respectively (up to 2000 Hz for pumping). The horn effect created by the geometry of the tyre and road surface can amplify up to frequencies of 10 000 Hz²⁰.

4.1.1.2 Road vehicle type

Vehicles noise emissions at speed vary from vehicle to vehicle. For acoustical purposes the classification of vehicles are considered as light or heavy. Heavy vehicles could be considered as articulated, tanker or other industrial freight trucks.

4.1.1.3 Road traffic volume

Road traffic with the volume and type of traffic generated may vary from day to day. Noise levels due to traffic volumes from the haul/existing roads will be estimated using the methods stipulated in SANS 10210:2004 (Calculating and predicting road traffic noise).

4.1.1.4 Other road noise contributors

Other noise sources associated with motor vehicles include the exhaust outlet, engine motor and associated engine components such as fan belt (mostly audible below 60 km p/h). Many motor engine revs per minute (rpm) convert to a low range of frequency below the 100 Hz range. Wind shear noise can contribute to vehicle movement although mostly at very high speeds only.

¹⁹ Milieu. *Inventory of Potential Measures for a Better Control of Environmental Noise*. DG Environment of the European Commission. 2010.

²⁰ FEHRL Report 2006/02, *Guidance manual for the implementation of low-noise road surfaces*

5 METHODS: NOISE IMPACT ASSESSMENT

5.1 POTENTIAL NOISE IMPACTS ON ANIMALS²¹

A great deal of research was conducted in the 1960's and 1970's on the effects of aircraft noise on animals. While aircraft noise have a specific characteristic that might not be comparable with industrial noise, the findings should be relevant to most noise sources.

Overall, the research suggests that species differ in their response to:

- Various types of noise, durations of noise, magnitude of the noise, characteristic of the noise and sources of noise.

A general animal behavioural reaction to aircraft noise is the startle response. However, the strength and length of the startle response appears to be dependent on:

- Which species is exposed (difference in hearing sensitivity, susceptibility to noise-induce hearing loss etc.);
- Whether there is one animal or a group; and
- Whether there have been some previous exposures.

There are numerous other factors in the environment of animals that also influence the effects of noise. These include predators, weather, changing prey/food base and ground-based disturbance, especially anthropogenic. This hinders the ability to define the real impact of noise on animals.

From these and other studies the following can be concluded:

- Animals respond to impulsive (sudden) noises (higher than 90 dBA) by running away. If the noises continue, animals would try to relocate. This is not relevant to wind energy facilities because the turbines do not generate impulsive noises close to these sound levels;
- Animals of most species exhibit adaptation with noise, including aircraft noise and sonic booms;
- More sensitive species would relocate to a more quiet area, especially species that depend on hearing to hunt or evade prey, or species that makes use of sound/hearing to locate a suitable mate; and
- Noises associated with helicopters, motor- and quad bikes significantly impact on animals.

²¹ USEPA, 1971: "Effects of Noise on Wildlife and other animals".

As such various South African/International guidelines existing very briefly mentioning potential noise impacts on wildlife from industrial and commercial industries, it has the issue where no acoustical criteria is defined²². Faunal guidelines exists regarding the protection of an animal's surrounding environment, with "physical" impacts such as water, vegetation etc. a far more critical impact than that of acoustics.

With the available information in mind, this documents intent remains a determination of the existing rating level and the potential increase of magnitude above (in dB, with applicable corrections) at a receptors dwelling as per legislation/guidelines, and due to a proposed noise source of significance (see **Section 2**).

5.1.1 Effects of Noise on Wildlife

Potential noise impacts on wildlife are very highly species dependent. Studies showed that most animals adapt to noises and would even return to a site after an initial disturbance, even if the noise continues. The more sensitive animals that might be impacted by noise would most likely relocate to a quieter area.

There are a few specific studies discussing the potential impacts of noise on wildlife associated with construction, transportation and industrial facilities. Available information indicates that noises from transportation and industrial may mask the sounds of a predator approaching; similarly predators depending on hearing would not be able to locate their prey.

Many natural based acoustics themselves may be loud or impulsive. Examples include thunder, wind induced noises that could easily exceed 35 dBA ($L_{A90,fast}$) above wind speeds averaging 6 m/s (wind conditions of a moderate breeze on the Beaufort Scale²³), noise levels during early morning dawn chorus or loud cicada noises during late evening or early morning.

5.1.2 Effects of Noise on Domesticated Animals

It may be that domesticated animals are more accustomed to noise sources of an industrial, commercial or other anthropogenic nature, although exposure to high noise levels may affect domestic animals well-being. Sound levels in animal shelters can exceed 100 dB, much more than what can be expected at a domestic dwelling from an industrial, commercial or transportation noise source (10 minute equivalent)^{24&25}. The high noise

²² E.g. International council of Mining & Metals. "Good Practice Guidance for Mining and Biodiversity". P.g. 63.

²³ Met Office, "National Meteorological Library and Archive Fact sheet 6 – The Beaufort Scale", Version 1, Crown copyright 2010, p.4.

²⁴ Crista L. Coppola. Noise in the Animal Shelter Environment: Building Design and the Effects of Daily Noise Exposure.

²⁵ David Key, Essential Kennel Designs.

levels may see negative influences on animals cardiovascular systems and behaviour, and may be damaging to the hearing of dogs in the kennel facility²⁶.

Domesticated animals may also respond differently to noises than animals in the wild. Domesticated dogs are pack animals and may respond excitedly or vocally to other noises, smells, visual and other stimulants, in contrast to wild animals that may flee at the slight sound of a noise or visual disturbances. Animals that are transported at least once in their life (such as pigs to an abattoir) would endure high noise levels for the duration of the delivery period. A change in the heart rate, renal blood flow and blood pressure of study subjects were noted in the above studies.

5.1.3 Laboratory Animal Studies

Although many laboratory animals have wild counterparts (rats, mice) the laboratory test subjects differ in many aspects (genetics, behaviour etc.). Also noise levels of studies are conducted at generally very high levels at over 100 dB, much more than what would be experienced in environmental settings around industrial, commercial or transportation activities.²⁷ Other dissimilarities to laboratory tests and a natural environment include the time exposure (duration of noise), the spectral and noise character (impulsive noise vs. constant noise) etc. Although there exist dissimilarities in tests conducted and noise levels around commercial and industrial environments, laboratory rodents exposed to high noise levels did indicate physiological, behavioural changes, hearing loss and other such effects²⁸.

5.2 WHY NOISE CONCERNS COMMUNITIES²⁹

Noise can be defined as "unwanted sound", and an audible acoustic energy that adversely affects the physiological and/or psychological well-being of people, or which disturbs or impairs the convenience or peace of any person. One can generalise by saying that sound becomes unwanted when it:

- Hinders speech communication;
- Impedes the thinking process;
- Interferes with concentration;
- Obstructs activities (work, leisure and sleeping); and
- Presents a health risk due to hearing damage.

²⁶ Wei, B. L. (1969). Physiological effects of audible sound. AAAS Symposium Science, 166(3904), 533-535.

²⁷ USEPA, 1971: "Effects of Noise on Wildlife and other animals".

²⁸ Ann Linda Baldwin. "Effect of Noise on Rodent Physiology". 2007.

²⁹ World Health Organization, 1999; Noise quest, 2010; Journal of Acoustical Society of America, 2009

However, it is important to remember that whether a given sound is "noise" depends on the listener or hearer. The driver playing loud rock music on their car radio hears only music, but the person in the traffic behind them hears nothing but noise.

Response to noise is unfortunately not an empirical absolute, as it is seen as a multi-faceted psychological concept, including behavioural and evaluative aspects. For instance, in some cases, annoyance is seen as an outcome of disturbances, in other cases it is seen as an indication of the degree of helplessness with respect to the noise source.

Noise does not need to be loud to be considered "disturbing". One can refer to a dripping tap in the quiet of the night, or the irritating "thump-thump" of the music from a neighbouring house at night when one would prefer to sleep.

Severity of the annoyance depends on factors such as:

- Background sound levels as well as the background sound levels the receptor is used to;
- The manner in which the receptor can control the noise (helplessness);
- The time, unpredictability, frequency distribution, duration, and intensity of the noise;
- The physiological state of the receptor; and
- The attitude of the receptor about the emitter (noise source).

5.2.1 Annoyance associated with Industrial Processes

Annoyance is the most widely acknowledged effect of environmental noise exposure, and is considered to be the most widespread. It is estimated that less than a third of the individual noise annoyance is accounted for by acoustic parameters, and that the non-acoustic factors play a major role. Non-acoustic factors that have been identified include age, economic dependence on the noise source, attitude towards the noise source and self-reported noise sensitivity.

On the basis of a number of studies into noise annoyance, exposure-response relationships were derived for high annoyance from different noise sources. These relationships, illustrated in **Figure 5-1**, are recommended in a European Union position paper published in 2002, stipulating policy regarding the quantification of annoyance. This can be used in Environmental Health Impact Assessment and cost-benefit analysis to translate noise maps into overviews of the numbers of persons that may be annoyed, thereby giving insight into the situation expected in the long term. It is not applicable to local complaint-type situations or to an assessment of the short-term effects of a change in noise climate.

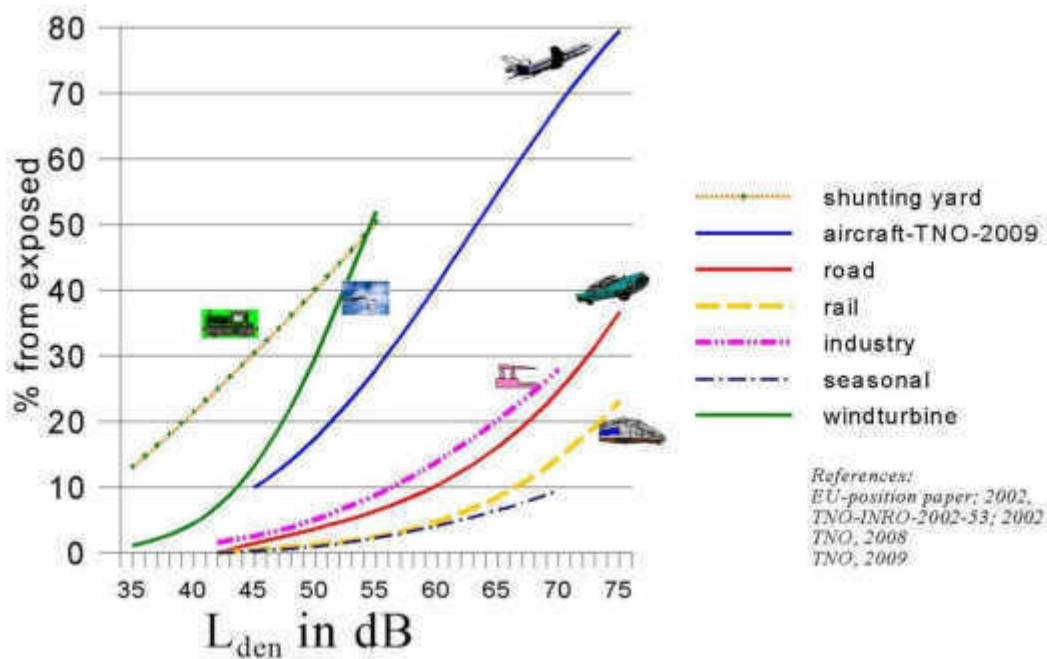


Figure 5-1: Percentage of annoyed persons as a function of the day-evening-night noise exposure at the façade of a dwelling

As shown in **Figure 5-1**, there is significant potential of annoyance associated with noise from shunting operations, mainly due to the highly impulsive character of the noises created.

5.3 IMPACT ASSESSMENT CRITERIA

5.3.1 Overview: The Common Characteristics

The word "noise" is generally used to convey a negative response or attitude to the sound received by a listener. There are four common characteristics of sound, any or all of which determine listener response and the subsequent definition of the sound as "noise". These characteristics are:

- Intensity;
- Loudness;
- Annoyance; and
- Offensiveness.

Of the four common characteristics of sound, intensity is the only one which is not subjective and can be quantified. Loudness is a subjective measure of the effect sound has on the human ear. As a quantity it is therefore complicated, but has been defined by experimentation on subjects known to have normal hearing.

The annoyance and offensive characteristics of noise are also subjective. Whether or not a noise causes annoyance mostly depends upon its reception by an individual, the environment in which it is heard, the type of activity and mood of the person and how acclimatised or familiar that person is to the sound.

5.3.2 Noise criteria of concern

The criteria used in this report were drawn from the criteria for the description and assessment of environmental impacts from the EIA Regulations, published by the Department of Environmental Affairs (June 2006) in terms of the NEMA, SANS 10103:2008 as well as guidelines from the World Health Organization.

There are a number of criteria that are of concern for the assessment of noise impacts. These can be summarised in the following manner:

- *Increase in noise levels:* People or communities often react to an increase in the ambient noise level they are used to, which is caused by a new source of noise. With regards to the Noise Control Regulations, an increase of more than 7 dBA is considered a disturbing noise. See also **Figure 5-2**.
- *Zone Sound Levels:* Previously referred to as the acceptable rating levels, it sets acceptable noise levels for various areas. See also **Table 5-1**.
- *Absolute or total noise levels:* Depending on their activities, people generally are tolerant to noise up to a certain absolute level, e.g. 65 dBA. Anything above this level will be considered unacceptable.

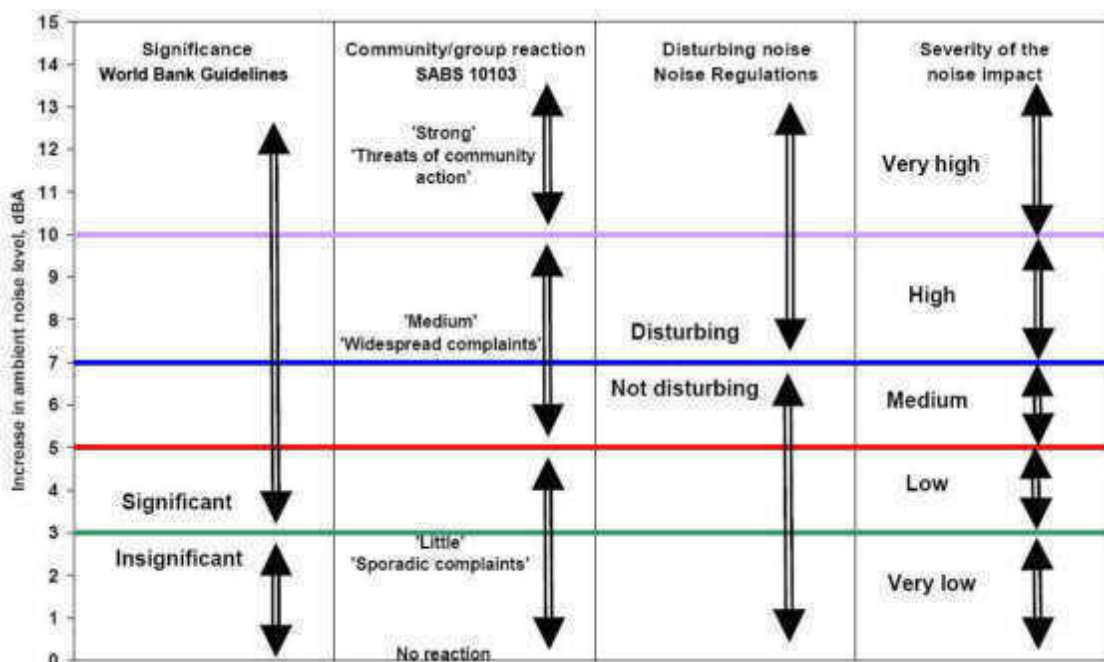


Figure 5-2: Criteria to assess the significance of impacts stemming from noise

In South Africa, the document that addresses the issues concerning environmental noise is SANS 10103:2008 (See also **Table 5-1**). It provides the equivalent ambient noise levels (referred to as Rating Levels), $L_{Req,D}$ and $L_{Req,N}$, during the day and night respectively to which different types of developments may be exposed.

Due to the variance in ambient sound measurements it is recommended that the project consider the guideline levels for residential use as set by international institutions such as World Health Organization, World Bank and International Finance Corporation for residential areas as well as the South African SANS10103:2008 guidelines.

During site measurements (**Section 3.3**) $L_{Aeq,T}$ ranged between "Rural" to "Suburban". By considering other measured variables and by taking a precautionous stance (due to seasonal faunal sounds, unwanted noises from dwellings etc.) the following SANS 10103:2008 rating levels (zone sound levels for a quieter area than measured during the site visit, particularly during the night-times – based on the character of the area) will be considered. For receptors in the study area the following was considered:

- Urban district $L_{Req,D}$ of 55 dBA; and
- Urban district $L_{Req,N}$ of 45 dBA.

International guidelines should also be considered. The International IFC (Equator Principle) Residential; institutional and educational referenced areas includes ratings of:

- Use of $L_{Req,D}$ of 55 dBA during the daytimes; and
- Use of $L_{Req,N}$ of 45 dBA during the night-times.

SANS 10103:2008 also provides a guideline for estimating community response to an increase in the general ambient noise level caused by an intruding noise. If Δ is the increase in sound level, the following criteria are of relevance:

- **$\Delta \leq 3$ dBA:** An increase of 3 dBA or less will not cause any response from a community. It should be noted that for a person with average hearing acuity an increase of less than 3 dBA in the general ambient noise level would not be noticeable.
- **$3 < \Delta \leq 5$ dBA:** An increase of between 3 dBA and 5 dBA will elicit 'little' community response with 'sporadic complaints'. People will just be able to notice a change in the sound character in the area.
- **$5 < \Delta \leq 15$ dBA:** An increase of between 5 dBA and 15 dBA will elicit a 'medium' community response with 'widespread complaints'. In addition, an increase of 10 dBA is subjectively perceived as a doubling in the loudness of a noise. For an

increase of more than 15 dBA the community reaction will be 'strong' with 'threats of community action'.

Note that an increase of more than 7 dBA is defined as a disturbing noise and prohibited (National and Provincial Noise Control Regulations).

Table 5-1: Acceptable Zone Sound Levels for noise in districts (SANS 10103:2008)

1	2	3	4	5	6	7
Type of district	Equivalent continuous rating level ($L_{Req,T}$) for noise dBA					
	Outdoors			Indoors, with open windows		
	Day/night $L_{R,dn}^a$	Daytime $L_{Req,d}^b$	Night-time $L_{Req,n}^b$	Day/night $L_{R,dn}^a$	Daytime $L_{Req,d}^b$	Night-time $L_{Req,n}^b$
a) Rural districts	45	45	35	35	35	25
b) Suburban districts with little road traffic	50	50	40	40	40	30
c) Urban districts	55	55	45	45	45	35
d) Urban districts with one or more of the following: workshops; business premises; and main roads	60	60	50	50	50	40
e) Central business districts	65	65	55	55	55	45
f) Industrial districts	70	70	60	60	60	50

5.3.3 Other noise sources of significance

In addition, other noise sources that may be present should also be considered. During the day, people are generally bombarded with the sounds from numerous sources considered "normal", such as animal sounds, conversation, amenities and appliances (TV/Radio/CD playing in background, computer(s), freezers/fridges, etc). This excludes activities that may generate additional noise associated with normal work.

At night, sounds that are present are natural sounds from animals, wind as well as other sounds we consider "normal", such as the hum from a variety of appliances (magnetostriction) drawing standby power, freezers and fridges.

Figure 5-3 illustrates the sound levels associated with some equipment or in certain rooms. This is however more for illustrative purposes, as there are many manufacturers with different equipment, each with a different noise emission character.

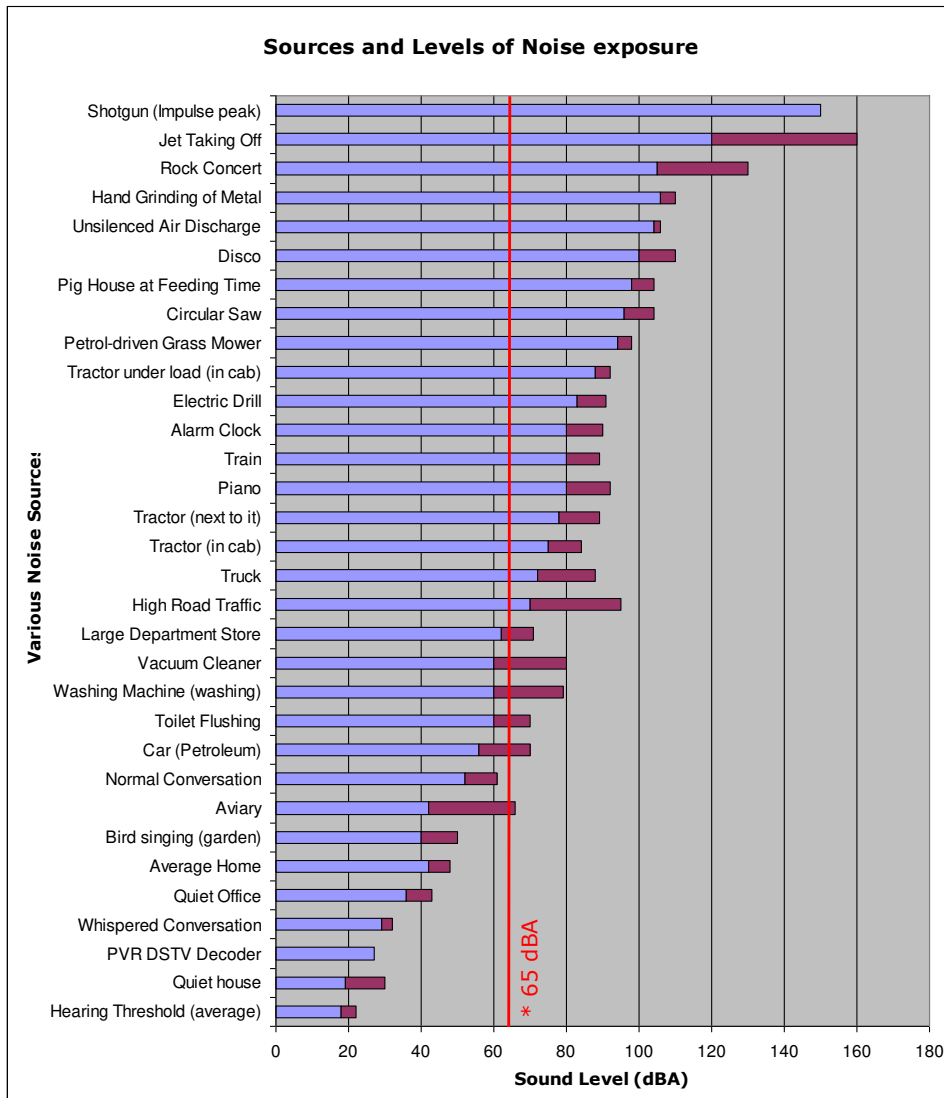


Figure 5-3: Typical Noise Sources and associated Sound Pressure Level

5.3.4 Determining the Significance of the Noise Impact

The level of detail as depicted in the EIA regulations was fine-tuned by assigning specific values to each impact. In order to establish a coherent framework within which all impacts could be objectively assessed, it was necessary to establish a rating system, which was applied consistently to all the criteria. For such purposes each aspect was assigned a value as defined in the third column in the tables below.

The impact consequence is determined by the summing the scores of Magnitude **Table 5-2**), Duration (**Table 5-3**) and Spatial Extent (**Table 5-4**). The impact significance (see **Sections 5.3.5** and **Section 5.3.6**) is determined by multiplying the Consequence result with the Probability score (**Table 5-5**).

An explanation of the impact assessment criteria is defined in the following tables.

Table 5-2: Impact Assessment Criteria - Magnitude

This defines the impact as experienced by any receptor. In this report the receptor is defined as any resident in the area, but excludes faunal species.		
Rating	Description	Score
<i>Low</i>	Increase in average sound pressure levels between 0 and 3 dB from the expected ambient sound levels. Ambient sound levels are defined by the lower of the measured $L_{A_{1eq,8h}}$ or $L_{A_{1eq,16h}}$ during measurement dates (Section 3.3). Total projected noise level is less than the Zone Sound Level and/or Equator Principle in wind-still conditions.	2
<i>Low Medium</i>	Increase in average sound pressure levels between 3 and 5 dB from the expected ambient sound levels. Total projected noise levels between 3 and 5 above the Zone Sound Level and/or Equator Principle (wind-less conditions).	4
<i>Medium</i>	Increase in average sound pressure levels between 5 and 7 dB from the ambient sound levels. Increase in sound pressure levels between 5 and 7 above the Zone Sound Level and/or Equator Principle (wind less conditions). Sporadic complaints expected.	6
<i>High</i>	Increase in average sound pressure levels between 7 and 10 from the ambient sound level. Total projected noise levels between 7 and 10 dBA above the Zone Sound Level and/or Equator Principle (wind-less condition). Medium to widespread complaints expected.	8
<i>Very High</i>	Increase in average ambient sound pressure levels higher than 10 dBA. Total projected noise levels higher than 10 dB above the Zone Sound Level and/or Equator Principle (wind less-conditions). Change of 10 dBA is perceived as 'twice as loud', leading to widespread complaints and even threats of community or group action. Any point where instantaneous noise levels exceed 65 dBA at any receptor.	10

Table 5-3: Impact Assessment Criteria - Duration

The lifetime of the impact that is measured in relation to the lifetime of the proposed development (construction, operational and closure phases). Will the receptors be subjected to increased noise levels for the lifetime duration of the project, or only infrequently.		
Rating	Description	Score
<i>Temporary</i>	Impacts are predicted to be of short duration (portion of construction period) and intermittent/occasional.	1
<i>Short term</i>	Impacts that are predicted to last only for the duration of the construction period.	2
<i>Long term</i>	Impacts that will continue for the life of the Project, but ceases when the Project stops operating.	4
<i>Permanent</i>	Impacts that cause a permanent change in the affected receptor or resource (e.g. removal or destruction of ecological habitat) that endures substantially beyond the Project lifetime.	5

Table 5-4: Impact Assessment Criteria – Spatial extent

Classification of the physical and spatial scale of the impact		
Rating	Description	Score
<i>Site</i>	The impacted area extends only as far as the activity, such as footprint occurring within the total site area.	1
<i>Local</i>	The impact could affect the local area (within 1,000 m from site).	2
<i>Regional</i>	The impact could affect the area including the neighbouring farms, the transport routes and the adjoining towns.	3

<i>National</i>	The impact could have an effect that expands throughout the country (South Africa).	4
<i>International</i>	Where the impact has international ramifications that extend beyond the boundaries of South Africa.	5

Table 5-5: Impact Assessment Criteria - Probability

This describes the likelihood of the impacts actually occurring, and whether it will impact on an identified receptor. The impact may occur for any length of time during the life cycle of the activity, and not at any given time. The classes are rated as follows:		
Rating	Description	Score
<i>Improbable</i>	The possibility of the impact occurring is none, due either to the circumstances, design or experience. The chance of this impact occurring is zero (0 %).	1
<i>Possible</i>	The possibility of the impact occurring is very low, due either to the circumstances, design or experience. The chances of this impact occurring is defined to be up to 25 %.	2
<i>Likely</i>	There is a possibility that the impact will occur to the extent that provisions must therefore be made. The chances of this impact occurring is defined to be between 25% and 50 %.	3
<i>Highly Likely</i>	It is most likely that the impacts will occur at some stage of the development. Plans must be drawn up before carrying out the activity. The chances of this impact occurring is defined between 50 % to 75 %.	4
<i>Definite</i>	The impact will take place regardless of any prevention plans, and only mitigation actions or contingency plans to contain the effect can be relied on. The chance of this impact occurring is defined to be between 75% and 100 %.	5

In order to assess each of these factors for each impact, the following ranking scales as contained in **Table 5-6** will be used.

Table 5-6: Assessment Criteria: Ranking Scales

PROBABILITY		MAGNITUDE	
Description / Meaning	Score	Description / Meaning	Score
Definite/don't know	5	Very high/don't know	10
Highly likely	4	High	8
Likely	3	Medium	6
Possible	2	Low Medium	4
Improbable	1	Low	2
DURATION		SPATIAL SCALE	
Description / Meaning	Score	Description / Meaning	Score
		International	5
Permanent	5	National	4
Long Term	4	Regional	3
Short term	2	Local	2
Temporary	1	Footprint	1

5.3.5 Identifying the Potential Impacts without Mitigation Measures (WOM)

Following the assignment of the necessary weights to the respective aspects, criteria are summed and multiplied by their assigned probabilities, resulting in a Significance Rating (SR) value for each impact (prior to the implementation of mitigation measures).

Significance without mitigation is rated on the following scale:

SR<30	Low (L)	Impacts with little real effect and which should not have an influence on or require modification of the project design or alternative mitigation. No mitigation is required.
30< SR <60	Medium (M)	Where it could have an influence on the decision unless it is mitigated. An impact or benefit which is sufficiently important to require management. Of moderate significance - could influence the decisions about the project if left unmanaged.
SR>60	High (H)	Impact is significant, mitigation is critical to reduce impact or risk. Resulting impact could influence the decision depending on the possible mitigation. An impact which could influence the decision about whether or not to proceed with the project.

5.3.6 Identifying the Potential Impacts with Mitigation Measures (WM)

In order to gain a comprehensive understanding of the overall significance of the impact, after implementation of the mitigation measures, it will be necessary to re-evaluate the impact. Significance with mitigation is rated on the following scale:

SR<30	Low (L)	The impact is mitigated to the point where it is of limited importance.
30< SR <60	Medium (M)	Notwithstanding the successful implementation of the mitigation measures, to reduce the negative impacts to acceptable levels, the negative impact will remain of significance. However, taken within the overall context of the project, the persistent impact does not constitute a fatal flaw.
SR>60	High (H)	The impact is of major importance. Mitigation of the impact is not possible on a cost-effective basis. The impact is regarded of high importance and taken within the overall context of the project, is regarded as a fatal flaw. An impact regarded as high significance, after mitigation could render the entire development option or entire project proposal unacceptable.

5.4 REPRESENTATION OF NOISE LEVELS

Noise rating levels will be calculated in this report using the appropriate sound propagation models as defined. It is therefore important to understand the difference between sound or noise level as well as the noise rating level (also see Glossary of Terms, [Appendix A](#)).

Sound or noise levels generally refers to a level as measured using an instrument, whereas the noise rating level refers to a calculated sound exposure level to which various corrections and adjustments was added. These noise rating levels are further processed into a 3D map illustrating noise contours of constant rating levels or noise isopleths. In this project it illustrate the potential extent of the calculated noises of the complete project and not noise levels at a specific moment in time.

6 METHODS: CALCULATION OF NOISE CLIMATE

6.1 NOISE CLIMATE ON THE SURROUNDING ENVIRONMENT

6.1.1 Linear Sources – Road Traffic

The noise emission into the environment due to road traffic will be calculated using the sound propagation model described in SANS 10210. Calculated corrections such as the following will be considered:

- Distance of receptor from the road;
- Road construction material;
- Average speeds of travel;
- Types of vehicles used;
- Road gradient; and
- Ground acoustical conditions.

6.2 SOUND PROPAGATION - CALCULATION LIMITATIONS

Limitations due to the calculations of the noise emissions into the environment include the following:

- Many sound propagation models do not consider certain sound characteristics as calculations are based on an equivalent level (however impulse and tone corrections do exist in certain models). These characteristics may include differentiation between “natural” or “unnatural” sounds or amplitude modulation;
- Many sound propagation models do not calculate the increase of the ambient soundscape due to wind shear (masking noise);
- Most sound propagation models do not consider refraction through the various temperature layers (specifically relevant during the night-times);
- Many sound propagation models do not consider the low frequency range (third octave 16 – 31.5 Hz). This would be relevant to facilities with a potentially low frequency issues;
- Many environmental models consider sound to propagate in hemi-spherical way. Certain noise sources (e.g. a speakers, exhausts, fans) emit sound power levels in a directional manner;
- It is assumed that the octave sound power levels selected for processes and equipment accurately represents the sound character and power levels of processes/equipment. The determination of these levels in itself is subject to errors, limitations and assumptions with any potential errors carried over to any model making use of these results;

- Rating level contours as illustrated in this document are representative of the various rating levels and the change of mentioned ratings. It is used as a representation for an assessment purposes;
- The impact of atmospheric absorption is simplified and very uniform meteorological conditions are considered. This is an over-simplification and the effect of this in terms of sound propagation modelling is difficult to quantify; and
- Acoustical characteristics of the ground are over-simplified with ground conditions accepted as uniform. Ground conditions will be considered in this assessment.

As such, sound propagation modelling does not aim to calculate the sound level at a receptors, but rather aim to estimate a noise level (referred to as the Rating Level) that considers factors and corrections such as source characteristics, tones, impulsiveness, time-of-day corrections, etc. The calculated noise level therefore is referred to as the noise Rating Level in this report.

6.3 INVESTIGATED INITIAL SCENARIO

This section investigates calculated Rating Levels at the Rooihuiskraal development based on current traffic volumes. Daytime (06:00 – 22:00) and night-time (22:00 – 06:00) operations will be assessed. Most critical investigational times would be the night-time hours when a quiet environment is desired (at night for sleeping, weekends etc.). Calculations are based on a worst-case scenario and will not be relevant during all times, only peak traffic conditions. Calculations are more indicative of Rating Levels of houses with a direct line of sight from the development to the N14 Road.

6.3.1 Investigated Construction Scenarios for Representation- Day and Night-times

6.3.1.1 Road Traffic

Traffic calculations on N14 Road based on values courtesy of Syntell Group Company, Mikros Traffic Monitoring (**Section 1.4**). Roads considered as (single-lane alternative directions) continuous paved random chippings and grooving route (non-porous i.e. semi dense air void of 9 – 14 %³⁰ or less, no sealant). Traffic speed was calculated at constant mean speed of 120 km/h³¹. A 2.5 dB façade correction (in which a façade will be at the position of the receiver) was added, as recommended by SANS10210:2004³².

³⁰ SILVIA. *Guidance Manual for the Implementation of Low Noise Road Surface 2nd ed.* FEHRL Report

³¹ Committee of Transport Officials. "TRH 26, South African Road Classification and Access Management Manual". Version 1.0.2012.

³² "Add +2,5 dB to the predicted noise level if the calculations are being undertaken to determine the amount of road traffic noise to which a future development (in which a façade will be at the position of the receiver) will be subjected". SANS10210:2008.

6.3.1.2 Existing Ambient Contributors and Acoustical Factors

The following ambient soundscape factors were considered:

- Intervening ground conditions of a medium ground nature, i.e. some flora etc. (50% hard ground conditions). Refer to **Section 1.3.5**; and
- Activities assessed functioned during wind-still conditions, in good sound propagation conditions (20°C and 80% humidity).

6.4 INVESTIGATED 15 YEAR FUTURE SCENARIO³³

This section investigates the future calculated Rating Level when with an increased traffic flow on the N14 Road can be expected (e.g. in 15 years). This is conducted as required by legislation. Daytime (06:00 – 22:00) and night-time (22:00 – 06:00) operations will be assessed. Most critical investigational times would be the night-time hours when a quiet environment is desired (at night for sleeping, weekends etc.). Calculations are based on a worst-case scenario and will not be relevant during all times, only peak traffic conditions. Calculations are more indicative of Rating Levels of houses with a direct line of sight from the development to the N14 Road.

6.4.1 Investigated Operational Scenarios for Representation- Day and Night-times

6.4.1.1 Road Traffic

Future traffic increase of 5% assumed from initial calculations (**Section 6.4.1.1**). Roads considered as (single-lane alternative directions) continuous paved random chippings and grooving route (non-porous i.e. semi dense air void of 9 – 14 %³⁴ or less, no sealant). Traffic speed was calculated at constant mean speed of 120 km/h³⁵. A 2.5 dB façade correction (in which a façade will be at the position of the receiver) was added, as recommended by SANS10210:2004³⁶.

6.4.1.2 Existing Ambient Contributors and Acoustical Factors

The following ambient soundscape factors were considered:

- Intervening ground conditions of a medium ground nature, i.e. some flora etc. (50% hard ground conditions). Refer to **Section 1.3.5**; and
- Activities assessed functioned during wind-still conditions, in good sound propagation conditions (20°C and 80% humidity).

³³ Noise Control Regulations: Gauteng Province (GN 5479 Act No.73 of 1989).

³⁴ SILVIA. *Guidance Manual for the Implementation of Low Noise Road Surface 2nd ed.* FEHRL Report

³⁵ Committee of Transport Officials. "TRH 26, South African Road Classification and Access Management Manual". Version 1.0.2012.

³⁶ "Add +2,5 dB to the predicted noise level if the calculations are being undertaken to determine the amount of road traffic noise to which a future development (in which a façade will be at the position of the receiver) will be subjected". SANS10210:2008.



Figure 6-1: Investigated scenarios

7 MODELLING RESULTS AND IMPACT ASSESSMENT

7.1 INITIAL SCENARIO – WORST-CASE REPRESENTATION: PEAK NOISE CLIMATE

This impact assessment is quite precautionary and is a worst-case representation of potential maximum equivalent (average) noise climate ($L_{Req,1h}$) the receptors could be exposed to due to the peak operations of the N14 Highway.

Calculated Rating Levels due to the day and night-time initial noise climate at receptors dwellings is presented in [Appendix D.1](#) and [Appendix D.2](#) respectively.

Figure 7-1 and **Figure 7-2** illustrates the resulting representation of the day and night-time worst-case peak noise climate around the proposed development. These figure rating contours are illustrated from 55 or 45 dBA upwards (IFC table Residential - Equator Principle referencing), with contours illustrated in 5 dBA intervals. These figures indicate a $L_{Req,1h}$ value with no tone or impulse corrections.

Contours are more indicative of Rating Levels at dwellings with a direct line of sight from the assessed scenario to the receptors closest to the mentioned road. This is mostly relevant for dwellings on the outer edge of a township, that would likely screen Rating Levels at dwellings (or row of dwellings) directly behind and adjacent to it.

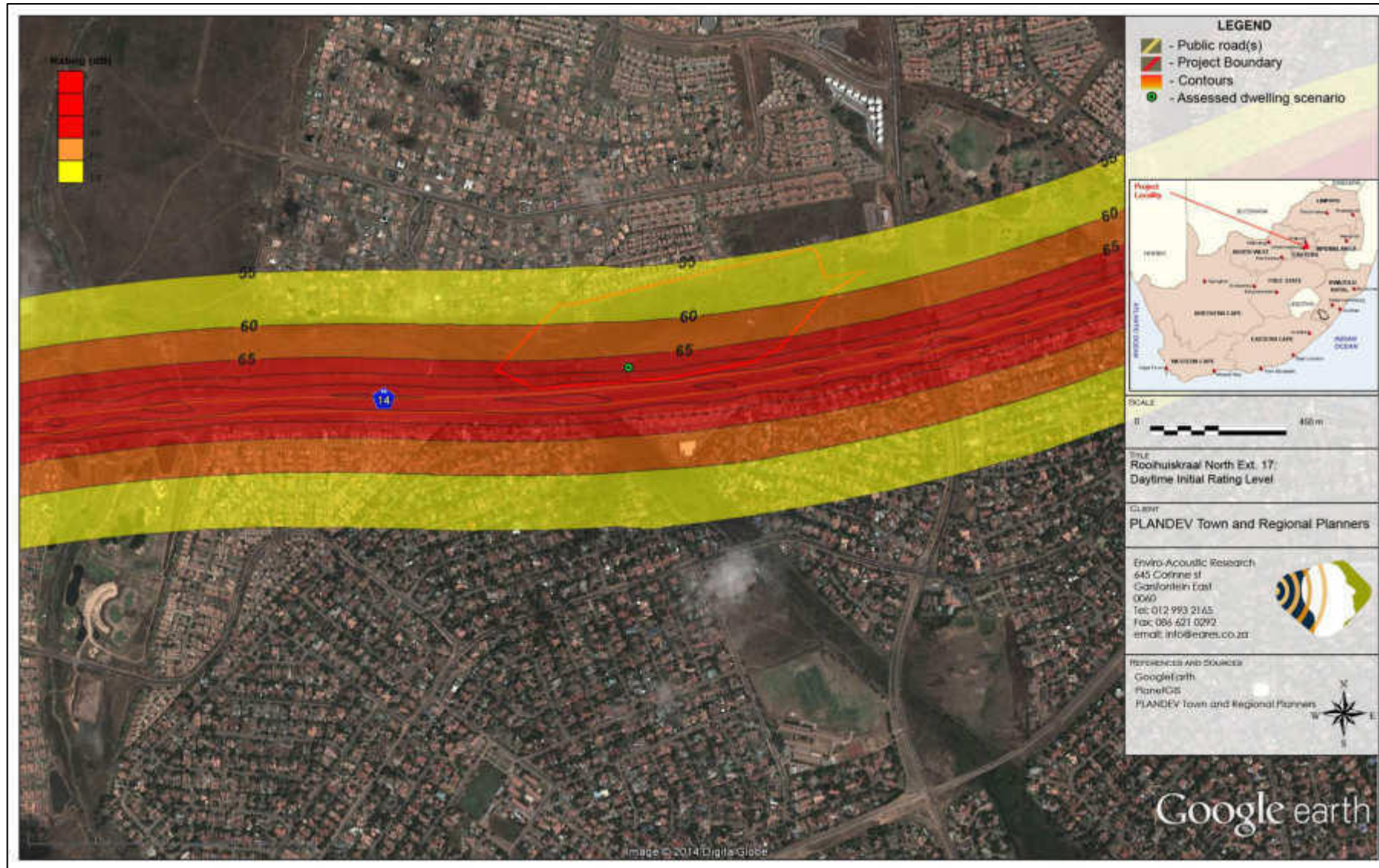


Figure 7-1: Projected representation of the initial daytime Rating Levels



Figure 7-2: Projected representation of the initial night-time Rating Levels

7.2 IMPACT ASSESSMENT – INITIAL PHASE REPRESENTATION

The impact significance as assessed for receptors at the Rooihuiskraal development is presented in **Table 7-1** and **Table 7-2** below.

Table 7-1: Impact Assessment: Daytime scenario – peak traffic conditions

Nature:	Peak N14 Road operations that takes place during the daytime hours of (06:00 – 22:00).
Acceptable Rating Level	Daytime Rating Level of 55 dBA – Urban Rating for dwellings with a direct line of sight and adjacent to the road. Use of $L_{Req,D}$ of 55 dBA; and IFC table (Equator Principle) for Residential; institutional and educational. Use of $L_{Req,D}$ of 55 dBA.
Extent	Site (1) – The impacted area extends only as far as the activity, such as footprint occurring within the total site area.
Duration	Long term (4) – Impacts that will continue for the life of the Project, but ceases when the Project stops operating.
Magnitude - ($L_{Req,D}$) > 55 dBA rating level	Very High (10) – for dwellings with a direct line of sight and adjacent to the road: <ul style="list-style-type: none"> • Equivalent calculated rating levels ($L_{Aeq,1hr}$) will exceed the SANS10103:2008 Rating; and • Equivalent calculated rating levels ($L_{Aeq,1hr}$) will exceed the IFC noise limits (Equator Principle) for Residential areas.
Probability	Possible (2): <ul style="list-style-type: none"> • Engagements (radio, TV, housecleaning activities, etc.) at receptors dwelling may screen noise levels during the daytimes. • Certain receptors may be at school, work etc. during peak traffic hours (e.g. 08:00 – 17:00 working hours).
Significance	30 (Low) . Also refer to Appendix D.1 .
Status	Negative.
Reversibility	Not relevant.
Comments	N/a
Can impacts be mitigated?	The developer is recommended to consider mitigation options in Section 8.1 even with a low significance identified.

Based on the preceding data it is obvious that the risk of a noise impact developing during the daytime hours is of a low significance. Mitigation is none-the-less recommended in **Section 8** for the developer to consider, as mitigation for the night-time peak noise climate is recommended (sections below).

Table 7-2: Impact Assessment: Night-time scenario – peak traffic conditions

Nature:	Peak N14 Road operations that takes place during the night-time hours of (22:00 – 06:00).
Acceptable Rating Level	Night-time Rating Level of 45 dBA – Urban Rating for dwellings with a direct line of sight and adjacent to the road. Use of $L_{Req,N}$ of 45 dBA; and IFC table (Equator Principle) for Residential; institutional and educational. Use of $L_{Req,N}$ of 45 dBA.
Extent	Site (1) – The impacted area extends only as far as the activity, such as footprint occurring within the total site area.
Duration	Long term (4) – Impacts that will continue for the life of the Project, but ceases when the Project stops operating.
Magnitude - ($L_{Req,N}$) > 45 dBA rating level	Very High (10) – for dwellings with a direct line of sight and adjacent to the road: <ul style="list-style-type: none"> • This is for a receptor located outside facing the road. • Equivalent calculated rating levels ($L_{Aeq,1hr}$) will exceed the SANS10103:2008 Rating; and • Equivalent calculated rating levels ($L_{Aeq,1hr}$) will exceed the IFC table (Equator Principle) for Residential areas.
Probability	Likely (3): <ul style="list-style-type: none"> • People mostly in bedroom located at opposite façade of house away from road. There will be at least one wall between the road and bedroom (10 – 15 dBA reduction). • People spending time in the garden will be shielded by the noise from the road by the buildings. • It is likely that single noise events (L_{max}, Section 2.9.2) due to road traffic movement will exceeded recommended international guideline magnitude.
Significance	45 (Medium) . Also refer to Appendix D.2.
Status	Negative.
Reversibility	Not relevant.
Comments	N/a
Can impacts be mitigated?	The developer is recommended to consider mitigation options in Section 8.1.

During a period where a receptor may require a restful period the likelihood of a noise impact occurring is of a higher significance then in comparison to the daytimes. Mitigation is highlighted in **Section 8** for the developer to consider, as well as the conclusion **Section 9**. As mentioned the developer intends on implementing certain of these mitigation options.

7.3 FUTURE SCENARIO – WORST-CASE REPRESENTATION: PEAK NOISE CLIMATE

This impact assessment is quite precautionary and a worst-case representation of potential maximum equivalent (average) noise climate ($L_{Req,1h}$) the receptors could be exposed to during a simulated peak traffic conditions of the N14 Highway in 15 years time.

Calculated Rating Levels due to the day and night-time operational noise climate from the N14 Road at receptors dwellings is presented in [Appendix D.3](#) and [Appendix D.4](#) respectively.

Figure 7-3 and **Figure 7-4** illustrates the resulting representation of the day and night-time worst-case peak noise climate around the proposed development. These figure rating contours are illustrated from 55 or 45 dBA upwards (IFC table Residential - Equator Principle referencing), with contours illustrated in 5 dBA intervals. These figures indicate a $L_{Req,1h}$ value with no tone or impulse corrections.

Contours are more indicative of Rating Levels at dwellings with a direct line of sight from the assessed scenario to the receptors closest to the mentioned road. This is mostly relevant for dwellings on the outer edge of a township, that would likely screen Rating Levels at dwellings (or row of dwellings) directly behind and adjacent to it.



Figure 7-3: Projected representation of the future daytime Rating Levels



Figure 7-4: Projected representation of the future night-time Rating Levels

7.4 IMPACT ASSESSMENT – FUTURE PHASE REPRESENTATION

The impact significance as assessed for receptors at the Rooihuiskraal development at future dates is presented in **Table 7-3** and **Table 7-4** below.

Table 7-3: Impact Assessment: Daytime scenarios – peak traffic conditions

Nature:	Peak N14 Road operations that takes place during the daytime hours of (06:00 – 22:00).
Acceptable Rating Level	Daytime Rating Level of 55 dBA – Urban Rating for dwellings with a direct line of sight and adjacent to the road. Use of $L_{Req,D}$ of 55 dBA; and IFC table (Equator Principle) for Residential; institutional and educational. Use of $L_{Req,D}$ of 55 dBA.
Extent	Site (1) – The impacted area extends only as far as the activity, such as footprint occurring within the total site area.
Duration	Long term (4) – Impacts that will continue for the life of the Project, but ceases when the Project stops operating.
Magnitude - ($L_{Req,D}$) > 55 dBA rating level	Very High (10) – for dwellings with a direct line of sight and adjacent to the road: <ul style="list-style-type: none"> • Equivalent calculated rating levels ($L_{Aeq,1hr}$) will exceed the SANS10103:2008 Rating; and • Equivalent calculated rating levels ($L_{Aeq,1hr}$) will exceed the IFC table (Equator Principle) for Residential areas.
Probability	Possible (2): <ul style="list-style-type: none"> • Engagements (radio, TV, housecleaning activities, etc.) at receptors dwelling may screen noise levels during the daytimes. • Certain receptors may be at school, work etc. during peak traffic hours (e.g. 08:00 – 17:00 working hours).
Significance	30 (Low) . Also refer to Appendix D.3 .
Status	Negative.
Reversibility	Not relevant.
Comments	N/a
Can impacts be mitigated?	The developer is recommended to consider mitigation options in Section 8.1 even with a low significance identified.

Based on the preceding data it is obvious that the risk of a noise impact developing during the future daytime hours is of a low significance. Mitigation is none-the-less recommended in **Section 8** for the developer to consider.

Table 7-4: Impact Assessment: Night-time scenarios – peak traffic conditions

Nature:	Peak N14 Road operations that takes place during the night-time hours of (22:00 – 06:00).
Acceptable Rating Level	Night-time Rating Level of 45 dBA – Urban Rating for dwellings with a direct line of sight and adjacent to the road. Use of $L_{Req,N}$ of 45 dBA; and IFC table (Equator Principle) for Residential; institutional and educational. Use of $L_{Req,N}$ of 45 dBA.
Extent	Site (1) – The impacted area extends only as far as the activity, such as footprint occurring within the total site area.
Duration	Long term (4) – Impacts that will continue for the life of the Project, but ceases when the Project stops operating.
Magnitude - ($L_{Req,N}$) > 45 dBA rating level	Very High (10) – for dwellings with a direct line of sight and adjacent to the road: <ul style="list-style-type: none"> • Equivalent calculated rating levels ($L_{Aeq,1hr}$) will exceed the SANS10103:2008 Rating; and • Equivalent calculated rating levels ($L_{Aeq,1hr}$) will exceed the IFC table (Equator Principle) for Residential areas.
Probability	Likely (3): <ul style="list-style-type: none"> • People mostly in bedroom located at opposite façade of house away from road. There will be at least one wall between the road and bedroom (10 – 15 dBA reduction). • People spending time in the garden will be shielded by the noise from the road by the buildings. • It is likely that single noise events (L_{max}, Section 2.9.2) due to road traffic movement will exceeded recommended international guideline magnitude.
Significance	45 (Medium) . Also refer to Appendix D.4 .
Status	Negative.
Reversibility	Not relevant.
Comments	N/a
Can impacts be mitigated?	The developer is recommended to consider mitigation options in Section 8.1 .

During a period where a receptor may require a restful period the likelihood of a noise impact occurring is of a higher significance then in comparison to the daytimes. Mitigation is highlighted in **Section 8** for the developer to consider.

8 MITIGATION OPTIONS

8.1 PRE PLANNING AND OPERATIONAL PHASE

8.1.1 Mitigation Options: Mitigation of noise source

8.1.1.1 N14 Highway

Mitigation of road noise during the pre-planning, design and construction of the road may yield the best reduction in noise levels at the Rooihuiskraal. As the N14 Road already exists, mitigation at the noise source is unfeasible and was not considered in this document.

8.1.2 Mitigation Options: Pathway Mitigation

The developer has indicated that there will likely be more than one storey at the development. Thus the implementation of a boundary wall as a screen would only be feasible for the ground floor receptors. The following factors could be implemented to ensure an effective noise boundary wall/barrier as relevant for ground floor dwellings, and includes:

- It is recommended that the barrier be built as close as possible to the footprint of the roads (noise source) as possible. The barrier design needs to consider diffraction, and should have no aperture or gaps; and
- Barriers must be sufficiently dense (at least 20 kilograms/square meter surface density) and sufficient in thickness. A brick wall provides a surface density of 244 kilograms/square m at thickness of 150 mm³⁷ and is considered as a typically good acoustical barrier. Certain metrological conditions (particularly during night-times) can see refraction of noise over the barrier due to the various temperature inversion layers. This means that noise levels from a road vehicle may propagate back down to the ground at a receptors dwelling due to the curvature of sound in the warmer upper night-time atmosphere. Barrier height cannot effect this propagation.

8.1.3 Mitigation Options: Mitigation at Receptors

Mitigation at receptors dwelling directly facing the N14 Road should be considered by the developer. These mitigation are optional and is left solely for the developer to implement, they include:

- It has been indicated by the developer that dwellings will be designed with bedrooms on the opposite façade of the N14 Road. This will enable the

³⁷ Environmental Protection Department; Government of the Hong Kong SAR Second Issue, January 2003

wall of the dwelling to act as a screen from the N14 Road at the receptors bedrooms during the night-times, especially when a quieter time is desired;

- Any apertures from residents facing the roads (doors, windows etc.) that have a direct line of sight to the roads can make use of double glazing (option solely left to developer). This will leave the option for the tenant to close windows on the façade facing the N14 Highway if a noise reduction is sought. This is especially important for the bedroom facing the N14 road. The following can be considered when implementing doors and windows facing the N14 Road:
 - The inner and outer glazing should be asymmetric (different thickness of glazing) as this may improve insulating properties. The best insulation is provide by a 4mm/10mm double glazing split;
 - The glazing should also be laminated with PVB (polyvinyl butyral) interlayer that may improve indoor reduction of higher frequencies. The developer needs to discuss this with a glazing specialist as a lamination better suited for acoustic screening may be available;
 - The gas cavity between the double/triple glazing should be as large as possible. Good acoustical insulation is only achieved between 50 and 150 mm cavity. The best air gap to consider would be a 100mm air void as this would help reduce low frequencies from the road traffic (engine revolutions);
 - The developer should discuss with a glazing specialist the best option for gas used for sound reduction in the double glazing cavity, although the gas is not a major sound reduction factor;
 - A structural, thermally improved aluminum thermal barrier air spacer in the insulating glass can improve acoustical performance by reducing the transmission of exterior noise sources in the thermal fenestration system³⁸ (only relevant for aluminum frames). Ventilation devices in the window can reduce the effect of acoustical insulation;
 - The window/door should be *very* well sealed between frame and supporting wall. Any air leakage will compromise the acoustical insulation and sealing of junctions must be considered;
 - The selection of window must be considered as well. Windows with outward opening sashes are preferred to sliding windows as when closed they achieve a positive compression seal against the window frame.

³⁸ The American Institute of Architects. National Convention and Design Exposition. 2012

- The developer should minimise the amount of apertures (gaps) in the sections facing receptors. These do not just include the windows as mentioned above but also holes in walls for service fixtures such as plumbing and electrical. If feasible the developer should design all services to run underground the facility (and not through walls) on the side facing the N14 Highway;
- It is highly recommended that the developer insulate the ceiling cavity (if applicable) with Glasswool (or similar) insulation, applicable at houses directly adjacent to N14 Road. The developer should consider the thickest available ceiling insulation (minimum 100 mm) or a NRC (Noise Control Coefficient) rating of 1.00³⁹. If a roof and ceiling is to be implemented the gap between the two should be as large as is technically possible; and
- Flanking is the transfer of noise through paths around a building element, rather than through the element directly. Flanking can describe the transfer of noise through gaps and cracks in a building element, or via incorrectly sealed junctions between two materials. These noise flanking paths can defeat noise reduction techniques. It is essential to consider the design of junctions, including internal detail. Common flanking paths arise because of poor design, when the junction of building elements is inadequately detailed.

³⁹ www.isover.co.za

9 CONCLUSIONS

With the input data as used, this assessment indicated that there is a potential noise impact of moderate significance during the night-time periods. There is always the likelihood that a degree of over-engineering or precautionary principals are adhered to in environmental assessments, and this may be the case with the night-time assessment.

As mentioned the developer has decided to design the complex dwellings with bedrooms on the opposite façade to the N14 Road. Calculations did consider the screening effect of a single/double *et al* effect of dwelling enclosure. As calculations are based on the exterior of the dwellings, the implementation of bedrooms on opposite façade to N14 Road will likely see a reduction in calculated Noise Rating Levels.

It should be noted that this does not suggest that the sound from the N14 Road will be inaudible - this is an unrealistic expectation that is not required or expected from any other agricultural, commercial, industrial or transportation related noise source, but rather that the sound due to the road traffic should be at a reasonable level as per regulations.

10 THE AUTHOR

The author of this report, M. de Jager (B. Ing (Chem), UP) graduated in 1998 from the University of Pretoria. He has been interested in acoustics as from school days, doing projects mainly related to loudspeaker enclosure design. Interest in the matter brought him into the field of Environmental Noise Measurement, Prediction and Control. As from 2007 he has been involved with the following projects:

- Full Noise Impact Studies for a number of Wind Energy Facilities, including: Cookhouse I and II, Kangnas, Amakhala Emoyeni, Dassiesfontein/Klipheuwel, Rhebokfontein, AB, Dorper, Suurplaat, Gouda, Gouda iNca, Riverbank, Oyster Bay, Walker Bay, De Aar, Loeriesfontein, Noupoot, Prieska, Deep River, West Coast, Happy Valley, Canyon Springs, Tsitsikamma WEF, West Coast One, Springfontein, Karoo Renewables, Kleinzee, Zen, iNca Swellendam, Hidden Valley, Garob, Spitskop, Banff, Hopefield Community, Kleinzee and Project Blue.
- Full Noise Impact Studies for a number of mining projects, including: Skychrome (Pty) Ltd (A Ferro-chrome mine), Mooinooi Chrome Mine (WCM), Buffelsfontein East and West (WCM), Elandsdrift (Sylvania), Jagdlust Chrome Mine (ECM), Der Brochen, Apollo Brick (Pty) Ltd (Clay mine and brick manufacturer), Arthur Taylor Expansion project (X-Strata Coal SA), Klipfontein Colliery (Coal mine), Imbabala Coal, AurexGold, Sephaku Limestone Mine, Sekoko Railway Siding, Verkeerdepan Expansion, Schoongezicht Coal, WPB Colliery, Landau Expansion project (Coal mine), Lesego Platinum, Goedehoop Colliery, Mopane Colliery.
- A number of smaller Noise Impact Assessments, Noise Monitoring Projects, Scoping Reports as well as Screening Investigations.

The author is an independent consultant to the project, developer or PLANDEV. He,

- does not and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations;
- have and will not have no vested interest in the proposed activity proceeding;
- have no and will not engage in conflicting interests in the undertaking of the activity;
- undertake to disclose all material information collected, calculated and/or findings, whether favourable to the development or not; and
- will ensure that all information containing all relevant facts be included in this report.

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APPENDIX A

Glossary of Acoustic Terms, Definitions and General Information

<i>1/3-Octave Band</i>	A filter with a bandwidth of one-third of an octave representing four semitones, or notes on the musical scale. This relationship is applied to both the width of the band, and the centre frequency of the band. See also definition of octave band.
<i>A – Weighting</i>	An internationally standardised frequency weighting that approximates the frequency response of the human ear and gives an objective reading that therefore agrees with the subjective human response to that sound.
<i>Air Absorption</i>	The phenomena of attenuation of sound waves with distance propagated in air, due to dissipative interaction within the gas molecules.
<i>Alternatives</i>	A possible course of action, in place of another, that would meet the same purpose and need (of proposal). Alternatives can refer to any of the following, but are not limited hereto: alternative sites for development, alternative site layouts, alternative designs, alternative processes and materials. In Integrated Environmental Management the so-called “no go” alternative refers to the option of not allowing the development and may also require investigation in certain circumstances.
<i>Ambient</i>	The conditions surrounding an organism or area.
<i>Ambient Noise</i>	The all-encompassing sound at a point being composed of sounds from many sources both near and far. It includes the noise from the noise source under investigation.
<i>Ambient Sound</i>	The all-encompassing sound at a point being composite of sounds from near and far.
<i>Ambient Sound Level</i>	Means the reading on an integrating impulse sound level meter taken at a measuring point in the absence of any alleged disturbing noise at the end of a total period of at least 10 minutes after such a meter was put into operation. In this report the term Background Ambient Sound Level will be used.
<i>Amplitude Modulated Sound</i>	A sound that noticeably fluctuates in loudness over time.
<i>Anthropogenic</i>	Human impact on the environment or anthropogenic impact on the environment includes impacts on biophysical environments, biodiversity and other resources
<i>Applicant</i>	Any person who applies for an authorisation to undertake a listed activity or to cause such activity in terms of the relevant environmental legislation.
<i>Assessment</i>	The process of collecting, organising, analysing, interpreting and communicating data that is relevant to some decision.
<i>Attenuation</i>	Term used to indicate reduction of noise or vibration, by whatever method necessary, usually expressed in decibels.
<i>Audible frequency Range</i>	Generally assumed to be the range from about 20 Hz to 20,000 Hz, the range of frequencies that our ears perceive as sound.
<i>Ambient Sound Level</i>	The level of the ambient sound indicated on a sound level meter in the absence of the sound under investigation (e.g. sound from a particular noise source or sound generated for test purposes). Ambient sound level as per Noise Control Regulations.
<i>Axle</i>	Shaft connecting two wheels on either side of the vehicle. The wheels are forced to rotate at the same speed. Vehicles with independent wheels have ‘stub axles’ that do not connect the two wheels on either side of the vehicle.
<i>Ballast Baseplate</i>	A layer of coarse stones supporting the sleepers. A track component designed to hold the rail in place, usually with resilience to provide improved vibration isolation.
<i>Broadband Noise</i>	Spectrum consisting of a large number of frequency components, none of which is individually dominant.
<i>C-Weighting</i>	This is an international standard filter, which can be applied to a pressure signal or to a SPL or PWL spectrum, and which is essentially a pass-band filter in the frequency range of approximately 63 to 4000 Hz. This filter provides a more constant, flatter, frequency response, providing significantly less adjustment than the A-scale filter for frequencies less than 1000 Hz.
<i>dB(A)</i>	Sound Pressure Level in decibel that has been A-weighted, or filtered, to match the response of the human ear.
<i>Decibel (db)</i>	A logarithmic scale for sound corresponding to a multiple of 10 of the threshold of hearing. Decibels for sound levels in air are referenced to an atmospheric pressure of 20 µ Pa.
<i>Diffraction</i>	The process whereby an acoustic wave is disturbed and its energy redistributed in space as a result of an obstacle in its path, Reflection and refraction are special cases of diffraction.
<i>Direction of Propagation</i>	The direction of flow of energy associated with a wave.
<i>Disturbing noise</i>	Means a noise level that exceeds the zone sound level or, if no zone sound level has been designated, a noise level that exceeds the ambient sound level at the same measuring point by 7 dBA or more.

<i>Echolocation</i>	Echo locating animals emit calls out to the environment and listen to the echoes of those calls that return from various objects near them. They use these echoes to locate and identify the objects. Echolocation is used for navigation and for foraging (or hunting) in various environments.
<i>Environment</i>	The external circumstances, conditions and objects that affect the existence and development of an individual, organism or group; these circumstances include biophysical, social, economic, historical, cultural and political aspects.
<i>Environmental Control Officer</i>	Independent Officer employed by the applicant to ensure the implementation of the Environmental Management Plan (EMP) and manages any further environmental issues that may arise.
<i>Environmental impact</i>	A change resulting from the effect of an activity on the environment, whether desirable or undesirable. Impacts may be the direct consequence of an organisation’s activities or may be indirectly caused by them.
<i>Environmental Impact Assessment</i>	An Environmental Impact Assessment (EIA) refers to the process of identifying, predicting and assessing the potential positive and negative social, economic and biophysical impacts of any proposed project, plan, programme or policy that requires authorisation of permission by law and that may significantly affect the environment. The EIA includes an evaluation of alternatives, as well as recommendations for appropriate mitigation measures for minimising or avoiding negative impacts, measures for enhancing the positive aspects of the proposal, and environmental management and monitoring measures.
<i>Environmental issue</i>	A concern felt by one or more parties about some existing, potential or perceived environmental impact.
<i>Equivalent continuous A-weighted sound exposure level ($L_{Aeq,T}$)</i>	The value of the average A-weighted sound pressure level measured continuously within a reference time interval T , which have the same mean-square sound pressure as a sound under consideration for which the level varies with time.
<i>Equivalent continuous A-weighted rating level ($L_{Req,T}$)</i>	The Equivalent continuous A-weighted sound exposure level ($L_{Aeq,T}$) to which various adjustments has been added. More commonly used as ($L_{Req,d}$) over a time interval 06:00 – 22:00 (T=16 hours) and ($L_{Req,n}$) over a time interval of 22:00 – 06:00 (T=8 hours). It is a calculated value.
<i>F (fast) time weighting</i>	(1) Averaging detection time used in sound level meters. (2) Fast setting has a time constant of 125 milliseconds and provides a fast reacting display response allowing the user to follow and measure not too rapidly fluctuating sound.
<i>Footprint area</i>	Area to be used for the construction of the proposed development, which does not include the total study area.
<i>Free Field Condition</i>	An environment where there is no reflective surfaces.
<i>Frequency</i>	The rate of oscillation of a sound, measured in units of Hertz (Hz) or kiloHertz (kHz). One hundred Hz is a rate of one hundred times per second. The frequency of a sound is the property perceived as pitch: a low-frequency sound (such as a bass note) oscillates at a relatively slow rate, and a high-frequency sound (such as a treble note) oscillates at a relatively high rate.
<i>Green field</i>	A parcel of land not previously developed beyond that of agriculture or forestry use; virgin land. The opposite of Greenfield is Brownfield, which is a site previously developed and used by an enterprise, especially for a manufacturing or processing operation. The term Brownfield suggests that an investigation should be made to determine if environmental damage exist.
<i>Grinding</i>	A process for removing a thin layer of metal from the top of the rail head in order to remove roughness and/or to restore the correct profile. Special grinding trains are used for this.
<i>G-Weighting</i>	An International Standard filter used to represent the infrasonic components of a sound spectrum.
<i>Harmonics</i>	Any of a series of musical tones for which the frequencies are integral multiples of the frequency of a fundamental tone.
<i>I (impulse) time weighting</i>	(1) Averaging detection time used in sound level meters as per South African standards and Regulations. (2) Impulse setting has a time constant of 35 milliseconds when the signal is increasing (sound pressure level rising) and a time constant of 1,500 milliseconds while the signal is decreasing.
<i>Impulsive sound</i>	A sound characterized by brief excursions of sound pressure (transient signal) that significantly exceed the ambient sound level.
<i>Infrasound</i>	Sound with a frequency content below the threshold of hearing, generally held to be

	about 20 Hz. Infrasonic sound with sufficiently large amplitude can be perceived, and is both heard and felt as vibration. Natural sources of infrasound are waves, thunder and wind.
<i>Integrated Development Plan</i>	A participatory planning process aimed at developing a strategic development plan to guide and inform all planning, budgeting, management and decision-making in a Local Authority, in terms of the requirements of Chapter 5 of the Municipal Systems Act, 2000 (Act 32 of 2000).
<i>Integrated Environmental Management</i>	IEM provides an integrated approach for environmental assessment, management, and decision-making and to promote sustainable development and the equitable use of resources. Principles underlying IEM provide for a democratic, participatory, holistic, sustainable, equitable and accountable approach.
<i>Interested and affected parties</i>	Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups and the general public.
<i>Interburden</i>	Material of any nature that lies between two or more bedded ore zones or coal seams. Term is primarily used in surface mining
<i>Joint rail</i>	A connection between two lengths of rail, often held together by an arrangement of bolts and fishplates.
<i>Key issue</i>	An issue raised during the Scoping process that has not received an adequate response and that requires further investigation before it can be resolved.
<i>Listed activities</i>	Development actions that is likely to result in significant environmental impacts as identified by the delegated authority (formerly the Minister of Environmental Affairs and Tourism) in terms of Section 21 of the Environment Conservation Act.
<i>Locomotive</i>	A powered vehicle used to draw or propel a train of carriages or wagons (as opposed to a multiple unit).
<i>L_{AMin} and L_{AMax}</i>	Is the RMS (root mean squared) minimum or maximum level of a noise source.
<i>Loudness</i>	The attribute of an auditory sensation that describes the listener's ranking of sound in terms of its audibility.
<i>Magnitude of impact</i>	Magnitude of impact means the combination of the intensity, duration and extent of an impact occurring.
<i>Masking</i>	The raising of a listener's threshold of hearing for a given sound due to the presence of another sound.
<i>Mitigation</i>	To cause to become less harsh or hostile.
<i>Natural Sounds</i>	Are sounds produced by natural sources in their normal soundscape.
<i>Negative impact</i>	A change that reduces the quality of the environment (for example, by reducing species diversity and the reproductive capacity of the ecosystem, by damaging health, or by causing nuisance).
<i>Noise</i>	a. Sound that a listener does not wish to hear (unwanted sounds). b. Sound from sources other than the one emitting the sound it is desired to receive, measure or record. c. A class of sound of an erratic, intermittent or statistically random nature.
<i>Noise Level</i>	The term used in lieu of sound level when the sound concerned is being measured or ranked for its undesirability in the contextual circumstances.
<i>Noise-sensitive development</i>	developments that could be influenced by noise such as: a) districts (see table 2 of SANS 10103:2008) 1. rural districts, 2. suburban districts with little road traffic, 3. urban districts, 4. urban districts with some workshops, with business premises, and with main roads, 5. central business districts, and 6. industrial districts; b) educational, residential, office and health care buildings and their surroundings; c) churches and their surroundings; d) auditoriums and concert halls and their surroundings; e) recreational areas; and f) nature reserves. In this report Noise-sensitive developments is also referred to as a Potential Sensitive Receptor
<i>Octave Band</i>	A filter with a bandwidth of one octave, or twelve semi-tones on the musical scale representing a doubling of frequency.
<i>Overburden</i>	In mining and in archaeology, overburden (also called waste or spoil) is the material that lies above an area of economic or scientific interest. In mining, it is most commonly the rock, soil, and ecosystem that lies above a coal seam or ore body
<i>Positive impact</i>	A change that improves the quality of life of affected people or the quality of the

	environment.
<i>Property</i>	Any piece of land indicated on a diagram or general plan approved by the Surveyor-General intended for registration as a separate unit in terms of the Deeds Registries Act and includes an erf, a site and a farm portion as well as the buildings erected thereon
<i>Public Participation Process</i>	A process of involving the public in order to identify needs, address concerns, choose options, plan and monitor in terms of a proposed project, programme or development
<i>Reflection</i>	Redirection of sound waves.
<i>Refraction</i>	Change in direction of sound waves caused by changes in the sound wave velocity, typically when sound wave propagates in a medium of different density.
<i>Reverberant Sound</i>	The sound in an enclosure which results from repeated reflections from the boundaries.
<i>Reverberation</i>	The persistence, after emission of a sound has stopped, of a sound field within an enclosure.
<i>Rail head</i>	The bulbous part at the top of the rail.
<i>Rolling Stock</i>	Rolling stock comprises all the vehicles that move on a railway. It usually includes both powered and unpowered vehicles, for example locomotives, railroad cars, coaches, and wagons.
<i>ROM</i>	The coal delivered from the mine that reports to the coal preparation plant is called run-of-mine, or ROM, coal. This is the raw material for the CPP, and consists of coal, rocks, middlings, minerals and contamination
<i>Shunting</i>	Shunting, in railway operations, is the process of sorting items of rolling stock into complete train sets.
<i>Railway Sidings</i>	A siding, in rail terminology, is a low-speed track section distinct from a running line or through route such as a main line or branch line or spur. It may connect to through track or to other sidings at either end.
<i>Significant Impact</i>	An impact can be deemed significant if consultation with the relevant authorities and other interested and affected parties, on the context and intensity of its effects, provides reasonable grounds for mitigating measures to be included in the environmental management report. The onus will be on the applicant to include the relevant authorities and other interested and affected parties in the consultation process. Present and potential future, cumulative and synergistic effects should all be taken into account.
<i>S (slow) time weighting</i>	(1) Averaging times used in sound level meters. (2) Time constant of one [1] second that gives a slower response which helps average out the display fluctuations.
<i>Sound Level</i>	The level of the frequency and time weighted sound pressure as determined by a sound level meter, i.e. A-weighted sound level.
<i>Sound Power</i>	Of a source, the total sound energy radiated per unit time.
<i>Sound Pressure Level (SPL)</i>	Of a sound, 20 times the logarithm to the base 10 of the ratio of the RMS sound pressure level to the reference sound pressure level. International values for the reference sound pressure level are 20 micropascals in air and 100 millipascals in water. SPL is reported as L_p in dB (not weighted) or in various other weightings.
<i>Soundscape</i>	Sound or a combination of sounds that forms or arises from an immersive environment. The study of soundscape is the subject of acoustic ecology. The idea of soundscape refers to both the natural acoustic environment, consisting of natural sounds, including animal vocalizations and, for instance, the sounds of weather and other natural elements; and environmental sounds created by humans, through musical composition, sound design, and other ordinary human activities including conversation, work, and sounds of mechanical origin resulting from use of industrial technology. The disruption of these acoustic environments results in noise pollution.
<i>Study area</i>	Refers to the entire study area encompassing all the alternative routes as indicated on the study area map.
<i>Sustainable Development</i>	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts: the concept of "needs", in particular the essential needs of the world's poor, to which overriding priority should be given; and the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and the future needs (Brundtland Commission, 1987).
<i>Timbre</i>	Timbre (also known as tone colour or tone quality) is the quality of the sound made by a particular voice or musical instrument.
<i>Tread braked</i>	The traditional form of wheel brake consisting of a block of friction material (which could be cast iron, wood or nowadays a composition material) hung from a lever and being pressed against the wheel tread by air pressure (in the air brake) or atmospheric pressure in the case of the vacuum brake.
<i>Tone</i>	Noise can be described as tonal if it contains a noticeable or discrete, continuous note. This includes noises such as hums, hisses, screeches, drones, etc. and any such subjective description is open to discussion and contradiction when reported.

<i>Wagon</i>	A freight-carrying vehicle.
<i>Zone of Potential Influence</i>	The area defined as the radius about an object, or objects beyond which the noise impact will be insignificant.
<i>Zone Sound Level</i>	Means a derived dBA value determined indirectly by means of a series of measurements, calculations or table readings and designated by a local authority for an area. This is similar to the Rating Level as defined in SANS 10103:2008.

APPENDIX B

Site Investigation – Photos of monitoring locations

Photo B.1: Measurement location A01





APPENDIX C

Measurement Locations

Table C.1: Locations of Measurement Locations (Datum type: WGS84, decimal degrees)

Point name	Receptor/NSD	Location latitude	Location longitude
A01	At boundary of Rooihuiskraal Noord Ext. 29	-25.891320°	28.121628°

APPENDIX D

Impact Assessment

Table D.1: Modelling results and assessment – initial daytimes– peak hours

Noise-sensitive development	Calculated Continuous Rating Level (L _{Req,1 h})	Above Equator Principle IFC guideline – 55 dB	Above SANS 10103 Rating Level – 55 dB		
Closest dwelling to N14 Highway – Outside Façade	70,2	15,2	15,2		
Closest dwelling to N14 Highway – Inside building assuming 15 dB attenuation	55,2	0,2	0,2		
Defining Significance of Noise Impact (See Section 5)					
Noise-sensitive development	Magnitude	Duration	Scale	Probability	Significance
Closest dwelling to N14 Highway	10	4	1	2	30

Table D.2: Modelling results and assessment – initial night-times– peak hours

Noise-sensitive development	Calculated Continuous Rating Level (L _{Req,1 h})	Above Equator Principle IFC guideline – 45 dB	Above SANS 10103 Rating Level – 45 dB		
Closest dwelling to N14 Highway – Outside Façade	62,9	17,9	17,9		
Closest dwelling to N14 Highway – Inside building assuming 15 dB attenuation	47,9	2,9	2,9		
Defining Significance of Noise Impact (See Section 5)					
Noise-sensitive development	Magnitude	Duration	Scale	Probability	Significance
Closest dwelling to N14 Highway	10	4	1	3	45

Table D.3: Modelling results and assessment – future daytimes– peak hours

Noise-sensitive development	Calculated Continuous Rating Level (L _{Req,1 h})	Above Equator Principle IFC guideline – 55 dB	Above SANS 10103 Rating Level – 55 dB		
Closest dwelling to N14 Highway – Outside Façade	70,4	15,4	15,4		
Closest dwelling to N14 Highway – Inside building assuming 15 dB attenuation	55,4	0,4	0,4		
Defining Significance of Noise Impact (See Section 5)					
Noise-sensitive development	Magnitude	Duration	Scale	Probability	Significance
Closest dwelling to N14 Highway	10	4	1	2	30

Table D.4: Modelling results and assessment – future night-times– peak hours

Noise-sensitive development	Calculated Continuous Rating Level (L _{Req,1 h})	Above Equator Principle IFC guideline – 45 dB	Above SANS 10103 Rating Level – 45 dB		
Closest dwelling to N14 Highway – Outside Façade	63,1	18,1	18,1		
Closest dwelling to N14 Highway – Inside building assuming 15 dB attenuation	48,1	3,1	3,1		
Defining Significance of Noise Impact (See Section 5)					
Noise-sensitive development	Magnitude	Duration	Scale	Probability	Significance
Closest dwelling to N14 Highway	10	4	1	3	45

APPENDIX E

Project Layout

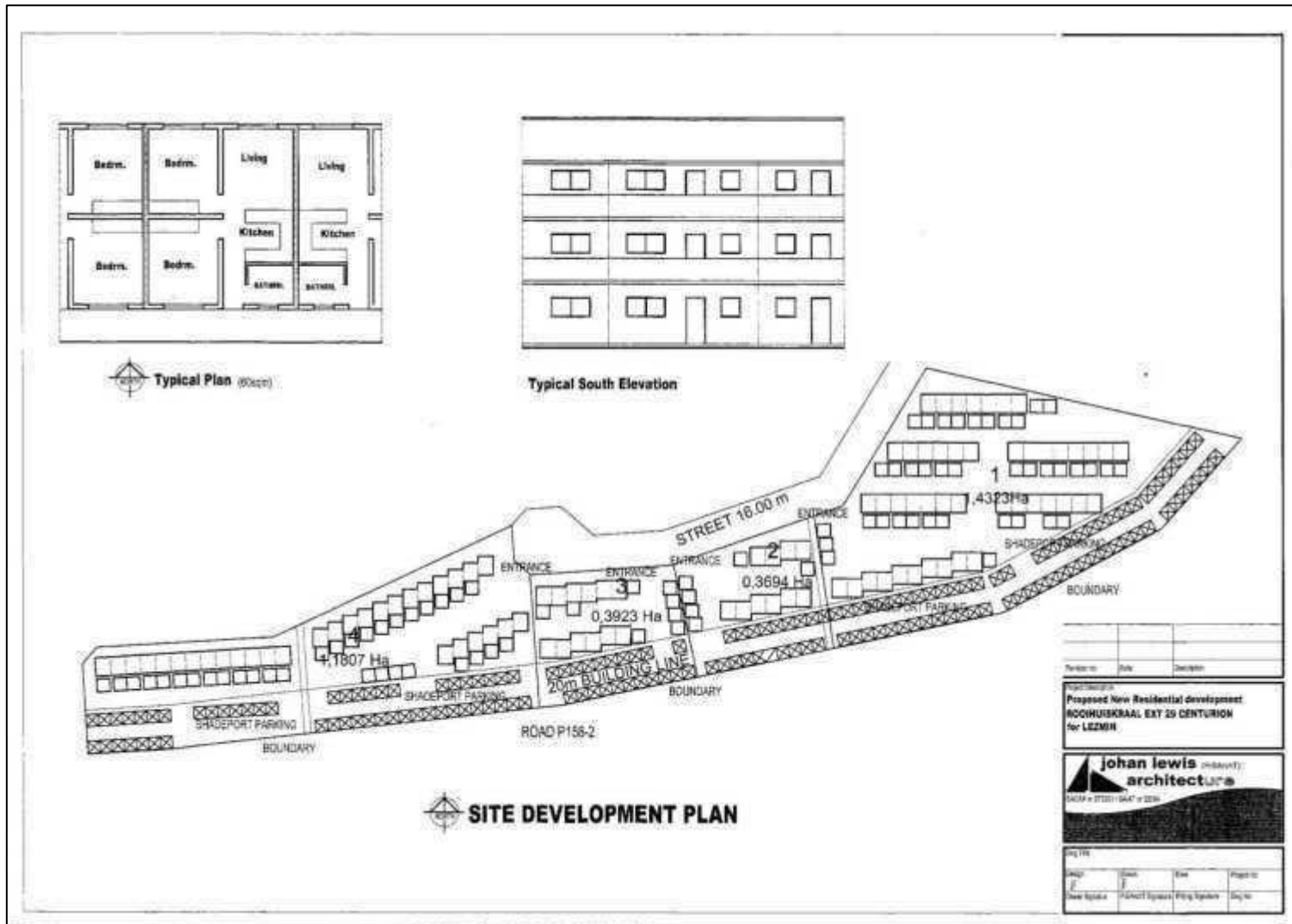


Figure E.1: Project Layout

End of Report



Appendix G16

Integrated Water Quality and
Quantity Management and
Monitoring Plan

**INTEGRATED WATER QUALITY AND QUANTITY MANAGEMENT AND MONITORING
PLAN (IWQQMMP) FOR THE PROPOSED ROOIHUISKRAAL X 29 RESIDENTIAL
DEVELOPMENT**

Author: Bokamoso Landscape Architects and Environmental Consultants CC

Date: May 2017

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1) INTRODUCTION AND BACKGROUND

The purpose of this Integrated Water Quality and Quantity Management and Monitoring Plan (IWQQMMP) is to supply the proposed Rooihuiskraal X29 Residential development with a dynamic, holistic and integrated system and process management tool aimed at the detection and remediation of adverse environmental impacts, pollution prevention and minimization at source, managing the impact of pollution and waste on the receiving environment and remediating damaged environments.

The plan also serves as a framework to ensure efficient, appropriate, affordable, economical and sustainable use and development of water resources and includes the management of wastes that have the potential to impact on the water resource, in such a manner that it promotes the conservation of water resources, and general health and safety.

In terms of Section 21 of the National Water Act (Act No. 36 of 1998) (NWA), the developer must obtain a water use license for any activity that will pose an impact to the water resource, should that activity impede or divert the flow of water in that water course, or if the activity leads to the alteration of the morphology of the river bed, banks, course and its characteristics (water quality, habitat, biota and the flow regime).

2) DESCRIPTION OF THE PROPOSED DEVELOPMENT

Lezmin 1066 BK proposes to develop a residential area, which will consist of three residential security complexes with 100 units per hectare, and associated civil service infrastructure such as water, sewer, storm water and access roads. The affected wetland is proposed to be incorporated into the development as a public open space.

The development overall falls within the Department of Water and Sanitation's (DWS) regulated area, i.e. the 1: 100 year floodline, or riparian habitat, whichever is the greatest, and/ or within a 500m radius from the boundary of a wetland.

Bokamoso Landscape Architects and Environmental Consultants CC was appointed for the Water Use Licence Application (WULA), required for the proposed Rooihuiskraal X29 Residential Development.

3) PROPERTY DESCRIPTION

3.1 Location

The proposed residential development is located adjacent to the N14 Highway, on a Part of the Remainder of Portion 9 and a Part of Portion 145 of the Farm Brakfontein 399 – JR. The site is currently surrounded by existing residential developments and the area of jurisdiction is within the City of Tshwane Metropolitan Municipality, in the Gauteng Province.

The study area is furthermore situated within the Department of Water and Sanitation's (DWS) A21B Quaternary Catchment Area, and falls within the Crocodile West and Marico Water Management Area.

Refer to Figure 1, Locality map and Figure 2, Aerial Map of the Study Area.

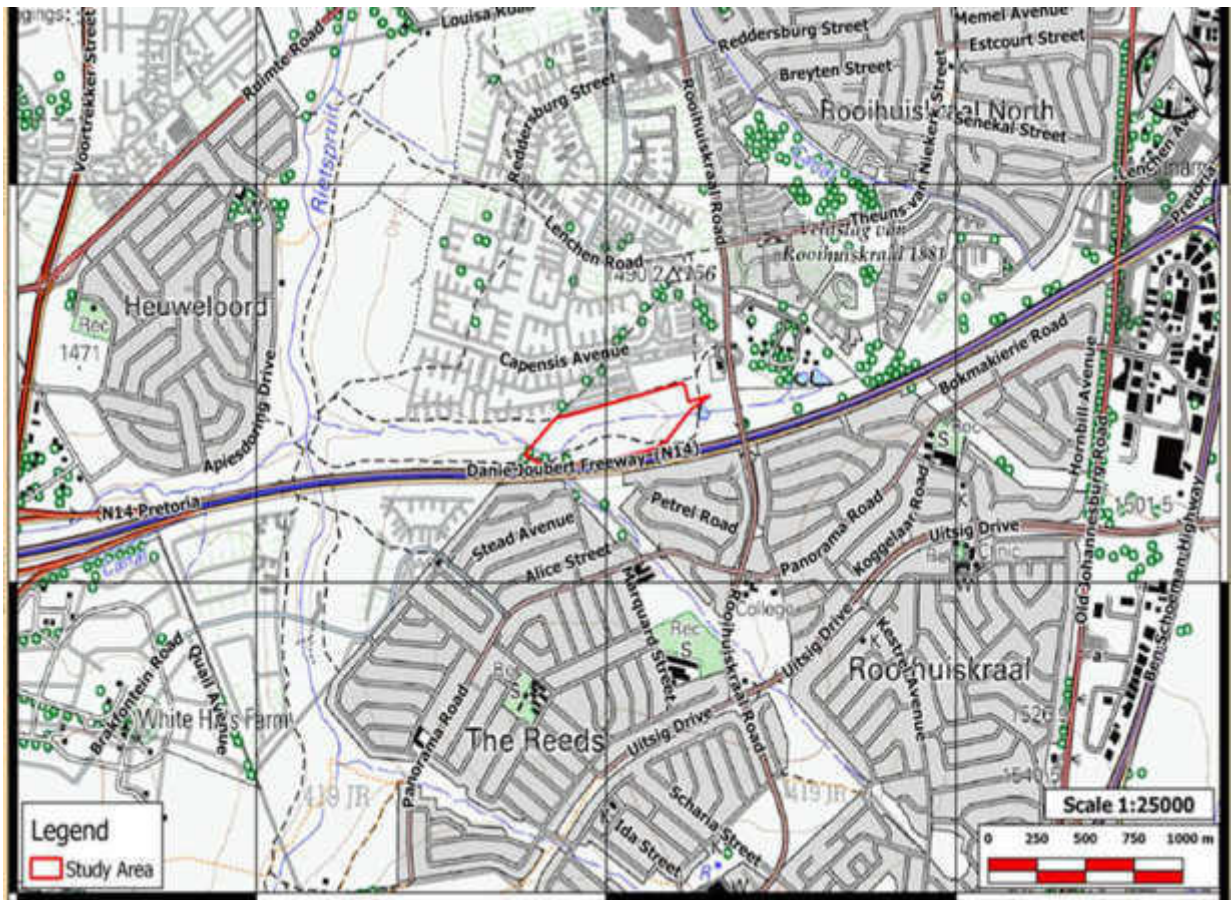


Figure 1: Locality Map



Figure 2: Aerial Map

4) SECTION 21 WATER-USE LICENSE APPLIED FOR

This study site is affected by the 1:100 year flood line, the riparian habitat, whichever is the greatest, and is within a 500m radius from the boundary of a wetland. There is a prominent non-perennial drainage line that flows into the perennial drainage line, namely the Rietspruit that runs through the site and a vlei riparian wetland.

Lezmin 1066 BK is applying for the following Section 21 Water-Uses:

- ✚ **Section 21(c):** 'Impeding or diverting the flow of water in a watercourse'
- ✚ **Section 21 (i):** 'Altering the bed, banks, course or characteristics of a watercourse'

4.1 Section 21 (c) 'Impeding or Diverting the Flow of Water in a Watercourse'

There are specific activities that will lead to the impedance or diversion of the flow of water in the affected rivers and the associated wetlands:

- ✚ Sewer pipeline;
- ✚ Manholes;
- ✚ Water pipeline; and a
- ✚ A concrete bridge structure (access road to the development).

Water pipeline

In terms of water services, a 110mm uPVC pipeline will be constructed parallel to the proposed road, and each erven will have a 110mm connection and a valve. This proposed pipe will be running in the middle of the development.

Sewer pipeline

The sewer pipeline will be provided to serve the development and will also run parallel to the proposed road, and it will furthermore be connected to the existing 3 sewer lines to the west of the development.

Access road

In terms of the access to the development, a road within 16m road servitude will be constructed. The design of the road intends to be skid resistant and its design is proposed for 20 years.

It is worthy to from an environmental perspective that the bridge must be constructed in such a way so as to counteract or minimize the fluctuating water flow patterns into the wetland.

The crossing support structure for the bridge needs to be designed in such a way that it prevents a very limited turbulent flow into the wetland.

Storm water pipeline

A 450mm pipeline is proposed to manage storm water. Construction activities can alter the surface water flows and in this case, it is crucial that the mitigation measures as set out in the storm water plan be implemented.

4.1.1 Implications associated with Water-Use Activity Section 21 (c) Water Use

- Presence of wetlands on the study site and their protection thereof;
- The impacts brought about by the proposed activities which can have a detrimental impact on the integrity and sustainability of the wetlands;
- The sewer pipeline will traverse a portion of the wetland and the watercourse. This poses a major issue as the sewer pipeline can leak and sewage can contaminate the wetland which furthermore has an impact on the water quality and integrity of the wetland;
- The storm water pipeline and the water reticulation pipeline will be traversing the extent of a watercourse;
- The concrete bridge structure that will be constructed to provide access to the development could cause fluctuating levels of water flow into the wetland and it could be disruptive to the wetland functioning, and the floral and faunal species that are dependent on it; and
- The crossing support structure that will be incorporated into the design of the bridge can cause a turbulent flow of water into the wetland which could be even more disruptive to the wetland floral and faunal species. Certain aquatic species could be washed further downstream, and certain species cannot tolerate a high turbulence, and that could be quite detrimental.

4.2 Section 21 (i) 'Altering the bed, banks, course or characteristics of a watercourse'

As discussed in terms of Section 21 (c) water use, the activities will also lead to an alteration and/ or a change in the morphology of the river and its associated water quality characteristics (water quality, flow regime, habitat and biota).

4.2.1 Implications associated with Section 21 (i) Water Use

- It is imperative that monitoring of both the surface and ground water occurs and in accordance with a prescribed monitoring programme, so as to achieve effective monitoring of water quality;
- Should excessive dust, silt and eroded material cause air pollution, the sediments and/ or particles from these dust particles will settle in the aquatic ecosystems and severely affect the aquatic organisms in such a manner that it can block the gills of fish, and an increased sedimentation load into the aquatic system can increase the turbidity of the water; and
- An increase in dust particles that settle on plant species and other forms of vegetation can cause these plant species growth to cease and other plant defects are caused.

5. OBJECTIVES OF THE INTEGRATED WATER QUALITY AND QUANTITY MANAGEMENT AND MONITORING PLAN (IWQQMMP)

Water pollution management:

- To manage, prevent, reduce, control and remediate surface water and groundwater pollution from all identified sources.
- To ensure that the quality of water needed to maintain ecological functions is protected, so that human use of water does not individually or cumulatively compromise the long-term sustainability of aquatic and associated ecosystems.

Land and/ or soil pollution management:

- To manage, prevent, reduce and control soil pollution linked to water quality management;
- To adopt an integrated approach to soil quality management; and
- To manage, prevent, reduce and control soil pollution problems arising from a range of other sources, for example, from the construction camp

site brought on by the waste, hazardous material, and chemical storage facilities.

This IWQQMMP addresses the following three phases of the development:

- Pre-construction planning phase;
- Construction phase; and
- Operational phase.

Monitoring

In order for the IWQQMMP to be successfully implemented all the role players involved must have a clear understanding of their roles and responsibilities in the project.

These role players may include the delegated environmental authorities (A), Lezmin 1066 BK (LBK), the Environmental Control Officer (ECO), Project Manager (PM), Contractors (C), and the Environmental Site Officer (ESO), Landowners, interested and affected parties and the relevant environmental and project specialists are also important role players.

Roles and responsibilities

Lezmin 1066 BK (LBK)

Lezmin 1066 BK is ultimately accountable for ensuring compliance with the IWQQMMP and conditions contained in the S21 WUL issued by the DWS. A must appoint an independent Environmental Control Officer (ECO)¹, for the duration of the pre-construction and construction phases, to ensure compliance with the requirements of the Environmental Authorization (EA), the Environmental Management Plan (EMP), the Storm Water Management Plan (SMP), the IWQQMMP and any other applicable plans or guidelines approved by the involved authorities in terms of the applicable environmental legislation. The ECO must become part of the project team and in order to ensure integrated

¹ This is also a condition of the Environmental Authorisation. The same ECO can be used for the S21 WUL compliance monitoring

planning and management, the ECO must oversee the project throughout all the development phases (planning, construction and post-construction phases).

Project Manager (PM)

The Project Manager is responsible for the coordination of various activities and must ensure compliance with this IWQQMMP through the distribution of the IWQQMMP to the contractors (main contractors and sub-contractors). The monthly ECO report will monitor the contractors' compliance with the IWQQMMP and these monthly reports will also be distributed to the Project Manager on a monthly basis for perusal. If non-compliance is detected, the Project Manager will ensure that the necessary remediation steps are taken.

Environmental Control Officer (ECO)

An independent Environmental Control Officer (ECO) shall be appointed by LBK for the duration of the pre-construction, construction and operational phases of the development (including the installation of the services and the bulk infrastructure), to ensure compliance with the requirements of this IWQQMMP as well as with any other guidelines and plans approved in terms of any other relevant environmental authorization.

Contact details of appointed ECO: Details will be sent when appropriate ECO is appointed.

- The ECO shall ensure that the contractors are aware of all the specifications pertaining to the project.
- Any damage to the environment must be repaired immediately after consultation between the ECO, Developer, Consulting Engineer and/ or any other relevant professional consultant and Contractor. If immediate action is not possible, timeframes must be determined and supplied to the ECO and temporary measures must then be implemented to avoid any damage and/ or any further damage to the environment.
- The ECO shall ensure that the developer staff and/or contractor are adhering to all stipulations of the IWQQMMP.

- The ECO shall be responsible for monitoring the IWQQMMP throughout the project by means of site visits, meetings and written correspondence. This monitoring aspect should be documented as part of the site meeting minutes.
- The ECO shall monitor the implementation of an environmental training program.
- A post construction environmental audit is to be conducted to ensure that all conditions in the IWQQMMP have been adhered to.

Environmental Site Officer (ESO)

LBK must appoint an Environmental Site Officer (ESO) for general assistance with daily compliance monitoring. The ESO can be an employee of LBK and must monitor the day-to-day construction and operating processes.

Contractor (C):

The contractors shall be responsible for ensuring that all activities on site are undertaken in accordance with the environmental provisions detailed in this document and that the sub-contractor and labourers are duly informed of their roles and responsibilities in this regard. The contractor will be required, where specified to provide a method statement setting out in detail how the management actions contained in the IWQQMMP will be implemented. The contractors and appointed sub-contractors will be responsible for the cost of rehabilitation of any environmental damage that may result from non-compliance with the environmental regulations.

Authority (A):

The authorities are the relevant environmental departments that issued the Environmental Authorization, the Water Use licenses and that approved all the guidelines and plans (including the IWQQMMP) to be implemented during the development phases (pre-construction, construction and operational phases) of the proposed bulk water supply pipeline.

In order to ensure compliance with the relevant guidelines and plans (including the IWQQMMP), the relevant authorities must review the monthly audit and/ or compliance reports compiled and submitted by the ECO. In the case of non-compliance, the relevant authorities must make remediation recommendations or take the necessary action to prevent any damage and/ or further damage to the environment. The relevant authorities should also undertake regular site visits. In the case of this project, the relevant authorities are the Gauteng Department of Agriculture and Rural Development (GDARD) and the Department of Water and Sanitation (DWS). The DWS will mainly oversee compliance with the requirements of the water license that were issued and with the IWQQMMP, and the GDARD will mainly oversee compliance with the EA and the EMP.

Lines of Communication

The ECO in writing should immediately report any breach of the IWQQMMP and the Conditions of the Section 21 WUL issued to the Project Manager. The Project Manager should then be responsible for rectifying the problem on-site after discussion with the contractor. Should this require additional cost, then LBK should be notified immediately before any additional steps are taken.

Reporting Procedures to the Developer

Any pollution incidents must be reported to the ECO immediately (within 12 hours). The ECO shall report to AT on a regular basis (site meetings).

Site Instruction Entries

The site instruction book entries will be used for the recording of general site instructions as they relate to the works on site. There should be issuing of stop work order for the purposes of immediately halting any activities of the contractor that may pose an environmental risk.

ESO (Environmental Site Officer) Diary Entries

Each of these books must be available in duplicate, with copies for the Project Manager and LBK. These books should be available to the authorities for inspection or on request. All spills are to be recorded in the ESO's diary.

Methods Statements

Method statements from the contractor will be required for specific sensitive actions on request of the authorities or ESO. All method statements will form part of the IWQQMMP documentation and are subject to all terms and conditions contained within the IWQQMMP document. For each instance wherein it is requested that the contractor submit a method statement to the satisfaction of the ESO, the format should clearly indicate the following:

- What - a brief description of the work to be undertaken;
- How - a detailed description of the process of work, methods and materials;
- Where - a description and/ or a sketch map of the locality of work; and
- When - the sequencing of actions with due commencement dates and completion date estimate.

The contractor must submit the method statement before any particular construction activity is due to start. Work may not commence until the method statement has been approved by the ESO and the DWS.

Record Keeping

All records related to the implementation of this management plan (e.g. site instruction book, ESO diary, methods statements etc.) must be kept together in an office where it is safe and can be retrieved easily. These records should be kept for two years and should be available at any time for scrutiny by any relevant authorities.


6. INTEGRATED WATER QUALITY AND QUANTITY MANAGEMENT AND MONITORING PLAN

Water Management during the Pre-construction / Planning Phase.		
General	Construction activities should preferably take place during the winter months. If it is not possible for construction activities to take place during the winter months, construction activities should take place in phases in order to prevent large exposed areas that will cause an increase in the speed of surface water.	ESO, Contractor, Sub-contractor
	Develop a management plan to ensure a clean-water environment during all phases of the project. The service of a suitably qualified engineer is essential in the planning phase.	Civil Engineer
	<p>Address the concerns and complaints of the affected parties regarding the ground water issues.</p> <ul style="list-style-type: none"> • All remedial action should be done in close liaison with the Department of Water and Sanitation (DWS). • Should an accidental spill occur, construction activities should be ceased temporarily, until the spill has been cleaned up. • The liabilities and proposed preventative and remedial actions will also have to be quantified. <p>Ensure that all surface water and storm water related EMP's are adhered to.</p>	LBK, Contractor, ECO
Water Management of Surface Water	Plan to ensure that all contractors that are employed on site are aware of their responsibilities with regard to water pollution prevention according to the requirements of the National Water Act, 1998 (Act 36 of 1998).	LBK, Contractor, ECO
	Plan to ensure that there is an effectiveness of measures to prevent pollution of surface water bodies.	ECO
	Take water samples of water bodies that will receive surface water run-off from the study area prior to the construction phase. This information will act as baseline information for the construction and operational phases.	LBK, Contractor, ECO
	No raw sewage or other pollutants such as plastic, oil, cement, etc. will be allowed to pollute water.	LBK, Contractor, ECO
	Bio-swale and bio-filters could be installed to minimize the risk of pollutants entering the natural drainage system of the area.	LBK, Contractor, ECO
	Attenuation ponds and energy dissipaters must be installed on the study area to break the speed of the water and to act as siltation ponds.	LBK, Contractor, ECO
	All excess runoff structures must end up in the infiltration structures (thereby ensuring maximum	Civil Engineer

	groundwater recharge).	
	Plan to slope ground surfaces in such a way that no ponding occurs.	Engineer, Contractor, ECO
	The engineer must place emphasis upon the design of drainage and retention systems that provide for efficient use of water quality. Drainage and storm water retention systems should, when possible, be incorporated.	Civil Engineer
Surface Water – Storm Water Management	A Storm Water Management Plan indicating the management of all surface runoff generated as a result of the development prior to entering any natural drainage system or wetland, must be submitted and approved by the local authority and DWS.	LBK
	The SWMP should be designed in a way that aims to ensure that post development runoff does not exceed predevelopment values in: <ul style="list-style-type: none"> ▪ Peak discharge for any given storm; ▪ Total volume of runoff for any given storm; ▪ Frequency of runoff; and ▪ Pollutant and debris concentrations reaching water courses. 	Civil Engineer
	Design all storm water structures (and other surface water flow modifications) in such a manner that the impact on the natural systems is minimized. Keep in mind that increased runoff invariably results from increased bare surfaces.	Civil Engineer
	When storm water planning is done, every attempt possible should be made to keep the post construction and pre-construction flows similar.	Civil Engineer
	Storm water outlets shall be correctly designed to prevent soil erosion. Construction guidelines shall be provided for the prevention and restriction of erosion and siltation.	Civil Engineer
	It is imperative that the development should be constructed in such a way that minimum velocities in storm water runoff are created.	Civil Engineer
	Adequate surface and sub-surface drainage should be provided prior or during development of the site to ensure that no build-up of storm water will occur.	Civil Engineer
Water Management of Underground Water	Ground water contamination and/ or pollution is a preliminary issue identified, and it is imperative that it be monitored as there could be other water bodies that are dependent on it as a source of water that feeds into their system.	LBK, ECO
	Ensure that all activities that may possibly affect ground water are performed in accordance with the requirements of the National Water Act, 1998 (Act 36 of 1998), DWS and the Local Authority.	LBK
	Plan for adequate chemical toilets to be used by contractors during the construction phase, and these toilets are to be placed at least a 100m from the edge of a watercourse.	Contractor, ECO

	The storage and handling of lubricants, oils, paint and material such as cement must be provided for as part of the different contractor's contracts. Specially demarcated and secure storage facilities must be provided for and such storage areas should be clearly illustrated on the master layout plan.	ECO
Water Management during the Construction Phase.		
Water Management of Surface Water	Take water samples of water bodies that will receive surface water during the construction phase on a monthly basis. These samples will be compared with baseline samples taken during the planning phase and monthly samples taken during the construction phase to detect surface water pollution. Consult with DWS and the contractor if water pollution is detected and put an action and/ or a rehabilitation plan in action.	LBK, ECO, ESO
	Ensure that contractors are aware of their responsibilities as far as water pollution is concerned in terms of the requirements of the National Water Act, 1998 (Act 36 of 1998). It will be imperative to monitor their activities. It is suggested that a penalty clause be inserted in the contracts to enable the applicant to take the necessary rehabilitation measures in case of non-compliance.	LBK, ESO, ECO, Contractor
	Maintain the surface water management infrastructure. The section of the SWMP that supplies guidelines and specifications for temporary storm water management during the construction phase must be implemented.	LBK, Contractor
Water Management of Surface Water – Storm Water Management	A SWMP must be compiled for the proposed development. This section of the report must address the management of all surface runoff generated as a result of the construction phase prior to entering any natural drainage system or wetland, and taking cognizance that storm water must be treated to an acceptable level, prior entering the water course.	LBK, Engineer
	Surface storm water generated as a result of construction phase must not be channeled directly into any natural drainage system or wetland.	Engineer
	Where necessary, temporary storm water diversion measures are recommended to control peak flows during thunder storms.	Civil Engineer
Water Management of Underground Water	Ensure that all construction activities that may possibly affect ground water are performed in accordance with the requirements of the National Water Act, 1998 (Act 36 of 1998), DWS and the Local Authority.	Contractor, ECO
	Ensure that adequate chemical toilets are available and are used by contractors during the construction phase - the provision and maintenance of which must form part of the contractor's liabilities.	ECO
	The storage and handling of lubricants, oils,	ECO

	paint, and material such as cement must be provided for as part of contractor's contracts. Specifically demarcated and secure storage facilities must be used.	
	Construct the disposal from hard surfaces in such a manner that the water can infiltrate into the underground water without causing surface erosion.	Contractor, ECO
	After mitigation and/ or preventative measures are implemented ground water monitoring must take place on a twice weekly basis to determine the effectiveness of the action and/ or emergency plan.	ECO
Water Management during the Operational Phase.		
Solid Waste Management (to Prevent soil and Groundwater contamination)	<u>Removal and storage of solid waste</u> Solid waste will be stored in receptacles provided on site and will be removed on a weekly basis to a registered landfill site.	ECO, LBK
Liquid waste management	<u>Removal of liquid waste</u> Liquid waste (especially that is hazardous) will be removed immediately after usage on-site, stored in appropriate containers and be carted to a registered site to dispose of in an approved manner. - It is critical to ensure that these containers are in a secure, safe and weather proof storage facility, underlain by a bunded concrete slab to protect against soil and water pollution.	ECO, LBK
Fuel Storage	Fuel containers exceeding 200 litres capacity should be stored in a manner that will prevent escape of contents to the environment in the case of accidents. -Fuel containers should be stored in a secure weatherproof building or within a secondary containment compound. Above and underground ground fuel storage installations should adhere to the relevant SABS specifications.	ECO, LBK
Water Management of Surface Water	The water quality of the water bodies to which surface water drains must be tested bi-annually for one year after completion of construction. If the water quality proves to be stable, the surface water quality monitoring intervals can be reduced to once a year for the remainder of the operational phase.	LBK
	Ensure that all concerned are aware of all aspects regarding the integrity of the water environment. Enforce if indispensable.	LBK
	Maintain the surface water management infrastructure.	LBK
	The management of water quality variables such as temperature, turbidity, pH, electrical conductivity, suspended solids, total dissolved solids, to name a few.	

Water Management of Surface Water – Storm Water Management	A storm water management plan must be compiled for the proposed development. A comprehensive storm water management plan indicating the management of all surface runoff generated as a result of the development (during both the construction and operational phases) prior to entering any natural drainage system or wetland, must be submitted and approved by the local authority and DWS.	LBK
Water Management of Underground Water	Monitor the water quality, water levels and abstraction volumes of the sampling points.  Maintain the groundwater water monitoring network.	LBK, ECO
Water Management of Underground Water	Continue to treat all operational activities that may possibly affect ground water in accordance with the requirements of DWS and the Local Authority.	LBK
	Maintain the disposal systems that originate on hard surfaces in order to allow the water to infiltrate into the underground water without causing surface erosion.	LBK
	Routine monitoring of water levels, rainfall figures and water quality is strongly recommended and should strictly be adhered to. This data will form the basis from which any changes in the groundwater regime are recognized.	LBK
	Hydro geological monitoring data should be evaluated bi-annually by a qualified hydro geologist.	LBK, ECO
	A Groundwater Management Plan with relevant Groundwater Monitoring and Reporting Protocol should be established and calibrated annually.	LBK, ECO

7. PROPOSED MONITORING REQUIREMENTS

Class	Parameter	Frequency	Motivation
Physical	Static groundwater levels	Monthly	-Time dependant data is required to understand the groundwater flow dynamics of the site. -An anomaly in static water levels caused by mounding below the drainage field may give early warning to spillages or leakages from lined or unlined facilities.
Chemical	Major chemical parameters: Ca, Mg, Na, K, NO ₃ , NH ₄ , SO ₄ , PO ₄ , Cl, Fe, Mn, F, Alkalinity, pH, EC, TDS, COD, BOD.	Quarterly (Jan., Apr., Jul., Sept) May be reduced to biannual (April & Sept.) as more data becomes available)	-Background information is crucial to assess impacts during operation and thereafter. -Changes in chemical composition may indicate areas of groundwater contamination and be used as an early warning system to implement management or remedial actions. Requirement of the Water Use Licence.

8. MONITORING PLAN

Monitoring parameter	Baseline information	Impact	Target	Indicator	Responsible official	Frequency of monitoring	Progress	Corrective action
Water quality								
Ph	The information for water quality is still to be provided							
EC								
TDS								
SO4								
K								
Al								
Fe								
Mn								
Po4								
NH4								
NO3								
Alkalinity								
Faecal coliforms								
Temperature								
Suspended solids								
Dissolved oxygen								
Turbidity								
Water quantity								
Flow regime		Altered flow regime and/ hydrology	To control the surface water flows	No alteration of surface water flows No aquatic biota affected by altered surface water flows Crossings must ensure that the creation of	Contractor Developer Engineer	Monthly	No sign of aquatic biota affected by the altered surface water flows Pre-development and post-development storm water flows are to be kept similar	Re-check the effectiveness of the storm water management plan and drainage measures to ensure that no negative implications are posed on the wetland

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				<p>turbulent flow in the system is reduced in order to counteract downstream erosion</p> <p>The proposed pipeline structure must be designed to allow for the minimum disturbance to surface water flows. The effective management of surface drainage and the prevention of erosion and siltation during the pipeline construction phase must also be addressed.</p>			Storm water management report approved and implemented	through fluctuating flow patterns
			To control and prevent an altered surface water flow due to trench excavations and sub-soil mounds	Appropriate management and no signs of severely altered flows	Engineer Contractor	Daily	Appropriate and effective storm water management	Check storm water design and trench depth
Characteristics								
Flood line change effects		Drainage lines	To ensure the protection of the ecological value of the drainage lines	<p>Guidelines implemented</p> <p>Prevent the erection of any permanent structures below the 1:100 year flood line.</p> <p>Prevent extensive cutting and filling exercises below the 1:100 year flood line</p> <p>Indicate the 1:100 year flood line on all the planning drawings</p>	Contractor Engineer	Continuous	<p>Qualified engineer appointed to confirm the 1: 100 year flood line (pre-construction and post-construction)</p> <p>No impacts on the floodlines</p> <p>No flood risks</p> <p>Improved flood management</p>	Confirmation of the 1: 100 year flood line must be checked at least twice a year

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Storm water measure efficiency		Appropriate storm water design	To prevent and restrict erosion, siltation and groundwater pollution To ensure that storm water is discharged at multiple discharge points and it is not concentrated in one area Storm water management infrastructure is to be maintained	Compilation and approval of storm water management plan Regular cleaning of debris and sediment accumulation in the watercourse as well as the renomatress, bioswales and storm water grid	Engineer Individual Developer	-	No significant signs of erosion, siltation and ground water pollution	Re-check the effectiveness of the storm water management plan and the design of structures such as the renomatress, the bioswales storm water grid, and the outlet pipes.
Erosion control measure efficiency		Erosion and siltation	To prevent erosion and siltation	No erosion scars, no topsoil loss, all damped and damaged areas successfully rehabilitated Storm water attenuation ponds must be implemented in order to function as energy dissipating mechanisms to break the velocity of water and to act as siltation ponds.	Contractor, ESO	Monitor daily	No visible signs of erosion scars, loss of topsoil, and areas are successfully rehabilitated	Check that all mitigation measures are effectively working, such as storm water diversion measures, topsoil stockpiles, etc.
Bio monitoring								
Macro and micro-invertebrates (biota)		Adverse effect on aquatic biota	To prevent an adverse effect on aquatic biota due to rubble dumping near the wetland	Changes in behaviour of aquatic biota	Contractor		No adverse effect recorded and monitored	Strict compliance to control rubble dumping

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			To ensure that the palisade fencing permits faunal migration					
Riparian vegetation		Damage brought about to the riparian system and the drainage lines	To protect the wetland and the riparian system from the proposed construction and operational activities	Adequate storm water management must be implemented to counteract bank and riparian zone erosion Upon the completion of construction activities, the site is to be rehabilitated to an acceptable level that permits the ecosystem to flourish and in accordance to the rehabilitation plan Alien invasive species such as <i>Melia azedarach</i> 1b and <i>Verbena bonariensis</i> are to be eradicated as per the structured program	Engineer Developer Landscape Architect	Bi - weekly	75% establishment of riparian vegetation	Ensure that sensitive areas are strictly demarcated Rehabilitate/cover, where possible, exposed areas immediately after construction Ensure that the alien invasive species are adequately eradicated
Biological toxicity		Soil and water pollution caused by the spillage of construction materials	To ensure that contaminated soils and water quality are addressed	No pollution of the environment	Contractor ESO	Daily	No water and soil contamination	Ensure that the storage areas for materials and chemicals are appropriately sealed off
Geomorphology/fluvial geomorphology		Stability of structures and restriction of land use due to geology	To ensure that precaution is implemented during trench excavations	Signage boards are bright and clear Clearly demarcated and/ or cordoned off areas with a fence or a barrier tape	Individual developer Contractor Engineer		No reporting of incidents related to trench excavations	The responsible official is to ensure that the trenches are strictly demarcated and no person is permitted to enter that area or the surrounding without

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			To ensure the stabilization of channel banks through significant engineering intervention		Engineer		No reported incidents of river banks collapsing	permission Appropriate and feasible bank stabilization measures approved by a qualified engineer and adequate vegetation cover
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Appendix G17

Rehabilitation Plan

2017

Rehabilitation Plan for Rooihuiskraal North Extension 29 on a Part of the Remainder of Portion 9 and a Part of Portion 145 of the Farm Brakfontein 399 – JR, Tshwane



BOKAMOSO LANDSCAPE
ARCHITECTS AND
ENVIRONMENTAL CONSULTANTS
P.O. BOX 11375
MAROELANA
0161
TEL: 012- 346 3810
Fax: 086 570 5659

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1. Introduction

Bokamoso Landscape Architects and Environmental Consultants CC was appointed by **Lezmin 1066 BK** to assist with the Section 21 Water-Use License Application (WULA) occurring on Portion 9 and a Part of Portion 145 of the Farm Brakfontein 399-JR. As a part of the WULA, a landscaping and aquatic rehabilitation plan must be compiled for the affected watercourses that are affected by the proposed Rooihuiskraal X 29 residential development.

1.1 Project Description

Lezmin 1066 BK proposes to develop a residential area, which will consist of three residential security complexes with 100 units per hectare, and associated civil service infrastructure such as water, sewer, storm water and access roads. The affected wetland is proposed to be incorporated into the development as a public open space.

The development overall falls within the Department of Water and Sanitation's (DWS) regulated area, i.e. the 1: 100 year floodline, or riparian habitat, whichever is the greatest, and/ or within a 500m radius from the boundary of a wetland.

2. Study Area

2.1 Geographical area

The study area for the proposed development site is located next to the N14 Highway between the R55 and the Rooihuiskraal roads, on a Part of the Remainder of Portion 9 and a Part of Portion 145 of the Farm Brakfontein 399-JR. The site is currently surrounded by existing residential developments. The area of jurisdiction is within the City of Tshwane Metropolitan Municipality.

The co-ordinates of the site lies between 25° 53' 14'' and 25° 53' 21'' south and 28° 07' 49'' and 28° 08' 32.9'' east.

See **Figure 1** for Topographical map and **Figure 2** for a satellite aerial image of the Study Area.

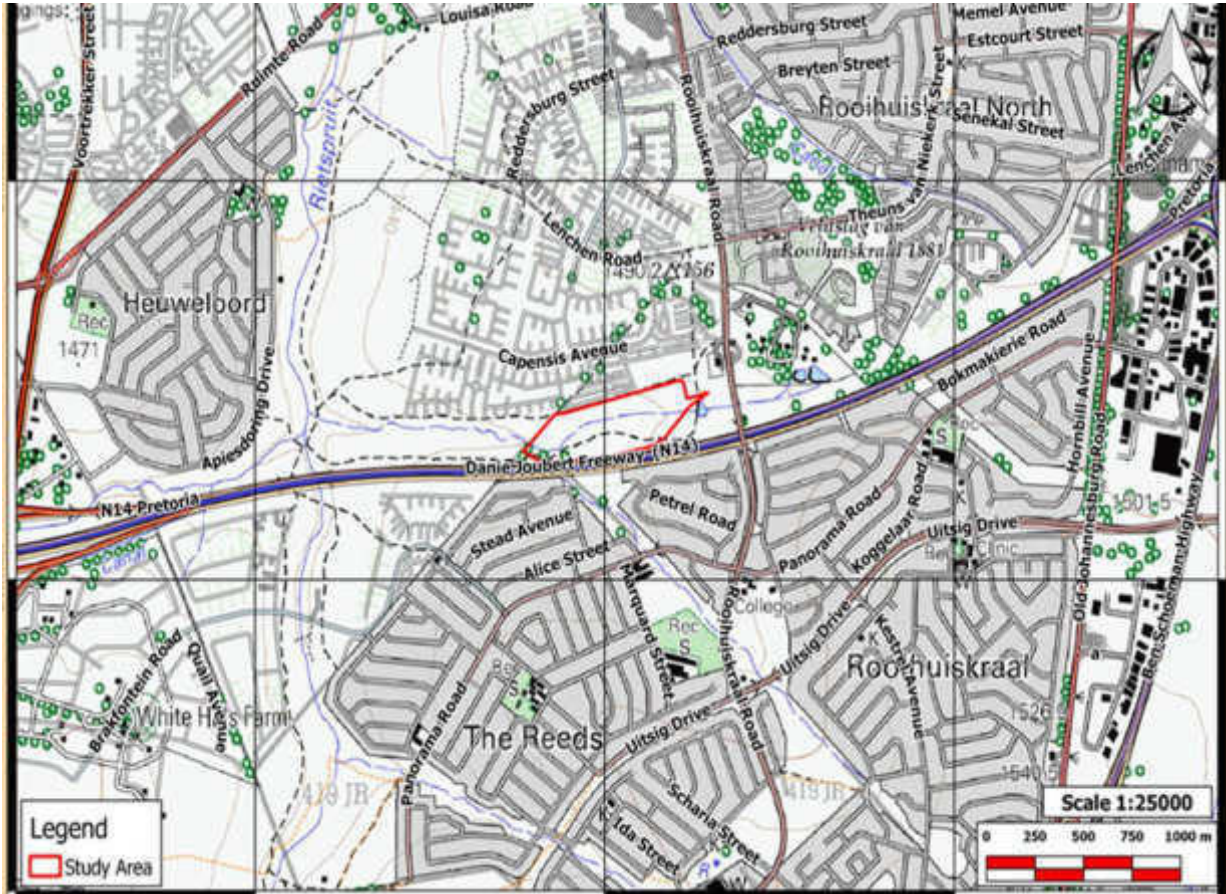


Figure 1: Study Area Topographical Map



Figure 2: Aerial map

2.2 Wetland Assessment

According to Scientific Aquatic Services (SAS) aspects applicable to the subject property and the surrounding areas are discussed below:

- The site is currently vastly taken over by alien invasive vegetation species.
- Indigenous vegetation that are present in the area are the *typha capensis*, in the permanent zone, *verbena bonariensis* in the seasonal zone, *thameda trinadra* in the temporary zone, and terrestrial species such as *hyparrahenia*.
- There is a presence of surface water in the area which was a clear indicator in identifying the temporary zone of the wetland.
- Certain ecologically important species such as the *Eucomis autunalis*

and the *Hypoxis hemerocallidea* are observed within the wetland boundary.

- Significant damage has occurred within the wetland such as damage to terrestrial vegetation and the alteration of soil characteristics, due to the dumping of dolomite stones.

Recommendations proposed

- The wetland area should be maintained, including a 15m buffer around it.
- It is critical that good mitigation measures are in place to control and manage storm water especially from paved surfaces.
- Furthermore, it is advised that good energy dissipating structures are implemented to prevent erosion of the wetland.
- Erosion berms should be constructed whilst activities are occurring, in order to prevent the formation of gullies.
- The interconnectivity and interdependency of the wetland to other features in the surrounding landscape beyond the study site must be sustained.
- The affected site must be rehabilitated post-construction activities, and re-vegetated with species of indigenous nature.

The following water courses were identified during the site assessment:

1. Unchannelled valley bottom (located on the upper gradients of the study area);
2. Channelled valley bottom (located towards the lower gradients' of the site; and
3. A perennial river, the Rietspruit that runs through the centre of the site.

According to TerraSoil Science, aspects applicable to the subject property and the surrounding areas are discussed below:

- There are substantial historic impacts that have occurred on the site and which have led to severe erosion and alteration of the hydrological regime of

the associated drainage features'.

- Such impacts that have been identified on the site and which are mostly anthropogenic in nature, are rubble dumping on the edge and within the drainage line, the dumping of animal carcasses which are hazardous in nature will pose a significant degree of toxicity in terms of the water quality to the downstream users; land use activities, the establishment of developments and roads; due to the excessive amount of rubble dumping on site it has led to the creation of a man-made dam; and extensive alien invasive species encroachment on the site and within the drainage lines.

Recommendations proposed

- The man-made dam that has been created due to rubble dumping can be upgraded to be used as a storm water attenuation and erosion mitigation structure.
- The animal carcasses must be addressed urgently to counteract infection and pollution of downstream water uses.
- Adequate storm water management must be implemented on site to counteract negative impacts on the integrity of the drainage system.
- A 30m buffer (a follow up letter of June 2017 it is confirmed that TerraSoil is in agreement with the 15m buffer as per the recommendations made by SAS) is not recommended for the wetland on site, and it is proposed that appropriate rehabilitation be undertaken for the drainage feature which should include storm water management.

2.3 Biodiversity Area

The site can be described as vacant land with the presence of alien invasive vegetation, rubble dumping and other associated anthropogenic activities. Such grassland species the Egoli granite grassland dominate the site. This grassland type is deemed as Endangered according to the National List of threatened terrestrial ecosystems for South Africa. The landscape is dominated with *Hyparrhenia hirta* grassland.

There is a possibility of a declining plant species; the *Hypoxix hemerocallidea* which is a Red Data species, and Orange Data species has been identified on the site.

It is worthy to note that the presence of orchids such as *H. nyikana* is significant in this study unit, and there the primary grassland is considered to have a moderate to high sensitivity.

Overall, a third of the site is regarded as sensitive, especially the watercourse area, and it is recommended that the Orange Listed species are relocated, and alien plant species, especially the Category 1 and 2 must be eradicated.

2.4. Storm Water Management Concept By Bokamoso

- Storm water will be entered from the N14 Highway, and will be captured in a catch basin for the overflow (storm water grid). From the storm water grid, it will go through a proposed storm water pipe. From the pipe, the storm water will spill on a stone pitching surface of the storm water outlet which permits a sustainable surface that can withstand water flowing over the top;
- This stone pitched surface in conjunction with (concrete blocks energy dissipaters) will assist to dissipate the energy of the water;
- Storm water will then flow through a reno mattress and associated rock features to assist in further dissipating the energy of the storm water;
- Thereafter, storm water will flow through indigenous wetland vegetation which will act as a biological filtering system prior the storm water entering the watercourse;
- In addition, a berm and/ or embankment will be implemented to assist in capturing silt and debris, and preventing it from entering the watercourse;
- The overall concept is to decrease the energy of the flow of storm water prior entering the watercourse, and to ensure that the water flows over a wider area, and that it is not concentrated in one area, in order to reduce the scouring effect of erosion.

Subsequent to the reno mattress of each storm water outlet, indigenous wetland vegetation, boulders, and vegetated berms should be implemented to further maximise the ecological functioning of the wetland system. This system will help with dispersing the energy of the storm water and at the same time improve the water quality through the wetland vegetation filtration process.

3. Rehabilitation Plan development process

This Rehabilitation Plan was compiled in accordance with the Department of Water and Sanitation (DWS) **Environmental Best Practice Specifications** Integrated Environmental Management Series.

The DWS defines Rehabilitation as:

'Making the land useful again after a disturbance. It involves the recovery of ecosystem functions and processes in a degraded habitat. Rehabilitation does not necessarily re-establish the pre-disturbance condition, but does involve establishing geological and hydrologically stable landscapes that support the natural ecosystem mosaic.'

4. Rehabilitation Methodology

The purpose of this rehabilitation plan is to improve the ecological status of the study area compared to the pre-construction status, to prevent erosion, and to improve the aesthetic appeal of the area. It is also vital to note that rehabilitation should aim to ensure that rescued plants that were stripped before construction are re-introduced or returned to the study site, post-construction.

The objective of this rehabilitation plan is to ensure:

- All construction infrastructure is removed post construction;
- Ensure environment is reinstated in disturbed areas;
- Compacted areas are shaped, ripped and scarified;
- Indigenous vegetation is reintroduced;

- Alien vegetation is removed and controlled;
- Site is monitored following rehabilitation; and that
- The development is sustainable overall contributing to and ensuring that the open space systems are rehabilitated.

The activities associated with the proposed development and its related infrastructure will bring about very much siltation, erosion and sedimentation which can enter the proposed watercourse. This has to be controlled through effective storm water management, and it is recommended that at the outlet structures, energy dispensers and gabion baskets are placed and/ or implemented to ensure that the flow of water into the stream is decreased.

In terms of the bridge construction, this will entail a concrete bridge structure (20.3m x 7m and a 2m walkway) over the wetland area. This connection is required in order to gain access to the proposed development and to connect the proposed development to the other Rooihuiskraal extensions. The method to implement the bridge will entail the bridge structure to span to the floodlines and the base of the bridge will be supported by concrete piles.

Please take note that the flow regime of the stream will not be altered or disturbed by the bridge construction. There will only be a temporary diversion of the stream which will be done using sandbags.

Due to the threat of the encroachment of alien invasive species, active rehabilitation is required to remove alien species, in order to protect the ecological integrity of the wetland and its associated faunal and floral species.

4.1 Areas to be rehabilitated

All areas disturbed during the implementation of all associated infrastructure are to be rehabilitated. These areas include but are not limit to:

- River bed and banks;

- Channelled valley bottom wetland;
- Unchannelled valley bottom wetland;
- The Rietspruit River; and the
- Riparian zone.

4.2 Rehabilitation Methods

4.2.1 Cleaning

All building rubble, waste and weeds are to be removed.

4.2.2 Shaping/Sloping

All slopes should be shaped to a maximum slope of 1:3 to prevent erosion from occurring, and for the safety of humans and animals.

All disturbed areas should be sloped to blend in with the surrounding environment.

4.2.3 Ripping/ Scarifying

Ripping entails loosening the soil up to a depth of 300mm.

Scarifying entails roughening the surface of soil to a depth of 50mm, creating a smoother surface than ripping.

Areas compacted during construction phase should be ripped and scarified in order to loosen soil to allow for seed germination.

4.2.4 Planting/Re-vegetate

Re-vegetation is a very important part of sloping as it will make the soil more stable and create roughness. Planting can be affected by utilising transplanted plants, nursery plants, seed or seedlings.

4.2.5 Stabilisation

Slopes steeper than 1: 3 or slopes where the soils are sandy, must be stabilised.

One or more of the following methods may be required:

- Topsoil covered with a geotextile, plus a specified grass seed mixture;
- A 50:50 by volume rock: topsoil mix 200mm thick, plus a specified grass seed mixture Logging or stepping (logs placed in continuous lines following the contours);
- Earth or rock-pack cut-off berms;
- Benches (sand bags);
- Packed branches;
- Ripping and / or scarifying along the contours; and
- Storm water berms.

4.2.6 Landscaping

The constructed residential development and associated infrastructure need to be rehabilitated in such a way so as to fit harmoniously into the surrounding environment by means of landscaping. The proposed landscaping should adhere to all the plans, policies and regulations of the City of Tshwane. Planting should be of indigenous endemic species. It is also important that the recommendations of the Fauna and Flora Report as well as the EMPr be adhered to in terms of rehabilitation.

It is proposed that the residential area be designed with recreational pedestrian walkways and street furniture along the river. The idea is to make the river frontage area an attractive and aesthetically appealing area that are used by humans for late afternoon strolls and for the general enjoyment of the natural open space. On-going rehabilitation and maintenance works adjacent to the river also forms part of the development plan.

Please take note the landscaping proposed for the watercourse area can be used and/ or implemented for the areas associated with the development that are not open space areas.

The following are proposed to be used as landscaping along the development:

- Indigenous trees and flowers are to be planted along the parking area and along the river edges;
- Boulder rocks are recommended to be placed along the river edges which can assist with erosion control (as per Bokamoso's storm water management concept);
- As a form of recreation, benches can be placed around the river area to allow residents to enjoy the scenery of the private open space;
- The walkways are recommended to be edged with dump rock stone to create a more natural and aesthetic appeal of the development overall; and
- It is recommended that green pockets with indigenous plants and flowers be implemented between the residential stands, allowing for a more natural and satisfying appeal of the development.

It is integral to note that landscaping in general should aim to compliment the surrounding natural vegetation and should blend in with the local vegetation. Landscaping effects that is in harmony with the natural vegetation will both reduce the visual impacts associated with the development and it will also create a more natural habitat for flora and fauna.

4.3 Rehabilitation Action Plan

Rehabilitation actions to be taken together with assigned responsibility are listed in **Table 1** below.

Table 1: Rehabilitation Actions and Responsibility

#	Rehabilitation Action	Method	Responsibility
1	Remove building rubble of construction work activities and any other from the river and from the site	All building rubble generated during the construction phase of the project, as well as building rubble are to be removed from site and disposed of at a registered landfill site with prior permission from the Local Municipality.	Civil contractor/ Environmental Site Officer
2	De-establish site camp	The site camp is to be de-established by removing all construction plant, equipment, storage containers, fencing, ablution, etc.	Civil contractor/ Environmental Site Officer
3	Remove and dispose of all waste generated during the construction phase	Domestic waste to be removed to a registered landfill site. Hazardous waste to be removed to an appropriately classed h: landfill site. Ablution (chemical toilets) facilities to be emptied and contents disposed of at a registered and properly functioning sewage treatment works. Clear the site of all inert waste and rubble, including surplus rock, foundations and batching plant aggregates.	Civil contractor/ Environmental Site Officer
4	Clean up river and	Any rubble visible on the banks of the river and the wetland area should be collected	Civil contractor/

#	Rehabilitation Action	Method	Responsibility
	riparian zone	and disposed of at a registered landfill site.	Environmental Site Officer
5	Cap disturbed areas with topsoil	<p>During the installation of services, it can lead to soil being exposed, and susceptible to erosion;</p> <p>Topsoil stockpiled during the construction phase should be returned to disturbed areas for the purpose of capping. Disturbed areas include but are not limited to site camp area, watercourse area.</p> <p>Topsoil should be returned prior to onset of the wet season.</p> <p>Topsoil should be returned to the same area as from which it was stripped.</p> <p>Replace topsoil to the original depth.</p> <p>All areas of disturbed and compacted soils need to be ripped and re-profiled.'</p> <p>Large amounts of topsoil will be lost during the construction phase. It is best that at least 2cm of topsoil be removed prior construction, and stockpiled in an area that is clearly demarcated as a no-go area and in order that it will not interfere with the natural drainage area. Should topsoil be lost, then there will be a surplus supply available.</p> <p>Stockpiles and surround downhill sides and/ or slopes are recommended to be covered with a sediment fence to cease materials from being washed away.</p> <p>Where the implementation and/ or laying of infrastructure such as the pipelines in this case, the area or trench is to be refilled, thereafter rehabilitation is to occur.</p>	Civil contractor Site Manager

#	Rehabilitation Action	Method	Responsibility
	Preventing damage of the existing soils and geology	Surfaces that are susceptible to erosion are recommended to be protected by cladding with biodegradable material, or with a top layer of soil being seeded with grass and/ or planted with a suitable groundcover.	Engineer
6	Slope/Shape embankments	Slopes are to be no steeper than 1:3. Shape all disturbed areas to blend in with the surrounding landscape;	Civil contractor Site Manager
7	Erosion of drainage lines	<p>Appropriate flow diversion and erosion control structures, such as an earth embankment should be placed in areas exposed to high levels of erosion due to the steep gradient of the slope.</p> <p>Erosion control blankets are further recommended to provide support on the steep slopes. These blankets can also be pegged down to ensure that the blanket remains intact.</p> <p>Steep slopes and soft easily erodible soil are recommended to be vegetated with grass or a specific type of hydro-seeding.</p> <p>To counteract sedimentation input into the wetland and the Rietspruit River over a longer period, the stockpiled material must be retained in a bermed area. Construct the berm to divert, disperse and dissipate water away from the pipeline route.</p>	Engineer

#	Rehabilitation Action	Method	Responsibility
8	Rip and scarify compacted areas	<p>Once topsoil has been returned, area is to be ripped and scarified.</p> <p>Areas compacted during construction phase should be ripped in order to loosen soil to allow for seed germination.</p> <p>Compacted soil is to be ripped to atleast 200m.</p> <p>Do not rip and scarify during wet conditions as soil will not break up.</p> <p>Rip and scarify along contours to prevent creation of channels which could lead to erosion.</p> <p>It is integral to try and maintain the natural drainage patterns as far as possible.</p> <p>Any drains and channels should be smoothed down in order to link with the natural drainage patterns.</p> <p>All clumps and rocks are to be removed from the soil before rehabilitation.</p>	Civil contractor Site Manager
9	Stabilise embankments/slopes	<p>Slopes steeper than 1:3 or slopes where the soils are sandy, must be stabilised.</p> <p>One or more of the following methods are recommended:</p> <ul style="list-style-type: none"> • Topsoil covered with a geotextile, plus a specified grass seed mixture; • Ripping and / or scarifying along the contours; • Gabions and/ or reno mattresses. 	Landscape contractor
10	Trenching	<p>All trenches are to be backfilled.</p> <p>Lateral seepage water that accumulates upslope of the compacted fill area of the</p>	Engineer

#	Rehabilitation Action	Method	Responsibility
		pipeline trench should be mitigated and managed to allow for flowing over the in-filled trench area without causing erosion. This can be done through the establishment of stabilised overflow areas and vegetation of the soil covering.	
11	Planting/Re-vegetation of open and sloped areas	<p>All planting is to be conducted by a suitably qualified contractor.</p> <p>Planting method suggested for this project is hydroseeding as it will be best for the sloped areas and is known to be a successful method. This is the most cost effective method for rehabilitation of large areas as all surfaces are covered and vegetation quality is high. Rehabilitated areas need to have a ground cover of at least 80%.</p> <p>Only seed or seedlings indigenous to the area should be used for planting.</p> <p>Any materials used for seeding, mulching or fertilizing must be certified as weed free.</p> <p>Plants should be irrigated daily for at least 14 days until the grass is able to survive independently.</p> <p>Thereafter, the watering of grass should take place every four days for 20 minutes after the grass has hardened off.</p> <p>Where relevant, certain plant species are to be conserved under nursery conditions.</p> <p>Where possible, open areas must be maintained, as it functions as an ecological linkage.</p>	Civil contractor Site Manager
12	Floral and faunal species adaptability with the ecological processes	The proposed plant species to be utilized as a part of the rehabilitation plan must be non-invasive and indigenous to that area and can adapt to the local climate. The floral species should be able to attract faunal species to the area. All planting work is to be undertaken by a suitably qualified Contractor, making use of the correct equipment.	Landscape architect

#	Rehabilitation Action	Method	Responsibility
		<p>Orange listed species such as the <i>Hypoxis hemerocallidae</i> and <i>Eucomis autumnalis</i> that will be affected during construction should be temporarily removed and relocated to a suitable habitat until construction is over.</p> <p>It is essential to ensure that the Orange listed species are conserved under nursery conditions.</p> <p>The following plant or floral species are recommended to be used as a part of the rehabilitation process; <i>Rhus pyroides</i> and/ or <i>Searsia pyroides</i> (tree and/ or shrub species).</p> <p>The following grass species: <i>Hyparhenia hirta</i> to be used as a part of the rehabilitation process.</p>	
13	Storm water mitigation	<p>Storm water will be entered from the N14 Highway, and will be captured in a catch basin for the overflow (storm water grid). From the storm water grid, it will go through a proposed storm water pipe. From the pipe, the storm water will spill on a stone pitching surface of the storm water outlet which permits a sustainable surface that can withstand water flowing over the top.</p> <p>This stone pitched surface in conjunction with (concrete blocks energy dissipaters) will assist to dissipate the energy of the water;</p> <p>Storm water will then flow through a reno mattress and associated rock features</p>	Engineer

#	Rehabilitation Action	Method	Responsibility
		<p>to assist in further dissipating the energy of the storm water;</p> <p>Thereafter, storm water will flow through indigenous wetland vegetation which will act as a biological filtering system prior to the storm water entering the watercourse;</p> <p>In addition, a berm and/ or embankment will be implemented to assist in capturing silt and debris, and preventing it from entering the watercourse;</p> <p>The overall concept is to decrease the energy of the flow of storm water prior to entering the watercourse, and to ensure that the water flows over a wider area, and that it is not concentrated in one area, in order to reduce the scouring effect of erosion. Refer to the proposed Storm Water Status Quo and the Storm Water Master Layout by Bokamoso attached as Appendix G13 of the Draft Basic Assessment Report.</p>	
14	Remove alien invasive vegetation	<p>All alien invasive vegetation encountered within the study area and along the riparian zone should be removed. Section 5 describes a recommended alien invasive monitoring programme.</p> <p>A number of alien invasive species occur within the study area especially along the wetland area. I.e. <i>Melia azedarach</i> 1b, <i>Verbena bonariensis</i> 1b, and <i>Salix babylonica</i> <i>Acacia mearnsii</i>.</p>	Civil contractor/ Environmental Site Officer

4.4 Timeframe for implementation

Implementation of this plan should commence immediately following completion of the construction phase of the proposed construction activities, and should be concluded within three (3) months. If practical, rehabilitation should commence immediately following completion of a specific section of the residential development, rather than rehabilitating the entire study area upon completion of all construction activities. It is also recommended that rehabilitation be planned for completion prior to the onset of the rainy season i.e. during late winter and early spring.

4.5 Vegetation species to be utilised

Due to the study area being classified as the Egoli Granite Grassland with tall grass species such as *Hyparrhenia hirta* dominating the area, it is recommended that vegetation species endemic to this area be utilised for rehabilitation. Below is a list of plant species associated with the Egoli Granite Grassland.

It is worthy to note that the terrestrial habitats that are currently on the site have been altered and are therefore in a degraded state, and can no longer be considered as the Egoli Granite Grassland. Although there is limited connectivity with similar habitats due to the anthropogenic activities that have taken place, the wetland is still in a relatively good ecological condition and could potentially support Red Listed and sensitive species such as the *Leptailurus serval* and the *Otomys auratus*.

Small trees:

- Grassland – No trees should be planted

Shrubs:

- Grassland – No shrubs should be planted.

Graminoids (grasses):

- **Grassland:** *Cymbopogon caesius*, *Hyparrhenia hirta*, *Eragrostis capensis* and *Themeda triandra*
- *Imperata cylindrica*

Herbs:

- **Grassland:** *Hypoxis hemerocallidea*, *Nidorella anomala*, *Helichrysum nudifolium* var. *oxyphyllum*, *Habenaria nyikana* subsp. *Nyikana*, *Pelargonium luridum*, *Scabiosa columbaria*
- **Watercourse:** *Typha capensis*, *Berkheya radula*, *Schoenoplectus* sp., *Cyperus* spp., *Fimbristylis complanata*, *Habenaria nyikana* subsp. *Nyikana*, *Hypoxis hemerocallidea*

5. Alien vegetation eradication

An alien invasive eradication and monitoring programme is recommended for the study area for all phases of the construction activities as this will promote biodiversity in the area and limit the distribution of alien invasive species via water and human activity.

The purpose of the eradication of alien invasive plants is the restoration and rehabilitation of the study area.

Methods that may be used to control alien invasive species include:

- Mechanical treatment
 - Removing by means of hands, tools, instruments or machines.
- Chemical treatment
 - Using herbicides to control target species.
- Biological treatment
 - Using natural enemies of the target specie that affect the biological integrity of the target specie.
- Habitat management
 - Using burning, grazing etc.

Actions to be taken as part of an alien vegetation eradication programme are listed in **Table 2** below. Responsibility for implementing this eradication programme will resort with the appointed Civil Contractor.

Table 2: Alien plant eradication programme

#	Eradication Action	Method
1	Set aside funds for implementation of the programme	During the planning phase of the project, the project budget should cater for alien plant eradication.
2	Establish extent of infestation	Request alien vegetation specialist to conduct survey of the Study Area and adjacent watercourse prior to construction commencing in order to establish: <ul style="list-style-type: none"> • Extent of infestation; • Species to be eradicated.
3	Select treatment method	An appropriate treatment method based on species occurring in the Study Area should be selected.
4	Remove alien vegetation	Alien vegetation removal should commence in areas of highest infestation and prior to flowering. Vegetation should be removed prior to construction commencing. Any alien vegetation spotted during the construction phase should also be removed. Following construction/expansion activities, all disturbed areas should be scouted for presence of alien vegetation, and removed.
5	Rehabilitate cleared areas	Areas where alien vegetation has been removed must be rehabilitated in accordance with this plan (Refer Table 1).
6	Follow-up eradication	Eradication of alien vegetation must continue until natural vegetation coverage reaches 80% in all disturbed areas.

6. Rehabilitation Plan Responsibility

6.1 Implementation

It is proposed that responsibility for the implementation of this rehabilitation plan in accordance with its content rests with the appointed Civil Contractor.

6.2 Monitoring

6.2.1 Monitoring Responsibility

It is proposed that the responsibility for monitoring the implementation of this rehabilitation plan rests with the appointed ECO.

6.2.2 Monitoring Timeframe

It is proposed that effectiveness of rehabilitation be monitored by the appointed ECO from commencement of the rehabilitation phase of the construction of the pipeline, and for at least six (6) months following completion of the rehabilitation, to ensure that:

- Rehabilitation commences immediately following completion of the construction phase;
- 80% of endemic vegetation has re-established;
- Alien plant eradication continues until 80% of the endemic vegetation has re-established.

7. REFERENCES

1. Department of Water Affairs & Forestry, February 2005. **Environmental Site Management & Rehabilitation Awareness Course Memorandum: Management Level.** Integrated Environmental management Sub-Series No. IEMS 1.6. Third Edition. Pretoria
2. Department of Water Affairs and Forestry, February 2005. **Environmental Best Practice Specifications: Construction.** Integrated Environmental Management Sub-Series No. IEMS 1.6. Third Edition. Pretoria.



Appendix H

Environmental Management
Programme (EMPr)

ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPR) FOR THE PROPOSED ROOIHUISKRAAL NORTH X 29

A Part of the Remainder of Portion 9 and A
Part of Portion 145 of the Farm Brakfontein
399 JR



June 2017

BOKAMOSO
LANDSCAPE ARCHITECTS
AND ENVIRONMENTAL
CONSULTANTS CC

Tel: 012-346 3810
Fax: 086 5705659
Email:
reception@bokamoso.net
P.O. Box 11375
Maroelana
0161

1 Project Outline

1.1 **Background**

Bokamoso Landscape Architects and Environmental Consultants were appointed by **Lezmin 1066 BK** to compile a Basic Assessment Application to obtain Environmental Authorization for the proposed Residential 3 development of **Rooihuiskraal North Ext 29**.

1.2 **Project description**

The proposed residential development of **Rooihuiskraal North Ext 29** will be situated on Part of the Remainder of Portion 9 and a Part of Portion 145 of the Farm Brakfontein 399-JR, Tshwane; Gauteng Province.

An Environmental Authorization process is underway in order to obtain authorization to develop a residential development.

Timeframe for construction:

Will be provided when Environmental Authorization is received. Therefore the timeframe for construction is still unknown.

The developer will be responsible for the on-site activities. The EMPr will be a binding document for purposes of compliance.

1.3 **Receiving Environment**

Biodiversity:

- The proposed study area falls within the Ecological Support and Important Area which is dominated by the Egoli Granite Grassland, which is regarded as Vulnerable.

- The 2017 survey indicated that the study site has suitable habitat for one Red List species and four Orange List species, of which two Orange List species, *Hypoxis hemerocallidea* and *Eucomis autumnalis*, were recorded on site. Both these Orange Listed species were recorded in the 2008 and 2010 surveys.
- The orchid, *Habenaria nyikana* subsp. *nyikana*, was also recorded during the 2017 survey but not in the 2008 and 2010 survey. These species are, however, not categorised as Red listed and should be relocated prior to the commencement of construction to either the north of the study site, where similar environmental conditions occur, or in the watercourse buffer area where two of these species already occur.
- Parts of the terrestrial habitats present on the study area have been transformed and degraded to such an extent that it can no longer be regarded as typical of the Egoli Granite Grassland. There is limited connectivity with similar habitats as the study area is surrounded by roads and residential developments. There is, however still suitable habitat on the study area for Red Listed species. The Wetland is still in a good ecological condition and could potentially support Red Listed and sensitive species such as *Leptailurus serval* and *Otomys auratus*.
- No Red Listed invertebrate species are expected to occur in this particular study area, except for the wetland specialist, the Marsh sylph.
- There is potentially suitable habitat for the Striped Harlequin Snake (*Homoroselaps dorsalis*) and the Giant bullfrog (*Pyxicephalus adspersus*).
- The majority of the study area is regarded as degraded with some illegal dumping taking place. This has a negative impact to the environment.

Hydrology:

- A watercourse/ wetland occur within the study area.
- The study area is affected by floodlines.
- The wetland/ watercourse occurs approximately in the middle of the site.

Cultural /Historical:

- No cultural heritage resources are present on the proposed development area.
- The Rooihuiskraal Historical Terrain is situated to the east of the site and is literally divided by the M37/ Rooihuiskraal Road. The Rooihuiskraal Historical Terrain was declared a national monument in 1981, the original farmstead dates back to the 1880's. It was the location of two battles during the Anglo-Boer war.

Visual:

- The proposed development will be visible from the N14 Highway (to the north of N14 Highway).

Geology:

- The majority of the site is underlain by loose or potentially collapsible sands to depths of up to 0,6m and locally to 1,4m.
- The site is underlain at depth by Archaean Granite of the Halfway House Granite Suite.
- The area is **NOT** underlain by dolomite.

2 EMP Objectives and context

Objectives

The objectives of this plan are to:

- Identify the possible environmental impacts of the proposed activity;
- Develop measures to minimise, mitigate and manage these impacts;
- Meet the requirements of the Record of Decision of GDARD and requirements of other Authorities; and
- Monitor the project.

EMPr context

This EMPr fits into the overall planning process of the project by carrying out the conditions of consent set out by the Gauteng Department of Agriculture and Rural Development.

This EMP addresses the following three phases of the development:

- Pre-construction planning phase;
- Construction phase; and
- Operational phase.

3 Monitoring

In order for the EMPr to be successfully implemented all the role players involved must have a clear understanding of their roles and responsibilities in the project.

These role players may include the Authorities (A), other Authorities (OA), Developer/ Proponent (D), Environmental Control Officer (ECO), Project Manager (PM), Contractors (C), Environmental Assessment Practitioner (EAP) and Environmental Site Officer (ESO). Landowners, Interested and Affected Parties (I&APs) and the relevant environmental and project specialists are also important role players.

3.1 Roles and responsibilities**Developer (D)**

The developer is ultimately accountable for ensuring compliance with the EMPr and conditions contained in the Environmental Authorization. The developer must appoint an independent Environmental Control Officer (ECO), for the duration of

the pre-construction and construction phases, to ensure compliance with the requirements of this EMPr. The developer must ensure that the ECO is integrated as part of the project team.

Construction Manager (PM)

The Project Manager is responsible for the coordination of various activities and ensures compliance with this EMPr through delegation of the EMP to the contractors and monitoring of performance as per the Environmental Control Officer's monthly reports.

Environmental Control Officer (ECO)

An independent Environmental Control Officer (ECO) shall be appointed, for the duration of the pre-construction and construction phases of the development, by the developer to ensure compliance with the requirements of this EMPr.

- The Environmental Control Officer shall ensure that the contractor is aware of all the specifications pertaining to the project.
- Any damage to the environment must be repaired as soon as possible after consultation between the Environmental Control Officer, Consulting Engineer and Contractor.
- The Environmental Control Officer shall ensure that the developer staff and/or contractor are adhering to all stipulations of the EMPr.
- The Environmental Control Officer shall be responsible for monitoring the EMPr throughout the project by means of site visits and meetings. This should be documented as part of the site meeting minutes.
- The Environmental Control Officer shall be responsible for the environmental training program.
- The Environmental Control Officer shall ensure that all clean up and rehabilitation or any remedial action required, are completed prior to transfer of properties.

- A post construction environmental audit is to be conducted to ensure that all conditions in the EMPr have been adhered to.

Principal Contractor (C):

The Principal contractors shall be responsible for ensuring that all activities on site are undertaken in accordance with the environmental provisions detailed in this document and that sub-contractor and laborers are duly informed of their roles and responsibilities in this regard.

The Principal contractor will be required, where specified to provide Method Statements setting out in detail how the management actions contained in the EMPr will be implemented.

The Principal contractors will be responsible for the cost of rehabilitation of any environmental damage that may result from non-compliance with the environmental regulations.

Environmental Site Officer (ESO):

The ESO is appointed by the developer and then finally the home owner as his/her environmental representative to monitor, review and verify compliance with the EMPr by the contractor. The ESO is not an independent appointment but must be a member of the contractor's management team. The ESO must ensure that he/she is involved at all phases of the construction (from site clearance to rehabilitation). These duties can be taken up by another officer on the construction site. This individual should convey any queries or concerns the ECO has.

Authority (A):

The authorities are the relevant environmental department that has issued the Environmental Authorization. The authorities are responsible for ensuring that the monitoring of the EMPr and other authorization documentation is carried out by means of reviewing audit reports submitted by the ECO and conducting regular site visits.

Other Authorities (OA):

Other authorities are those that may be involved in the approval process of the EMPr.

Environmental Assessment Practitioner (EAP):

According to Section 1 of NEMA the definition of an Environmental Assessment Practitioner is "the individual responsible for the planning, management and coordination of Environmental Impact Assessments, Strategic Environmental Assessments, Environmental Management Programmes or any other appropriate environmental instruments through regulations".

3.2 Lines of Communication

The Environmental Control Officer in writing should immediately report any breach of the EMPr to the Project Manager. The Project Manager should then be responsible for rectifying the problem on-site after discussion with the contractor. Should this require additional cost, then the developer should be notified immediately before any additional steps are taken.

3.3 Reporting Procedures to the Developer

Any pollution incidents must be reported to the Environmental Control Officer immediately (within 12 hours). The Environmental Control Officer shall report to the Developer on a regular basis (site meetings).

3.4 Site Instruction Entries

The site instruction book entries will be used for the recording of general site instructions as they relate to the works on site. There should be issuing of stop work order for the purposes of immediately halting any activities of the contractor that may pose environmental risk.

3.5 ESA/ESO (Environmental Site Officer) Diary Entries

Each of these books must be available in duplicate, with copies for the Engineer and Environmental Site Officer. These books should be available to the authorities for inspection or on request. All spills are to be recorded in the ESA/Environmental Site Officer's diary.

3.6 Methods Statements

Methods statements from the contractor will be required for specific sensitive actions on request of the authorities or ESA/ESO (Environmental Site Officer). All method statements will form part of the EMPr documentation and are subject to all terms and conditions contained within the EMPr document. For each instance wherein it is requested that the contractor submit a method statement to the satisfaction of ESA/ESO, the format should clearly indicate the following:

- What – a brief description of the work to be undertaken
- How – a detailed description of the process of work, methods and materials
- Where – a description / sketch map of the locality of work; and

- When – the sequencing of actions with due commencement dates and completion date estimate.

The contractor must submit the method statement before any particular construction activity is due to start. Work may not commence until the method statement has been approved by the ESA/ESO.

3.7 Record Keeping

All records related to the implementation of this Management Programme (e.g. site instruction book, ESA/ESO diary, methods statements etc.) must be kept together in an office where it is safe and can be retrieved easily. These records should be kept for two years and must be available at any time for scrutiny by any relevant authorities.

3.8 Acts

3.8.1. The National Water Act, 1998 (Act No: 36 of 1998)

The purpose of this Act is to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled in ways that take into account, amongst other factors, the following:

- ❑ Meeting the basic human needs of present and future generations;
- ❑ Promoting equitable access to water;
- ❑ Promoting the efficient, sustainable and beneficial use of water in the public interest;
- ❑ Reducing and preventing pollution and degradation of water resources;
- ❑ Facilitating social and economic development; and
- ❑ Providing for the growing demand for water use.

Impact on proposed Development:

Significant – A Section 21 (c) and (j) Water Use License will be confirmed during a pre-application meeting with the Department of Water Affairs. In order for them to consider whether a Water Use License is required they will need a copy of the Basic Assessment Report.

3.8.2. Atmospheric Pollution Prevention Act (Act 45 of 1965)

The NEMA: AQA serves to repeal the Atmospheric Pollution Prevention Act (45 of 1965) and various other laws dealing with air pollution and it provides a more comprehensive framework within which the critical question of air quality can be addressed.

The purpose of the Act is to set norms and standards that relate to:

- ❑ Institutional frameworks, roles and responsibilities
- ❑ Air quality management planning
- ❑ Air quality monitoring and information management
- ❑ Air quality management measures
- ❑ General compliance and enforcement.

Amongst other things, it is intended that the setting of norms and standards will achieve the following:

- The protection, restoration and enhancement of air quality in South Africa
- Increased public participation in the protection of air quality and improved public access to relevant and meaningful information about air quality
- The reduction of risks to human health and the prevention of the degradation of air quality.

The Act describes various regulatory tools that should be developed to ensure the implementation and enforcement of air quality management plans. These include:

- Priority Areas, which are air pollution 'hot spots'
- Listed Activities, which are 'problem' processes that require an Atmospheric Emission License
- Controlled Emitters, which includes the setting of emission standards for 'classes' of emitters, such as motor vehicles, incinerators, etc.
- Control of Noise
- Control of Odours.

Impact on proposed Development:

Significant –The Act has relevance to the proposed development during the construction phase. Dust pollution could be a concern primarily during the construction phase of the proposed project. Dust control would be adequately minimised during this phase by way of water spraying and possible dust-nets, when working close to existing residential dwellings. It is not foreseen that the proposed development would contribute significantly to pollution in terms of emissions and noise during its operational phase, as it is a Residential 3 development, which does not include any noxious industries.

3.8.3 National Environmental Management Act (Act 107 of 1998)(as amended)

The NEMA is primarily an enabling Act in that it provides for the development of environmental implementation plans and environmental management plans. The principles listed in the act serve as a general framework within which environmental management and implementation plans must be formulated.

The principles in essence state that environmental management must place people and their needs at the forefront of its concern and that development must be socially, environmentally and economically sustainable.

Impact on proposed Development:

Significant – Section 28 (1) of NEMA stated that every person who causes, has caused or may cause significant pollution or degradation of the environment must

take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.

The EMPr is compiled in terms of Section 28 of NEMA.

3.8.4. The National Environmental Management: Waste Act (Act 59 of 2008)

This Act came into effect on 11 June 2009. It aims to consolidate waste management in South Africa, and contains a number of commendable provisions, including:

- The establishment of a national waste management strategy, and national and provincial norms and standards for, amongst others, the classification of waste, waste service delivery, and tariffs for such waste services;
- Addressing reduction, reuse, recycling and recovery of waste;
- The requirement for industry and local government to prepare integrated waste management plans;
- The establishment of control over contaminated land;
- Identifying waste management activities that requires a licence, which currently include facilities for the storage, transfer, recycling, recovery, treatment and disposal of waste on land;
- Co-operative governance in issuing licenses for waste management facilities, by means of which a licensing authority can issue an integrated or consolidated license jointly with other organs of state that has legislative control over the activity; and
- The establishment of a national waste information system.

On 3 July 2009 the Minister of Environmental Affairs and Tourism promulgated a list of waste management activities that might have a detrimental effect on the environment. These listed activities provide the activities that require a Waste

Management License. Two Categories are specified: Category A and Category B. As part of Category A: Waste Management License application, a Basic Assessment in terms of Section 24(5) of the National Environmental Management Act (Act 107 of 1998) must be submitted to the relevant Authority. As part of a Category B: Waste Management License a Scoping and EIA process in terms of Section 24(5) of the National Environmental Management Act (Act 107 of 1998) must be followed and submitted to the relevant Authority.

On 29 November 2013 the Minister of Environmental Affairs and Tourism amended the list of waste activities that might be detrimental to the environment and this was published under Government Notice 921. On 7 April 2017 the NEMA EIA Regulations have been amended.

Impact on proposed Development:

Not Significant—No Waste Management License will be required during the construction phase of the proposed residential development.

3.8.5 . The Municipal Systems Act (Act 32 of 2000)

This Act was introduced to provide for the core principles, mechanisms and processes that are necessary to enable municipalities to move progressively towards the social and economic upliftment of local communities, and ensure universal access to essential services that are affordable to all.

The proposed development will support the local authority in complying with the principles of the Municipal Systems Act, by assisting in providing the community with essential services, such as water and sewage infrastructure.

Impact on proposed Development:

Significant —The proposed development will promote the Municipal System within the area of Rooihuiskraal, as the proposed development will upgrade, and improve the essential services such as water and sewage reticulation networks,

therefore contributing to the social and Economic upliftment of the involved City of Tshwane Metropolitan Municipality.

3.8.6 National Veld and Forrest Fire Act, 1998 (Act No. 101, 1998)

The purpose of this Act is to prevent and combat veld, forest and mountain fires throughout the Republic. Furthermore the Act provides for a variety of institutions, methods and practices for achieving the prevention of fires.

Impact on proposed Development:

Significant – Fires of construction workers may only be lit in the designated site camp as indicated in assistance with the ECO. It is important that a site development camp be located on a part of the application site that is already disturbed.

3.8.7 National Heritage Resources Act, 1999 (Act No. 25 of 1999)

The National Heritage Resources Act legislates the necessity and heritage impact assessment in areas earmarked for development, which exceed 0.5ha. The Act makes provision for the potential destruction to existing sites, pending the archaeologist's recommendations through permitting procedures. Permits are administered by the South African Heritage Resources Agency (SAHRA).

Impact on proposed Development:

Not significant-According to African Heritage Consultants CC the appointed Cultural and Heritage specialist there are no important visible cultural heritage resources present on the proposed development area. No archaeological artefacts or sites could be found. The only structures present are two soil dam walls of which one has been partially washed away. These dam walls are relatively modern and fall outside the jurisdiction of Act 25 of 1999. There are no further graves present on the proposed development area. However, should any features be discovered during construction activities and clearing of the

application site, the correct "procedures for an Environmental incident" (at the end of the EMPr) must be followed.

The Rooihuiskraal Historical Terrain is situated to the east of the site and is literally divided by the M37/ Rooihuiskraal Road. The Rooihuiskraal Historical Terrain was declared a national monument in 1981, the original farmstead dates back to the 1880's. It was the location of two battles during the Anglo-Boer war.

3.8.8. Conservation of Agricultural Resources Act (Act No. 43 of 1983)

This Act provides for control over the utilization of the natural agricultural resources of the Republic in order to promote the conservation of the soil, the water sources and the vegetation and the combating of weeds and invader plants; and for matters connected therewith.

Impact on proposed Development:

Not Significant—According to the Gauteng Agriculture Potential Atlas (GAPA 3) the study area of Rooihuiskraal x 29 has low to no agricultural potential. In addition, the study area is located within the Gauteng Urban Edge, and does not fall within any of the seven Agriculture Hubs identified for the Gauteng Province. Based on the available information, Bokamoso were of the opinion that **No** Agriculture Potential Study was required for the application site. In addition, 80% of the site should remain vacant due to the wetland/ watercourse present on site as well as the Eskom overhead power lines. Only a small portion of the site can be used for the proposed residential development. The areas adjacent to the site are utilized for residential developments and therefore the proposed residential development is in line with the surrounding uses. It can therefore be concluded that it would not be economically viable to use the site for the purpose of agriculture.

3.8.9. National Environmental Management Act: Biodiversity Act (Act No. 10 of 2004)

The purpose of the Biodiversity Act is to provide for the management of South Africa's biodiversity within the Framework of the NEMA and the protection of species and ecosystems that warrant National protection. As part of the implementation strategy, the National Spatial Biodiversity Assessment was developed.

Impact on proposed Development:

Not Significant – Majority of the study area is regarded as degraded with some illegal dumping taking place. The proposed study area falls within the Ecological Support and Important Area which is dominated by the Egoli Granite Grassland, which is regarded as Vulnerable (Mucina and Rutherford, 2006). It was also confirmed that the study site has suitable habitat for one Red List species and four Orange List species, of which two Orange List species, *Hypoxis hemerocallidea* and *Eucomis autumnalis*, were recorded on site. Both these Orange Listed species were recorded in the 2008 and 2010 surveys (as mentioned above). The orchid, *Habenaria nyikana* subsp. *nyikana*, was also recorded during the 2017 survey but not in the 2008 and 2010 survey. These species are, however, not categorised as Red listed and should be relocated prior to the commencement of construction to either the north of the study site, where similar environmental conditions occur, or in the watercourse buffer area where two of these species already occur. GDARD should be consulted and a professional botanist should be contacted for the relocation of such species.

Parts of the terrestrial habitats present on the study area have been transformed and degraded to such an extent that it can no longer be regarded as typical of the Egoli Granite Grassland. There is limited connectivity with similar habitats as the study area is surrounded by roads and residential developments. There is, however still suitable habitat on the study area for Red Listed species. The Wetland is still in a good ecological condition and could potentially support Red

Listed and sensitive species such as *Leptailurus serval* and *Otomys auratus*. No Red Listed invertebrate species are expected to occur in this particular study area, except for the wetland specialist, the Marsh sylph. There is potentially suitable habitat for the Striped Harlequin Snake (*Homoroselaps dorsalis*) and the Giant bullfrog (*Pyxicephalus adspersus*). The majority of the study area is regarded as degraded with some illegal dumping taking place. This has a negative impact to the environment.

3.8.11. National Spatial Biodiversity assessment

The National Spatial Biodiversity Assessment (NSBA) classifies areas as worthy of protection based on its biophysical characteristics, which are ranked according to priority levels.

Impact on proposed Development:

Not Significant – Majority of the study area is regarded as degraded with some illegal dumping taking place. The proposed study area falls within the Ecological Support and Important Area which is dominated by the Egoli Granite Grassland, which is regarded as Vulnerable (Mucina and Rutherford, 2006).). It was also confirmed that the study site has suitable habitat for one Red List species and four Orange List species, of which two Orange List species, *Hypoxis hemerocallidea* and *Eucomis autumnalis*, were recorded on site. Both these Orange Listed species were recorded in the 2008 and 2010 surveys (as mentioned above). The orchid, *Habenaria nyikana* subsp. *nyikana*, was also recorded during the 2017 survey but not in the 2008 and 2010 survey. These species are, however, not categorised as Red listed and should be relocated prior to the commencement of construction to either the north of the study site, where similar environmental conditions occur, or in the watercourse buffer area where two of these species already occur. GDARD should be consulted and a professional botanist should be contacted for the relocation of such species.

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3.8.12 Protected Species – Provincial Ordinances

Provincial ordinances were developed to protect particular plant species within specific provinces. The protection of these species is enforced through permitting requirements associated with provincial lists of protected species. Permits are administered by the Provincial Departments of Environmental Affairs.

Impact on proposed Development:

Not Significant- Majority of the study area is regarded as degraded with some illegal dumping taking place. The proposed study area falls within the Ecological Support and Important Area which is dominated by the Egoli Granite Grassland, which is regarded as Vulnerable (Mucina and Rutherford, 2006).). It was also confirmed that the study site has suitable habitat for one Red List species and four Orange List species, of which two Orange List species, *Hypoxis hemerocallidea* and *Eucomis autumnalis*, were recorded on site. Both these Orange Listed species were recorded in the 2008 and 2010 surveys (as mentioned above). The orchid, *Habenaria nyikana* subsp. *nyikana*, was also recorded during the 2017 survey but not in the 2008 and 2010 survey. These species are, however, not categorised as

Red listed and should be relocated prior to the commencement of construction to either the north of the study site, where similar environmental conditions occur, or in the watercourse buffer area where two of these species already occur. GDARD should be consulted and a professional botanist should be contacted for the relocation of such species.

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3.8.13. National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003)

The purpose of this Act is to provide for the protection, conservation and management of ecologically viable areas representative of South Africa's biological biodiversity and its natural landscapes.

Impact on proposed Development:

Not Significant- The Application site is not located within any conservancy or protected area. The Rooihuiskraal Historical Terrain is situated to the east of the site and is literally divided by the M37/ Rooihuiskraal Road.

The Rooihuiskraal Historical Terrain was declared a national monument in 1981, the original farmstead dates back to the 1880's. It was the location of two battles during the Anglo-Boer war.

3.8.14 National Road Traffic Act, 1996 (Act No. 93 of 1996)

This Act provides for all road traffic matters which shall apply uniformly throughout the Republic and for matters connected therewith.

Impact on proposed Development:

Not significant – Not Applicable.

3 Project activities

4.1 Pre-Construction Phase

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
General	Project contract	To make the EMPr enforceable under the general conditions of the contract.	The EMPr document must be included as part of the tender documentation.	The EMPr is included as part of the tender documentation.	Developer	-
Design and planning	Stability of structures and restriction of land use due to geology	To ensure stability of structures.	The layout and land uses must correspond to the stability zonation and development types recommended by the geotechnical engineer.	The land uses and layout corresponds to the recommended stability zonation and development types.	Individual Developer Engineer	-
			Deep strip footings or other alternatives approved by the engineer should be used for the foundations of construction.	Excavations and foundations remain stable.	Engineer Individual Developer	
			More detailed foundation investigation shall be done for each of the structures.	More detailed foundation investigations done.	Engineer Individual Developer	-
	Stability of excavations due to geology	To ensure stability of excavations.	Sides of excavations should be either shored or else battered back.	Excavations remain stable.	Engineer Individual Developer	
	Storm water design	To prevent and restrict erosion, siltation and groundwater pollution.	In order to prevent erosion, siltation, water pollution and the associated sedimentation of the wetland areas as a lot of stormwater are directed to the site from the N14 highway (which is situated directly adjacent to the south of the study site). The mitigation measure proposed for efficient stormwater control on the proposed site can be explained as follows: ▪ Stormwater will be entered from the N14	Compilation and approval of stormwater master plan layout.	Engineer Individual Developer	-

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			<p>Highway, and will be captured in a catch basin for the overflow (stormwater grid).</p> <ul style="list-style-type: none"> ▪ From the stormwater grid, it will go through a proposed stormwater pipe. ▪ From the pipe, the stormwater will spill on a stone pitching surface of the stormwater outlet which permits a sustainable surface that can withstand water flowing over the top. This stone pitched surface in conjunction with (concrete blocks energy dissipaters) will assist to dissipate the energy of the water. ▪ Stormwater will then flow through a reno mattress and associated rock features to assist in further dissipating the energy of the stormwater. Thereafter, stormwater will flow through indigenous wetland vegetation which will act as a biological filtering system prior the stormwater entering the watercourse. ▪ In addition, a berm and/ or embankment will be implemented to assist in capturing silt and preventing it from entering the watercourse. ▪ The overall concept is to decrease the energy of the flow of stormwater prior entering the watercourse, and to ensure that the water flows over a wider area, and that it is not concentrated in one area, in order to reduce the scouring effect of erosion. 			
		Erosion of drainage lines.	1) Appropriate flow diversion and erosion control structures i.e. earth embankments must be put in place in areas where soil may be exposed to high levels of erosion			

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			<p>due to steep slopes etc.</p> <p>2) Any damage, displacement or loss of soil resulting from unforeseen events is to be recorded and remediated immediately. Should this occur due to negligence on the contractor's behalf, the contractor shall carry remediation costs.</p> <p>3) Stormwater at the site camp must be managed so as to reduce/ minimise the silt loads in the stream channel.</p> <p>4) Construction on steep slopes and in soft or erodible material will require erosion control measures and appropriate grassing/ hydroseeding measures.</p> <p>5) All construction areas should be suitably top-soiled and vegetated as soon as is possible after construction; and disturbed areas to be rehabilitated must be ripped and the area must be backfilled with topsoil.</p> <p>Stormwater structure design should block amphibians from entering the road surface.</p>			
		<p>Watercourse/ Wetland- increased sediment input.</p>	<p>1) To prevent erosion of material that is stockpiled for long periods, the material must be retained in a bermed area.</p> <p>2) All topsoil within the area to be developed must be removed and stockpiled on site.</p> <p>3) The temporary storage of topsoil must be above the 20yr floodline or at least 20m from the top of any bank or drainage lines</p> <p>4) An earth bank is to be constructed around the upslope portion of any stockpiles in order to direct runoff and prevent scouring of stockpiles.</p>			

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			5) A silt fence is to be erected around any stockpiles in order to trap sediment and prevent stockpile sediment loss.			
	Light pollution	To minimise light pollution.	The generation of light by night events, security lighting and other lighting shall be effectively designed so as not to spill unnecessary outward into the oncoming traffic, or into the yards of the neighbouring properties or open spaces.	Lighting effectively designed.	Architect/ Landscape Architect	-
	Visual impact	To minimise the visual impact of the proposed development.	Architectural guidelines to minimize the visual impact: 1) Roof colour will blend in tastefully with the surrounding environment. Building design must be aesthetically pleasing. 2) Suitable plant materials should be used at strategic points to screen off impacts caused by roofs, cars in large parking areas and in particular the N14 bordering the study area to the south. 3) Mature existing trees should be retained as far as possible. The trees will soften the impact of the proposed development. 4) Rubble and litter must be removed on a weekly basis and be disposed of at a suitably registered landfill site.	Architectural guidelines minimise visual impact.	Architect	-
Climate	Extreme change in micro climate temperatures	To prevent the extreme change in micro climate temperatures.	Where open parking bays are involved, one tree for every two parking bays shall be indicated on Landscape Development Plan which shall be approved by the Design Review Committee / Local Authority.	Landscape Development Plan complies.	Landscape Architect	-
Fauna and flora	Floral biodiversity and ecological health	To ensure that the species introduced to the area, are compatible with the current and	1) The Landscape Development Plan for the proposed development shall be submitted to the local authority for approval. 2) It is important that all the plant positions, quantities and coverage per m ² be	The landscape development plan submitted to the local authority for approval.	Landscape Architect	-

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
		future quality of the ecological processes.	<p>indicated on a plan.</p> <p>3) The proposed planting materials for the areas to be landscaped shall be non-invasive, and preferably indigenous and /or endemic. Indigenous tree species will aid in habitat creation that will attract indigenous faunal species into the area.</p> <p>4) Where possible, trees naturally growing on the site should be retained as part of the landscaping.</p> <p>5) Trees used for screening adjacent to the N14 highway must be mature trees with a stem diameter of at least 80mm and a minimum height of 3m.</p> <p>6) Orange listed species that are affected by the proposed development are to be relocated to suitable habitat on a part of the site that is unaffected by the development.</p>			
Preparing Site Access	Environmental integrity	To avoid erosion and disturbance to indigenous vegetation.	<p>1) Designated routes shall be determined for the construction vehicles and designated areas for storage of equipment.</p> <p>2) Clearly mark the site access point and routes on site to be used by construction vehicles and pedestrians.</p> <p>3) Provide an access map to all contractors whom in turn must provide copies to the construction workers. Instruct all drivers to use the access point and determined route.</p>	<p>Access to site is erosion free.</p> <p>Minimum disturbance to surrounding vegetation.</p> <p>Vehicles make use of established access routes.</p>	Contractor	Continuous
		Entrance of Vehicles.	Entrance by vehicles, especially off-road cars and bakkies, off-road bicycles and quad bikes and construction staff should be prohibited, both during the construction phase and during the lifespan of the project.			

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
	Waste storage	To control the temporary storage of waste.	Temporary waste storage points on site shall be determined. These storage points shall be accessible by waste removal trucks and these points should not be located in sensitive areas/areas highly visible from the properties of the surrounding land-owners/tenants/in areas where the wind direction will carry bad odours across the properties of adjacent tenants or landowners.		Contractor ESO	-
		Ensure waste storage area does not generate pollution	Build a bund around the waste storage area to stop overflow into storm water.		Contractor	-

4.2 Construction Phase

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
Contractors Camp	Vegetation and topsoil	To minimize damage to and loss of vegetation and retain quality of Topsoil.	1) Site to be established under supervision of ECO. 2) Clearing and relocation of plants (Orange listed species: <i>Hypoxis hemerocallidae</i> and <i>Eucomis autumnalis</i> subsp <i>clavata</i>) to be undertaken in accordance with site specific requirements.	Minimal vegetation removed/ damaged during site activities.	Contractor	As and when required
	Surface and ground water pollution	To minimize pollution of surface and Groundwater resources.	1) Sufficient and temporary facilities including ablution facilities must be provided for construction workers operating on the site. 2) A minimum of one chemical toilet shall be provided per 10 persons. The contractor shall keep the toilets in a clean, neat and hygienic condition. Toilets provided by the contractor must be easily accessible and a maximum of 50m from the works area to ensure they are utilized. The contractor (who must use reputable toilet-servicing company) shall be responsible for the cleaning, maintenance and servicing of the toilets. The contractor (using reputable toilet-servicing company) shall ensure that all toilets are cleaned and emptied before the builders' or other public holidays. 3) No person is allowed to use any other area than chemical toilets. 4) No French drain systems may be installed. 5) No chemical or waste water must be allowed to contaminate the run-off on site. 6) Avoid the clearing of the site camp (of specific phase) or paved surfaces with soap.	Effluents managed Effectively. No pollution of water resources from site. Workforce use toilets provided.	Contractor ESO	As and when required
		To minimize	1) Drip trays and/ or lined earth bunds must	No pollution of	Contractor	Daily

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
		pollution of surface and Groundwater resources due to spilling of materials.	be provided under vehicles and equipment, to contain spills of hazardous materials such as fuel, oil and cement. 2) Repair and storage of vehicles only within the demarcated site area. 3) Spill kits must be available on site. 4) Oils and chemicals must be confined to specific secured areas within the site camp. These areas must be bunded with adequate containment (at least 1.5 times the volume of the fuel) for potential spills or leaks. 5) All spilled hazardous substances must be contained in impermeable containers for removal to a licensed hazardous waste site. 6) No leaking vehicle shall be allowed on site. The mechanic/ the mechanic of the appointed contractor must supply the environmental officer with a letter of confirmation that the vehicles and equipment are leak proof. 7) No bins containing organic solvents such as paints and thinners shall be cleaned on site, unless containers for liquid waste disposal are placed for this purpose on site.	the environment.	ESO	
		To minimize pollution of surface and groundwater resources by cement.	The mixing of concrete shall only be done at specifically selected sites, as close as possible to the entrance, on mortar boards or similar structures to prevent run-off into drainage lines, streams and natural vegetation.	No evidence of contaminated soil on the construction site.	Contractor ESO	Daily
		To minimize pollution of surface and Groundwater resources due to effluent.	No effluent (including effluent from any storage areas) may be discharged into any water surface or ground water resource.	No evidence of contaminated water resources.	Contractor ESO	Daily
	Increased turbidity of the	To prevent elevated level of	The implementation of silt traps at the outlet structures to effectively contain the silt prior	No evidence of elevated turbidity	Contractor ESO	Daily

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
	drainage line and wetland	turbidity in the drainage line and the wetland	entering the watercourse.	that will affect the aquatic biota.		
	Pollution of the environment	To prevent unhygienic usage on the site and pollution of the natural assets.	1) Weather proof waste bins must be provided and emptied regularly. 2) The contractor shall provide laborers to clean up the contractor's camp and construction site on a daily basis. 3) Temporary waste storage points on the site should be determined. THESE AREAS SHALL BE PREDETERMINED AND LOCATED IN AREAS THAT are ALREADY DISTURBED. These storage points should be accessible by waste removal trucks and these points should be located in already disturbed areas /areas not highly visible from the properties of the surrounding land-owners/ in areas where the wind direction will not carry bad odours across the properties of adjacent landowners. This site should comply with the following: <ul style="list-style-type: none"> • Skips for the containment and disposal of waste that could cause soil and water pollution, i.e. paint, lubricants, etc.; • Small lightweight waste items should be contained in skips with lids to prevent wind littering; • Bunded areas for containment and holding of dry building waste. 4) No solid waste may be disposed of on the site. 5) No waste materials shall at any stage be disposed of in the open veld of adjacent properties. 6) The storage of solid waste on the site, until such time as it may be disposed of, must be	No waste bins overflowing. No litter or building waste lying in or around the site.	Contractor ESO	Daily Weekly

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			in a manner acceptable to the local authority and DWA. 7) Cover any wastes that are likely to wash away or contaminate storm water.			
		Recycle material where possible and correctly dispose of unusable wastes.	1) Waste shall be separated into recyclable and non-recyclable waste, and shall be separated as follows: <ul style="list-style-type: none"> • General waste: including (but not limited to) construction rubble, • Reusable construction material. 2) Recyclable waste shall preferably be deposited in separate bins. 3) All solid waste including excess spoil (soil, rock, rubble etc) must be removed to a permitted waste disposal site on a weekly basis. 4) No bins containing organic solvents such as paints and thinners shall be cleaned on site, unless containers for liquid waste disposal are placed for this purpose on site. 5) Keep records of waste reuse, recycling and disposal for future reference. Provide information to the ECO.	Sufficient containers available on site. No visible signs of pollution.	Contractor ESO	Daily Weekly
	Waste	To keep the site clean and tidy. To ensure waste enters the appropriate waste stream in order to optimize recycling opportunities.	1) Rubble must be removed from the construction site frequently and be disposed of at an approved dumping site. 2) Sufficient and covered containers must be available on the construction site. 3) Such containers are to be emptied frequently. 4) All liquid effluent is to be disposed of in a manner approved of by the Local Authority. 5) Material to be used as backfill during a later stage of the building construction must be covered with a layer of soil to prevent litter from being blown over the site and to prevent unhygienic conditions.		Contractor	Monitor daily

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			<p>6) Chemical containers and packaging brought onto the site must be removed for disposal at a suitable site.</p> <p>7) The burning of waste is prohibited.</p> <p>8) Where possible, waste must be separated into clearly marked containers and subsequent recycling thereof must be a priority.</p> <p>The site camp should not be located in a highly visual area on the study area, or a screen or barrier should be erected as to not have a negative impact on the sense of place. The site camp and the rest of the study area should appear neat at all times;</p> <p>A temporary waste storage point shall be determined and established on site by means of demarcation. This storage points shall be accessible by waste removal vehicles. The temporary storage site may not be highly visible from the properties of the surrounding residents. Waste materials should be removed from the site on a regular basis (at least weekly), to a registered landfill site.</p> <p>All the waste generated by the proposed residential development construction must be temporarily stored at a preselected area on site to be carted to a registered landfill site allowed to take building rubble;</p> <p>Waste storage should occur in areas that have already been disturbed. These small waste receptacles must be emptied at the temporary waste storage area on a weekly basis for removal. All waste must be removed to a registered landfill site on a weekly basis. No waste materials may be</p>			

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			disposed of on or adjacent to the site; The storage of solid waste on site, until such time that it may be disposed of, must be in the manner acceptable to the local authority; and Records of waste reused, recycled, and disposed must be kept for future reference or inspection by authorities.			
	Increased fire risk to site and surrounding areas	To decrease fire risk.	1) Fires shall only be permitted in specifically designated areas and under controlled circumstances. 2) Food vendors shall be allowed within specified areas. 3) Fire extinguishers to be provided in all vehicles and fire beaters must be available on site. 4) Emergency numbers/ contact details must be available on site, where applicable. • No fires are allowed on the construction site. • Smoking only allowed in designated areas away from vegetation which could possibly catch fire. • Cigarette disposal facilities should be catered for in the designated smoking areas.	No open fires on site that have been left unattended.	Contractor	Monitor daily
Construction site	Geology and soils	To protect underground services from alkaline or corrosive attack.	Underground services should be treated appropriately prior to installation.	Underground services are not being corroded.	Contractor	Monitor regularly/ as required
		To prevent damage of the existing soils and geology.	1) The top layer of all areas to be excavated for the purposes of construction shall be stripped and stockpiled in areas where this material will not be damaged, removed or compacted.	Excavated materials correctly stockpiled.	Contractor	Monitor daily

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			2) All surfaces that are susceptible to erosion, shall be protected either by cladding with biodegradable material or with the top layer of soil being seeded with grass seed/planted with a suitable groundcover.	No signs of erosion.		
		To prevent the loss of topsoil. To prevent siltation & water pollution.	1) Stockpiling will only be done in designated places where it will not interfere with the natural drainage paths of the environment. 2) In order to minimize erosion and siltation and disturbance to existing vegetation, it is recommended that stockpiling be done/ equipment is stored in already disturbed/exposed areas. 3) Cover stockpiles and surround downhill sides with a sediment fence to stop materials washing away. 4) Remove vegetation only in areas designated during the planning stage. 5) Rehabilitation/ landscaping are to be done immediately after the involved works are completed. 6) All compacted areas should be ripped prior to them being rehabilitated/ landscaped by the contractor as appointed by the developer/ individual erf owner. 7) The top layer of all areas to be excavated must be stripped and stockpiled in areas where this material will not be damaged, removed or compacted. This stockpiled material should be used for the rehabilitation of the site and for landscaping purposes. 8) Strip topsoil at start of works and store in stockpiles no more than 1,5 m high in a designated materials storage area. 9) During the laying of any cables, pipelines or infrastructure (on or adjacent to the site)	Excavated materials correctly stockpiled. No visible signs of erosion and sedimentation. Minimal invasive weed growth. Vegetation only removed in designated areas.	Contractor of the Individual Developer	Monitor daily

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			topsoil shall be kept aside to cover the disturbed areas immediately after such activities are completed.			
	Erosion and siltation	To prevent erosion and siltation.	<p>1) It is recommended that the construction of the development be done in phases.</p> <p>2) Each phase should be rehabilitated immediately after the construction for that phase has been completed. The rehabilitated areas should be maintained by the appointed rehabilitation contractor until a vegetative coverage of at least 80% has been achieved as appointed by the developer/ individual erf owner.</p> <p>3) Mark out the areas to be excavated.</p> <p>4) Large exposed areas during the construction phases should be limited. Where possible areas earmarked for construction during later phases should remain covered with a vegetation coverage until the actual construction phase. This will prevent unnecessary erosion and siltation in these areas.</p> <p>5) Unnecessary clearing of flora resulting in exposed soil prone to erosive conditions should be avoided.</p> <p>6) All embankments must be adequately compacted and planted with grass to stop any excessive soil erosion and scouring of the landscape if required.</p> <p>7) The eradication of alien vegetation should be followed up as soon as possible by replacement with indigenous vegetation to ensure quick and sufficient coverage of exposed areas by the individual erf owner.</p> <p>8) Storm water outlets shall be correctly designed to prevent any possible soil erosion.</p>	<p>No erosion scars.</p> <p>No loss of topsoil.</p> <p>All damaged areas successfully rehabilitated.</p>	Contractor ESO	Monitor daily

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			<p>9) All surface run-off shall be managed in such a way so as to ensure erosion of soil does not occur.</p> <p>10) Implementation of temporary storm water management measures that will help to reduce the speed of surface water by the individual erf owner / developer.</p> <p>11) All surfaces that are susceptible to erosion shall be covered with a suitable vegetative cover as soon as construction is completed by the individual erf owner / developer.</p>			
	Stability of structures due to geology	To ensure stability of structures.	Preventative foundation designs shall be done. Detailed foundation inspections should be carried out at the time of construction to identify any variances and adjust foundation designs accordingly if need be. The foundation recommendations from the geotechnical engineers must be adhered to.		Engineers / Contractor / Individual Developer	When required
	Seepage of groundwater into excavations	To ensure that excavations do not become flooded.	Provision should be made for the removal of groundwater from excavations.		Contractor	Monitor daily
	Cracking of structures	To ensure that built structures do not crack due to collapsible soils and settlement.	<p>1)The floors of foundation excavations should be compacted by a hand-operated vibratory roller or else by a machine equivalent to a Wacker Rammer (a mechanised tamping device); a test section should firstly be compacted under supervision of the Engineer in order to determine the number of roller passes. The structures may then be constructed by conventional means.</p> <p>Additional precautionary measures that can be employed are:</p>	Built structures show no sign of cracks.	Engineer/ Contractor	As required

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			2) The provision of expansion joints in the walls of structures; 3) A concrete walkway of 1, 0m in width around the perimeter of each structure; and 4) The shaping of the walkway and the ground surface in the vicinity of the structures so as to drain water away from each structure so that no ponding of surface water can take place in the vicinity of the structures.			
	Hydrology	To minimise pollution of soil, surface and groundwater.	1) Increased run-off during construction must be managed using berms and other suitable structures as required to ensure flow velocities are reduced. 2) The contractor shall ensure that excessive quantities of sand, silt and silted water do not enter the storm water system.	No visible signs of erosion. No visible signs of pollution.	Contractor	Monitor daily
		Bridge construction.	1) The construction footprint of the wetland crossing should be kept to a minimum. 2) Bridge design is to be approved by relevant authorities. 3) The bridge needs to be constructed in such a way so as to minimize the change in flow patterns in the area so that the areas of the wetland which are influenced by the presence of a fluctuating water level are minimally affected. 4) Adequate stormwater management must be implemented for the proposed road in order to prevent bank and riparian zone erosion. 5) The crossing support structure needs to be designed in such a way so as to ensure that there is limited creation of turbulent flow within the wetland areas, so that there is no major alteration of the flow regime and hydraulics, thereof.	Bridge construction footprint kept to a minimum.	Contractor ESO	As and when required

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			6) Strict adherence to the storm water management plan is crucial to counteract severe effects of erosion.			
	Fauna and flora	To protect the existing fauna and flora.	1) All exotic invaders and weeds must be eradicated on a continuous basis. 2) Exotic invaders must be included in an alien management programme for the site. Eradication must occur every 3 months. 3) No plants that are not indigenous to the area, or exotic plant species, especially lawn grasses and other ground-covering plants, should be introduced in the communal landscaping of the proposed site, as they will drastically interfere with the nature of the area 4) Where possible, trees naturally growing on the site should be retained as part of the landscaping.	No exotic plants used for landscaping.	Contractor ESO / Home Owners Association / Design Review Committee	As and when required Every 6 months
		To protect the existing fauna and flora.	1) Trees that are intended to be retained shall be clearly marked on site. 2) Snaring and hunting of fauna by construction workers on or adjacent to the study area are strictly prohibited and the Council shall prosecute offenders. 3) All mitigation measures for impacts on the indigenous flora of the area should be implemented in order to limit habitat loss as far as possible and maintain and improve available habitat, in order to maintain and possibly increase numbers and species of indigenous fauna. 4) Wood harvesting of any trees or shrubs on the study area or adjacent areas shall be prohibited. 5) Where possible, work should be restricted to one area at a time.	No measurable signs of habitat destruction.	Contractor ESO	As and when required

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			<p>6) Noise should be kept to a minimum and the development should be done in phases to allow faunal species to temporarily migrate into the conservation areas in the vicinity.</p> <p>7) The integrity of remaining wildlife should be upheld, and no trapping or hunting by construction personnel should be allowed. Caught animals should be relocated to the conservation areas in the vicinity.</p> <p>8) Entrance by vehicles, especially off-road cars and bakkies, off-road bicycles and quad bikes and construction staff into the application site should be prohibited, both during the construction phase and during the lifespan of the project.</p>			
Social	Noise impact	To maintain noise levels below "disturbing" as defined in the national Noise Regulations.	<p>1) Site workers must comply with the Provincial noise requirements as outlined in Provincial Notice No. 5479 of 1999: Gauteng Noise Control Regulations.</p> <p>2) Noise activities shall only take place during working hours.</p>	No complaints from surrounding residents and I&APs.	Contractor	Monitored daily
	Dust impact	Minimise dust from the site.	<p>1) Dust pollution could occur during the construction works, especially during the dry months. Regular and effective damping down of working areas (especially during the dry and windy periods) must be carried out to avoid dust pollution that will have a negative impact on the surrounding environment.</p> <p>2) When necessary, these working areas should be damped down in the mornings and afternoons.</p>	<p>No visible signs of dust pollution.</p> <p>No complaints from surrounding residents and I&APs.</p>	Contractor	Monitored daily
	Safety and security	To ensure the safety and security of the public.	1) Although regarded as a normal practice, it is important to erect proper signs indicating the operations of heavy vehicles in the vicinity of dangerous crossings and access	No incidences reported.	Contractor ESO	Monitored daily

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			roads or even in the development site if necessary. 2) With the exception of the appointed security personnel, no other workers, friends or relatives will be allowed to sleep on the construction site (weekends included) 3) Construction vehicles and activities to avoid peak hour traffic times 4) Presence of law enforcement officials at strategic places must be ensured 5) Following actions would assist in management of safety along the road <ul style="list-style-type: none"> ▪ Adequate road marking ▪ Adequate roadside recovery areas ▪ Allowance for pedestrians and cyclists where necessary ▪ Although regarded as a normal practice, it is important to erect proper signs indicating the danger of the excavation in and around the development site. Putting temporary fencing around excavations where possible. 			
	Infrastructure and services	Installation of services.	Determine areas where services will be upgraded and relocated well in advance. Discuss possible disruptions with affected parties to determine the most convenient times for service disruptions and warn affected parties well in advance of dates that service disruptions will take place	No complaints from I&APs.	Contractor ESO	When required
	Cultural Resources		If any graves or archaeological sites are exposed during construction work it should immediately be reported to a museum. The report from the archaeologist must be provided to GDARD if any graves are recovered.	No destruction of or damage to graves or known archaeological sites.	Contractor ESO	Monitor daily
	Visual impact	In order to minimise	1) The disturbed areas shall be rehabilitated	Visual impacts	Contractor	Monitor daily

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
		the visual impact.	immediately after the involved construction works are completed. 2) Shade cloth must be used to conceal and minimise the visual impact of the site camps and storage areas.	minimized.	ESO	
	Vegetation	Landscaping	1) When planting trees, care should be taken to avoid the incorrect positioning of trees and other plants, to prevent the roots of trees planted in close proximity to the line of water-bearing services from causing leaking in, or malfunctioning of the services. 2) The proposed planting materials for the areas to be landscaped should preferably be endemic and indigenous. 3) All new trees and shrubs to be planted on the study area shall be inspected for pests and diseases prior to them being planted. 4) The inspection shall be carried out by the maintenance contractor at the property of the supplier and not on the study area. 5) All trees to be planted shall be in minimum 100L containers with a height of approximately 3 metres and a main stem diameter of approximately 80 mm.	Landscaping done according to landscape development plan.	Landscape architect Contractor / Individual Developer	When required
		Loss of plants.	1) Aerate compacted soil and check and correct pH for soils affected by construction activities. 2) Make sure plant material will be matured enough and hardened off ready for planting. Water in plants immediately as planting proceeds. 3) Apply mulch to conserve moisture. Plant according to the layout and planting techniques specified by the Landscape Architect in the Landscape Development plans for the site.	Landscaping done according to landscape development plan.	Landscape architect Contractor / Individual Developer	When required
		Spread of weeds	Ensure that materials used for mulching and	Weed growth	Landscape	When required

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			topsoil/ fertilisers are certified weed free. Collect certifications where available. Control weed growth that appears during construction.	controlled.	architect Contractor	
		To ensure rehabilitation of the site.	1) Compacted soils shall be ripped at least 200mm. 2) All clumps and rocks larger than 30mm diameter shall be removed from the soil to be rehabilitated. 3) The soil shall be leveled before seeding 4) Hydroseed the soil with a Potch mixture 5) Watering shall take place at least once per day for the first 14 days until germination of seeds have taken place 6) Thereafter watering should take place at least for 20 minutes every 4 days until grass have hardened off.	Grass have hardened off.	Landscape architect Contractor	Once a day Then every 4 days
		Rehabilitation of area directly surrounding new watercourse/ wetland crossing.	1) Vehicles and workers associated with construction should not have free access to the river bed and unnecessary disturbance to the river bed should be avoided. 2) Areas where vegetation has been cleared for construction should be replanted with indigenous vegetation upon completion of construction. 3) Erosion control measures should be implemented on all open soils and steep slopes. 4) Upon completion of the construction in the area, the area should be rehabilitated to a level that will ensure that wetland vegetation can become re-established. In this regard special mention of the following is made: <ul style="list-style-type: none"> • All areas of disturbed and compacted soils need to be compacted and reprofiled. 	No erosion surrounding new wetland/ watercourse crossing.	Landscape architect Contractor	Immediately after construction

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Performance indicator	Responsibility	Frequency of Action
			<ul style="list-style-type: none"> Ongoing removal of alien vegetation from the area must take place after the completion of the structure to prevent the uncontrollable recruitment of these species. 			

4.3 Operational Phase

TYPE	Environmental risk or issue	Objective or requirement	Mitigation measure	Responsibility	Frequency of Action
Site cleanup and preparation for use	Storm water pollution	Do not allow any materials to wash into the storm water system.	Remove erosion and sediment controls only if all bare soil is sealed, covered or re-vegetated. Sweep roadways clean and remove all debris from kerb and gutter areas. Do not wash into drains.	Contractor	-
		Minimise waste	Decontaminate and collect waste in storage area ready for off-site recycling or disposal. Arrange for final collection and removal of excess and waste materials.	Contractor	-
Establishing plants	Slow or no re-vegetation to stabilise soil; loss or degradation of habitat	To ensure re-vegetation to stabilize soil.	Agreed schedule for regular follow-up watering, weed control, mulch supplements and amenity pruning, if needed. Replace all plant failures within three month period after planting.	Contractor	To be agreed
Materials failure	Structural damage. Loss of site materials.		Inspect all structures monthly to detect any cracking or structural problems. Confirm with the designer if there are design problems. Rectify with materials to match, or other agreed solution.	Contractor	-
Drainage failure	On-site and downstream drainage pollution or	Stormwater management plan	Inspect all site drainage works and repair any failures. Confer with design engineer and to correct site problems.	Contractor / Dolomite Risk manager as appointed by the	-

TYPE	Environmenta l risk or issue	Objective or requirement	Mitigation measure	Responsibility	Frequency of Action
	flooding			home owner	
Site audit	Eventual project failure	Successful project establishment	Routinely audit the works and adjust maintenance schedule accordingly.	Contractor	-
General			Open fires and smoking during maintenance works are strictly prohibited.	Contractor	-

5 Procedures for environmental incidents

5.1 Leakages & spills

- Identify the source of problem.
- Stop goods leaking, if it is safe to do so.
- Contain spilt material, using spills kit or sand.
- Notify Environmental Control Officer
- Remove spilt material and place in a sealed container for disposal (if possible).
- Environmental Control Officer to follow Incident Management Plan.

5.2 Failure of erosion/sediment control devices

- Prevent further escape of sediment.
- Contain escaped material using silt fence, hay bales, pipes, etc.
- Notify ECO.
- Repair or replace failed device as appropriate.
- Dig/scrape up escaped material; take care not to damage vegetation.
- Remove escaped material from site.
- ECO to follow Incident Management plan.
- Monitor for effectiveness until re-establishment.

5.3 Bank/slope failure

- Stabilize toe of slope to prevent sediment escape using aggregate bags, silt fence, logs, hay bales, pipes, etc.
- Notify ECO.
- ECO to follow Incident Management plan.
- Divert water upslope from failed fence.
- Protect area from further collapse as appropriate.
- Restore as advised by ECO.
- Monitor for effectiveness until stabilized.

5.4 Discovery of rare or endangered species

- Stop work.
- Notify ECO.
- If a plant is found, mark location of plants.
- If an animal, mark location where sighted.
- ECO to identify or arrange for identification of species and or the relocation of the species if possible.
- If confirmed significant, ECO to liaise with Endangered Wildlife Trust.
- Recommence work when cleared by ECO.

5.5 Discovery of archeological or heritage items

- Stop work.
- Do not further disturb the area.

- Notify ECO.
- ECO to arrange appraisal of specimen.
- If confirmed significant, ECO to liaise with National, Cultural and History Museum
P.O. Box 28088
SUNNYSIDE
0132
Contact Mr. J. van Schalkwyk
or
Mr. Naude
- Recommence work when cleared by ECO.

6 EMP review

1. The Site Supervisor is responsible for ensuring the work crew is complying with procedures, and for informing the work crew of any changes. The site supervisor is responsible for ensuring the work crew is aware of changes that may have been implemented by GDARD before starting any works.
2. If the contractor cannot comply with any of the activities as described above, they should inform the ECO with reasons within 7 working days.



Appendix I

Other information



Appendix Ii

Company Profile and EAP CV

The logo for Bokamoso features the word "Bokamoso" in a stylized, cursive font with a white outline and a black shadow. To the right of the text is a large, intricate graphic of a tree with a thick trunk and a dense canopy of thin, dark branches. The background is a light green gradient with horizontal stripes.

Bokamoso

**Landscape Architects &
Environmental consultants**

**P.O.BOX 11375
Maroelana
0161**

**Tel: (012) 346 3810
Fax: (086) 570 5559**

**E-mail: lizelle@bokamoso.net
reception@bokamoso.net
Website: www.bokamoso.net**

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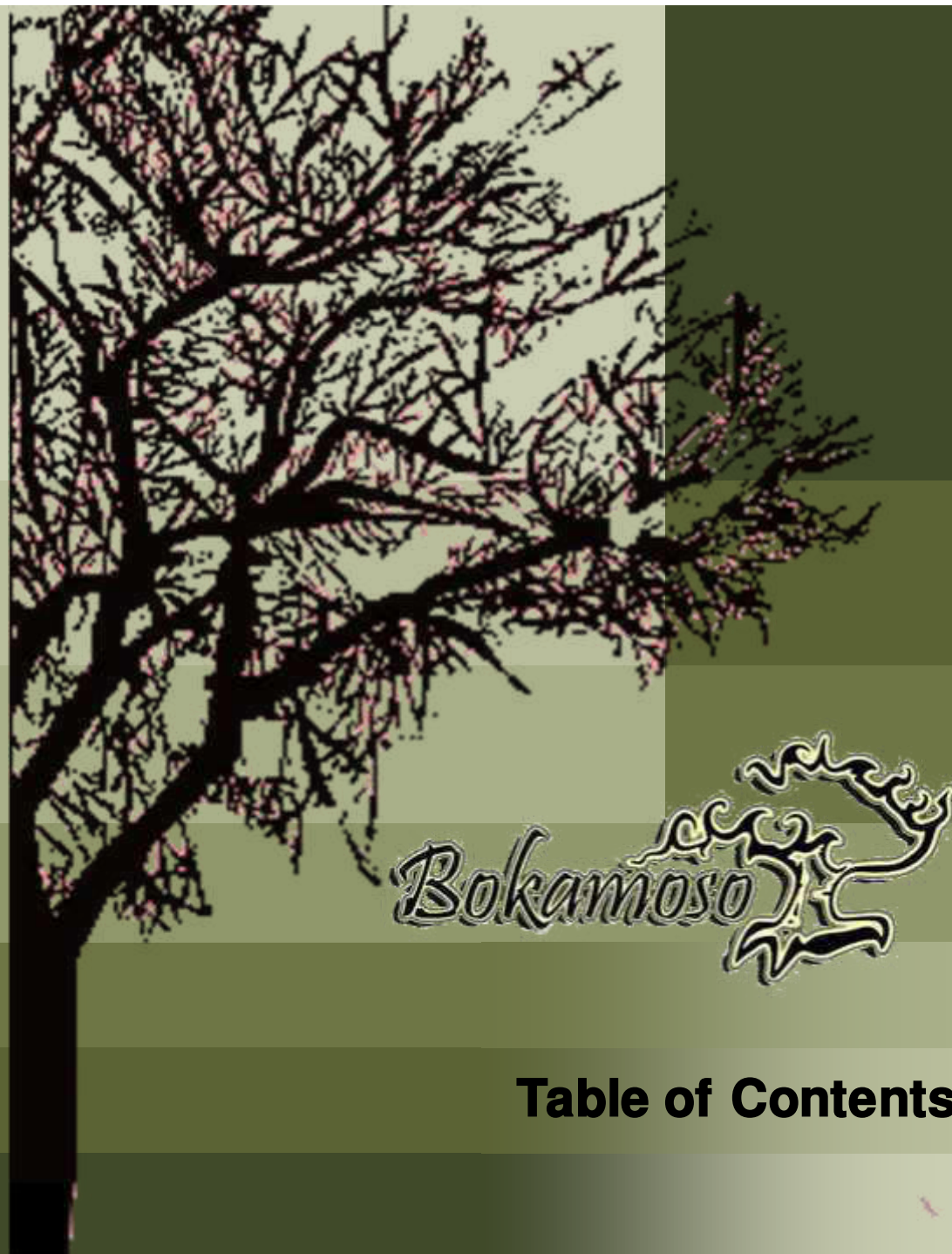


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Bokamoso specialises in the fields of Landscape Architecture and all aspects of Environmental Management and Planning. Bokamoso was founded in 1992 and has shown growth by continually meeting the needs of our clients. Our area of expertise stretches throughout the whole of South Africa. Our projects reflect the competence of our well compiled team. The diversity of our members enables us to tend to a variety of needs. Our integrated approach establishes a basis for outstanding quality. We are well known to clients in the private, commercial as well as governmental sector.

At Bokamoso we stand on a firm basis of environmental investigation in order to find unique solutions to the requirements of our clients and add value to their operations.



01 Executive Summary

011 Company Overview



Vision:

At Bokamoso we strive to find the best planning solutions by taking into account the functions of a healthy ecosystem. Man and nature should be in balance with each other.

Mission:

We design according to our ethical responsibility, take responsibility for successful completion of projects and constitute a landscape that contributes to a sustainable environment. We add value to the operations of our clients and build long term relationships that are mutually beneficial.

Values:

Integrity

Respect



Bokamoso stands on the basis of fairness. This include respect within our multicultural team and equal opportunities in terms of gender, nationality and race.

We have a wide variety of projects to tend to, from complicated reports to landscape installation. This wide range of projects enables us to combine a variety of professionals and skilled employees in our team.

Bokamoso further aids in the development of proficiency within the working environment. Each project, whether in need of skilled or unskilled tasks has its own variety of facets to bring to the table.

We are currently in the process of receiving our BEE scorecard. We support transformation in all areas of our company dynamics.



03 Human Resources

031 Employment Equity

Lizelle Gregory (100% interest)

Lizelle Gregory obtained a degree in Landscape Architecture from the University of Pretoria in 1992 and passed her board exam in 1995.

Her professional practice number is PrLArch 97078.

Ms. Gregory has been a member of both the Institute for Landscape Architecture in South Africa (ILASA) and South African Council for the Landscape Architecture Profession (SACLAP), since 1995.

Although the existing Environmental Legislation doesn't yet stipulate the academic requirements of an Environmental Assessment Practitioner (EAP), it is recommended that the Environmental Consultant be registered at the International Association of Impact Assessments (IAIA). Ms. Gregory has been registered as a member of IAIA in 2007.

Ms. Gregory attended and passed an International Environmental Auditing course in 2008. She is a registered member of the International Environmental Management and Assessment Council (IEMA).

She has lectured at the Tshwane University of Technology (TUT) and the University of Pretoria (UP). The lecturing included fields of Landscape Architecture and Environmental Management.

Ms. Gregory has more than 25 years experience in the compilation of Environmental Evaluation Reports:

Environmental Management Plans (EMP);

Strategic Environmental Assessments;

All stages of Environmental input ;

EIA under ECA and the new and amended NEMA regulations and various other Environmental reports and documents.

Ms. Gregory has compiled and submitted more than 600 Impact Assessments within the last 5-6 years. Furthermore, Ms. L. Gregory is also familiar with all the GDARD/Provincial Environmental policies and guidelines. She assisted and supplied GAUTRANS/former PWV Consortium with Environmental input and reports regarding road network plans, road determinations, preliminary and detailed designs for the past 12 years.



03 Human Resources

032 Members

Qualifications And Experience In The Field Of Environmental Planning And Management (Lizelle Gregory (Member Bokamoso)):

Qualifications:

- Qualified as **Landscape Architect** at UP 1991;
- Qualified as **Professional Landscape Architect in 1997**;
- A Registered Member at The **South African Council for the Landscape Architect Profession (SACLAP)** with Practise Number: **PrLArch97078**;
- A Registered Member at the **International Association for Impact Assessment Practitioners (IAIA)**;
- Qualified as an **Environmental Auditor in July 2008** and also became a Member of the International Environmental Management Association (IEMAS) in 2008.

Working Experience:

- Worked part time at Eco-Consult – 1988-1990;
- Worked part time at **Plan Associates as Landscape Architect in training** – 1990-1991;
- Worked as Landscape Architect at **Environmental Design Partnership (EDP)** from 1992 - 1994
- Practised under **Lizelle Gregory Landscape Architects** from 1994 until 1999;
- Lectured** at Part-Time at **UP** (1999) – Landscape Architecture and **TUT** (1998- 1999)- Environmental Planning and Plant Material Studies;
- Worked as **part time Landscape Architect and Environmental Consultant at Plan Associates** and **managed their environmental division for more than 10 years** – 1993 – 2008 (assisted the **PWV Consortium** with various road planning matters which amongst others included environmental Scans, EIA's, Scoping reports etc.)
- Renamed business as **Bokamoso in 2000** and is the only member of Bokamoso Landscape Architects and Environmental Consultants CC;
- More than 25 years experience in the compilation of Environmental Reports**, which amongst others included the compilation of various **DFA Regulation 31 Scoping Reports**, EIA's for EIA applications in terms of the applicable environmental legislation, Environmental Management Plans, Inputs for Spatial Development Frameworks, DP's, EMF's etc. Also included EIA Application on and adjacent to mining land and slimes dams (i.e. Brahm Fisherville, Doornkop)

Qualifications And Experience In The Field Of Landscape Architecture (Lizelle Gregory (Member Bokamoso)):

Landscape Architecture:

-Compiled landscape and rehabilitation plans for more than 22 years.

The most significant landscaping projects are as follows:

-Designed the Gardens of the Witbank Technicon (a branch of TUT). Also supervised the implementation of the campus gardens (2004);

-Lizelle Gregory was the Landscape Architect responsible for the paving and landscape design at the UNISA Sunnyside Campus and received a Corobrick Golden Award for the paving design at the campus (1998-2004);

-Bokamoso assisted with the design and implementation of a park for the City of Johannesburg in Tembisa (2010);

-The design and implementation of the landscape gardens (indigenous garden) at the new Coca-Cola Valpre Plant (2012-2013);

-Responsible for the rehabilitation and landscaping of Juksei River area at the Norwood Shopping Mall (Johannesburg) (2012-2013);

-Designed and implemented a garden of more than 3,5ha in Randburg (Mc Arthurpark). Bokamoso also seeded the lawn for the project (more than 2,5 ha of lawn successfully seeded) (1999);

-Bokamoso designed and implemented more than 800 townhouse complex gardens and submitted more than 500 Landscape Development Plans to CTMM for approval (1995 – 2013);

-Assisted with Landscape Designs and the Masterplan at Eco-Park (M&T Developments) (2005-2011);

-Bokamoso designed and implemented an indigenous garden at an office park adjacent to the Bronberg. In this garden it was also necessary to establish a special garden for the Juliana Golden Mole. During a recent site visit it was established that the moles are thriving in this garden. Special sandy soils had to be imported and special indigenous plants had to be established in the natural section of the garden.

-Lizelle Gregory also owns her own landscape contracting business. **For the past 20 years she trained more than 40 PDI jobless people (sourced from a church in Mamelodi)** to become landscape contracting workers. All the workers are (on a continuous basis) placed out to work at nurseries and other associated industries;

-Over the past 20 years the Bokamoso team compiled more than 800 landscape development plans and also implemented most of the gardens. Bokamoso also designed and implemented the irrigation for the gardens (in cases where irrigation was required). Lizelle regarded it as important to also obtain practical experience in the field of landscape implementation.

Consulting

Anè Agenbacht

Introduction to Sustainable Environmental Management—An overview of Principles, Tools, & Issues (Potch 2006)
Leadership Training School (Lewende Woord 2010)
BA Environmental Management (UNISA 2011)
PGCE Education (Unisa 2013) - CUM LAUDE
Project Manager
More than 10 years experience in the compilation of various environmental reports

Mary-Lee Van Zyl

MSc Plant Science (UP)
BSc (Hons) Plant Science (UP)
BSc Ecology (UP)
More than 5 years working experience in the Environmental field
Specialises in ECO works, Basic Assessments, EIA's, and Flora Reports
Compilation of various Environmental Reports

Dashentha Moodley

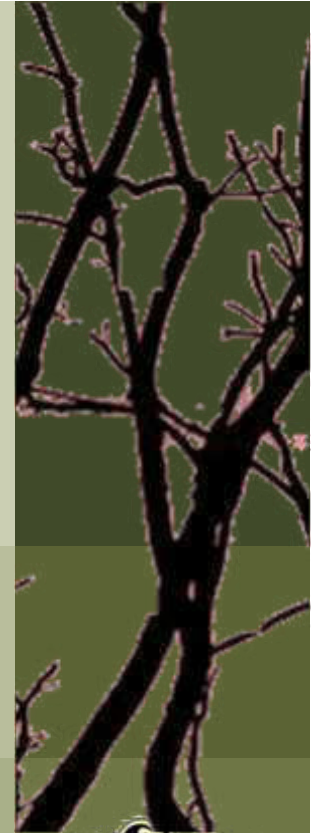
BA (Hons) Degree in Environmental Management (UNISA) - CUM LAUDE
Bachelor of Social Science in Geography & Environmental Management (UKZN)
More than 6 years experience in WUL Applications & Integrated Environmental Management within water resource management.
Senior Environmental Practitioner & Water Use Licence Consultant
Specialises in Water Use License & Compilation of various Env. Reports

Adèle Drake

BA Geography & History (UP)
NQF Level 7 Air Quality Management (UJ)
More than 15 years experience in the field of Environmental Management within Mining Industry (surface and underground), Forestry Industry, Renewable Energy Industry (WEF), and Environmental Consulting. Also ISO 14000, ISO 9000, and Safety Management Auditor.

Ronell Kuppen

BSc (Hons) in Geography (UNISA)
BA Environmental and Development (UKZN)
More than 5 years experience in Environmental Consulting
Specializing in WUL Applications, Waste License Applications, EIAs, Basic Assessments, Public Participations, Borrow Pits



03 Human Resources

033 Personnel

Ben Bhukwana

BSc Landscape Architecture (UP)

More than 8 years experience in the field of Landscape Architecture (Design, Construction, Implementation, and Management).
Specialises in landscape design, ECO, rehabilitation plans and compilation various environmental reports and compilation of tender documents

Juanita de Beer

Diploma Events Management and Marketing (Damelin)

Specializes in Public relations and Public Participation Processes (4 years experience)
Specialises in compiling various environmental reports

Alfred Thomas

CIW Foundation & Internet Marketing (IT Academy)

12 years experience in GIS and IT in general.
GIS Operator and Multimedia Specialist.

Lizette Delpont

MSc. In Aquatic Health (UJ)

BSc. Hons. Environmental Management

Environmental Assessment Practitioner and Wetland Specialist
Registered with the South African Wetland Society (SAWS)

A.E. van Wyk

BSc Environmental Sciences (Zoology and Geography)

Environmental Control Officer
Junior avifauna specialist

Juan Gregory

LLB (UP)

BA Law (UP)

Junior Environmental Impact Practitioner
Environmental Control Officer



03 Human Resources

034 Person-

Elsa Viviers

Interior Decorating (Centurion College)

(Accounting/ Receptionist) and Secretary to Lizelle Gregory

Loura du Toit

N. Dip. Professional Teacher (Heidelberg Teachers Training College)

Librarian and PA to the Project Manager

Merriam Mogalaki

Administration Assistant with in-house training in bookkeeping

Landscape Contracting

Elias Maloka

Assisting with Public Participations and Office Admin

Site manager overseeing landscape installations.

Irrigation design and implementation.

Landscape maintenance

More than 18 years experience in landscape construction works.

The contracting section comprises of six permanently employed black male workers. In many cases the team consists of up to 12 workers, depending on the quantity of work.



03 Human Resources

035 Personnel

In-house Specialists

Corné Niemandt

MSc Plant Science (UP 2015) – Cum Laude

BSc (Hons) Zoology (UP 2012)

BSc Ecology (UP 2011)

Specialises in ecological surveys and report writing

Compilation of fauna and flora specialist reports

GIS: Generating maps



03 Human Resources

036 Personnel



01 Environmental Management Services

- Basic Assessment Reports
- EIA & Scoping Reports
- Environmental Management Plans
- Environmental Scans
- Strategic Environmental Assessments
- EMP for Mines
- Environmental Input and Evaluation of Spatial Development Frameworks
- State of Environmental Reports
- Compilation of Environmental Legislation and Policy Documents
- Environmental Auditing and Monitoring
- Environmental Control Officer (ECO)
- Visual Impact assessments
- Specialist Assistance with Environmental Legislation Issues and Appeals
- Development Process Management
- Water Use License applications to DWA
- Waste License Application



04 Services

041 Consulting Services

02 Landscape Architecture

- Master Planning
- Sketch Plans
- Planting Plans
- Working Drawings
- Furniture Design
- Detail Design
- Landscape Development Frameworks
- Landscape Development Plans (LDP)
- Contract and Tender Documentation
- Landscape Rehabilitation Works

03 Landscape Contracting

Implementation of Plans for:

- Office Parks
- Commercial/ Retail / Recreational Development
- Residential Complexes
- Private Residential Gardens
- Implementation of irrigation systems



Bokamoso 

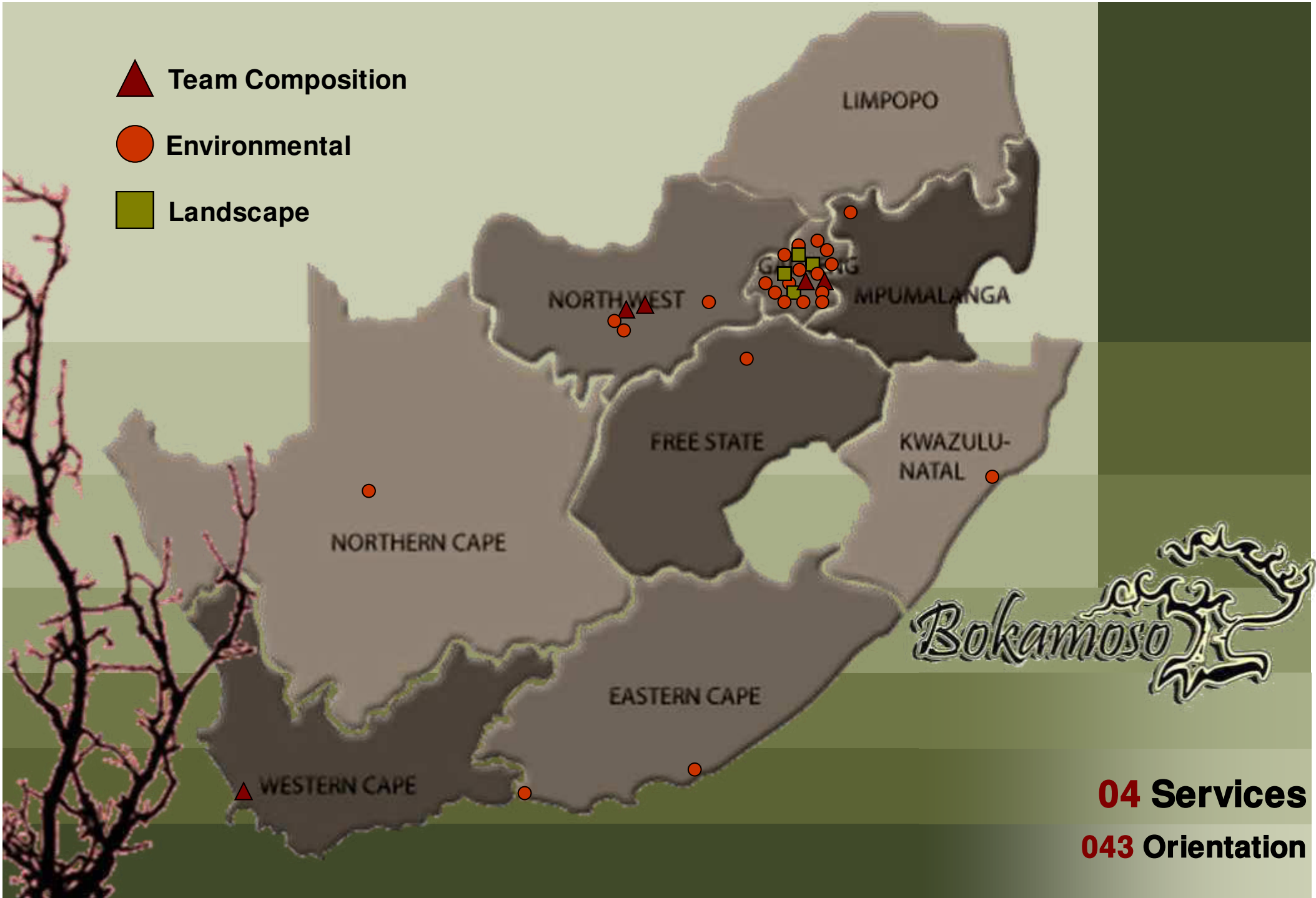
04 Services

042 Contracting Services

▲ Team Composition

● Environmental

■ Landscape



04 Services

043 Orientation

01 Valpre Bottling Plant, Heidelberg



project
shelter- site plan

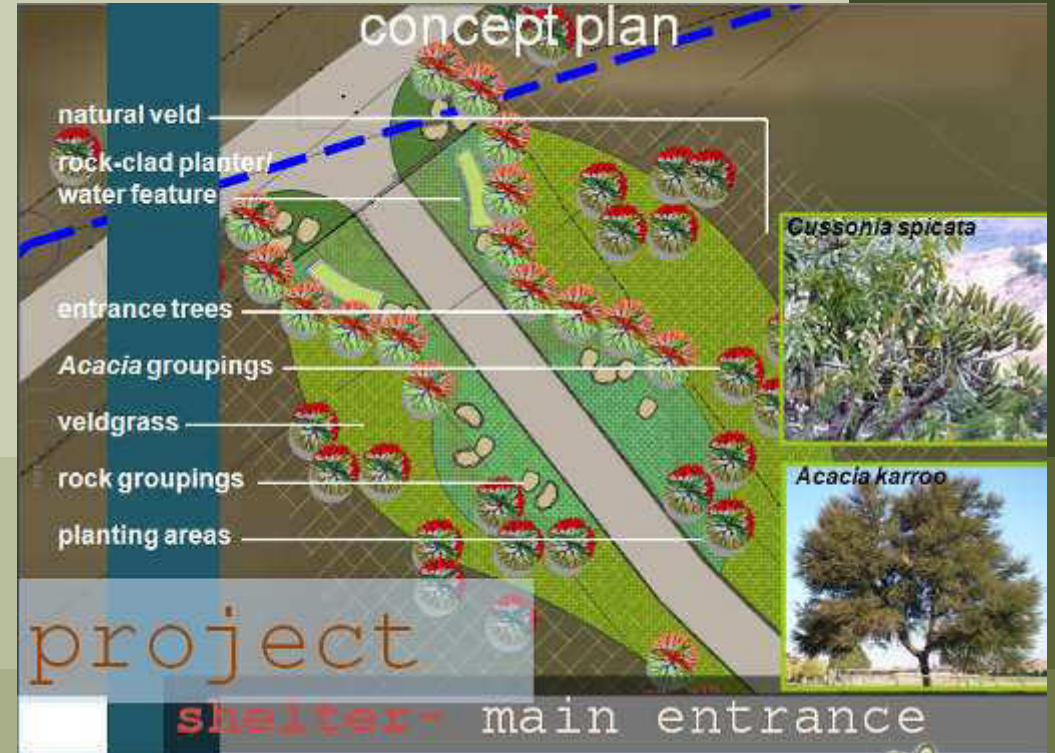
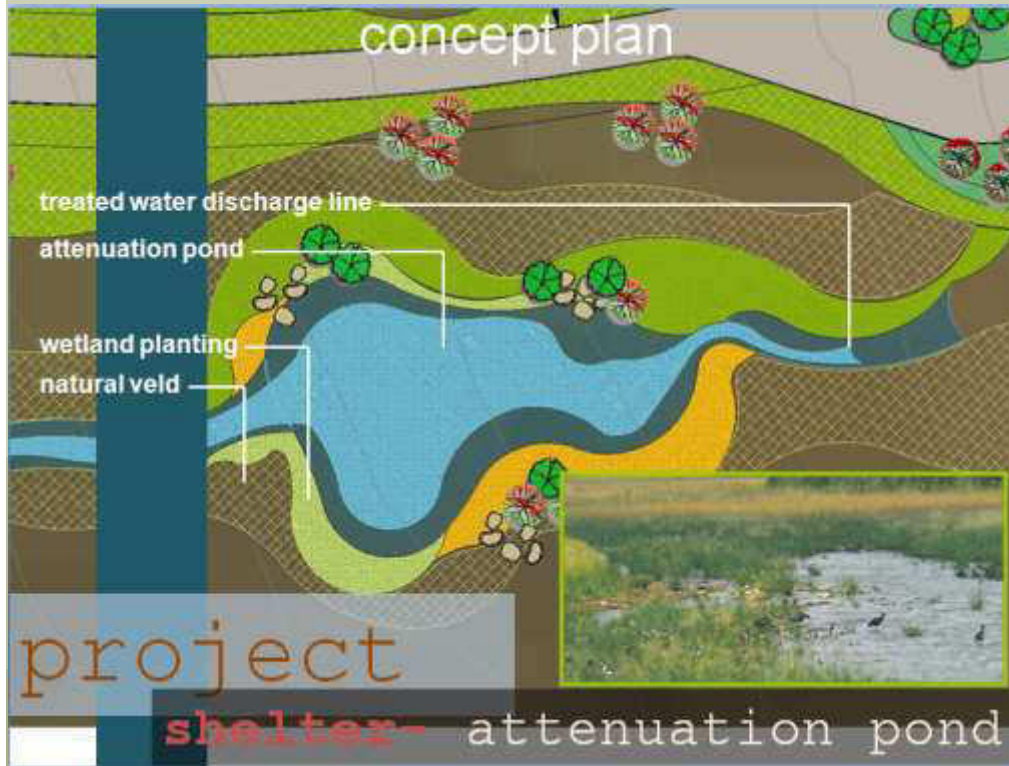


05 Landscape Projects- Current

051 Commercial



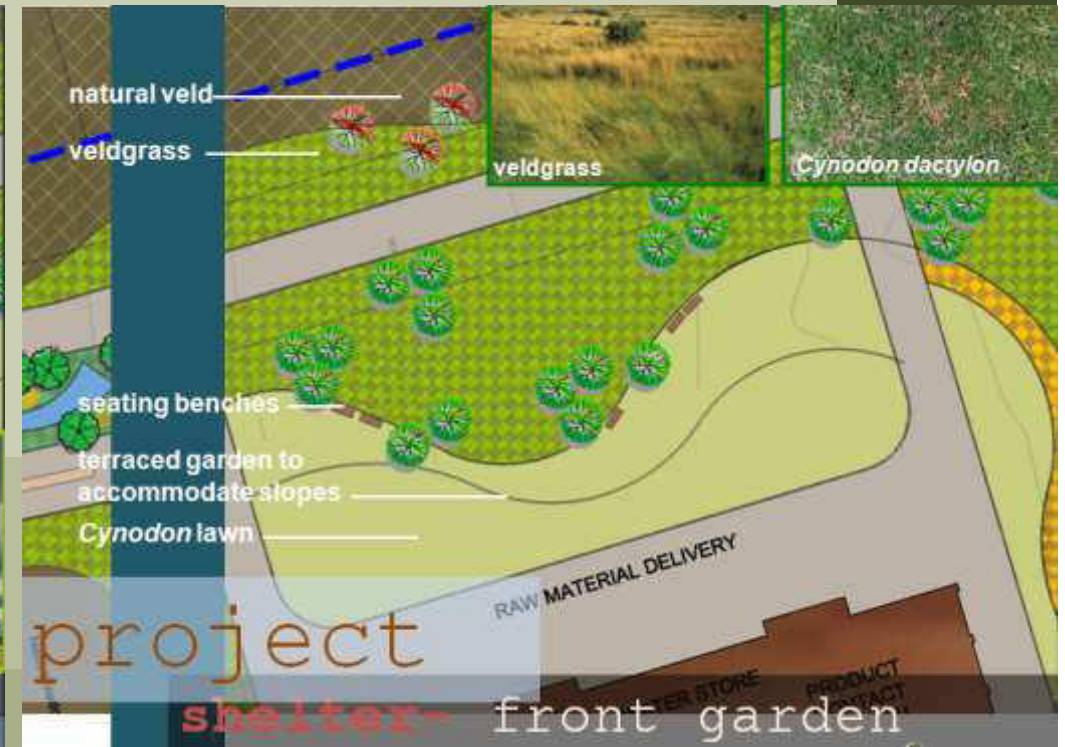
01 Valpre Bottling Plant, Heidelberg



05 Landscape Projects- Current

051 Commercial

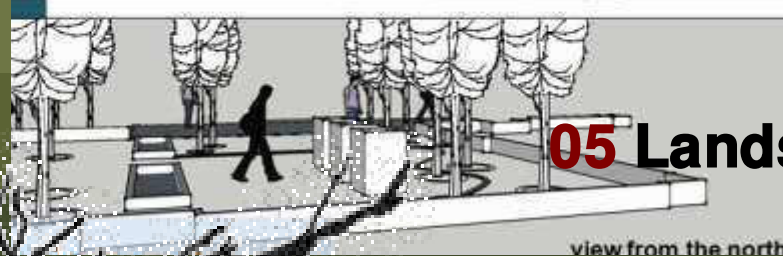
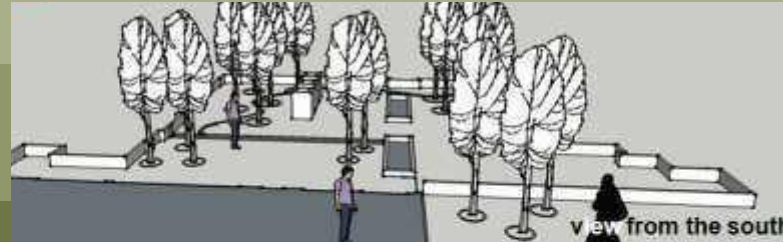
01 Valpre Bottling Plant, Heidelberg



05 Landscape Projects– Current

051 Commercial

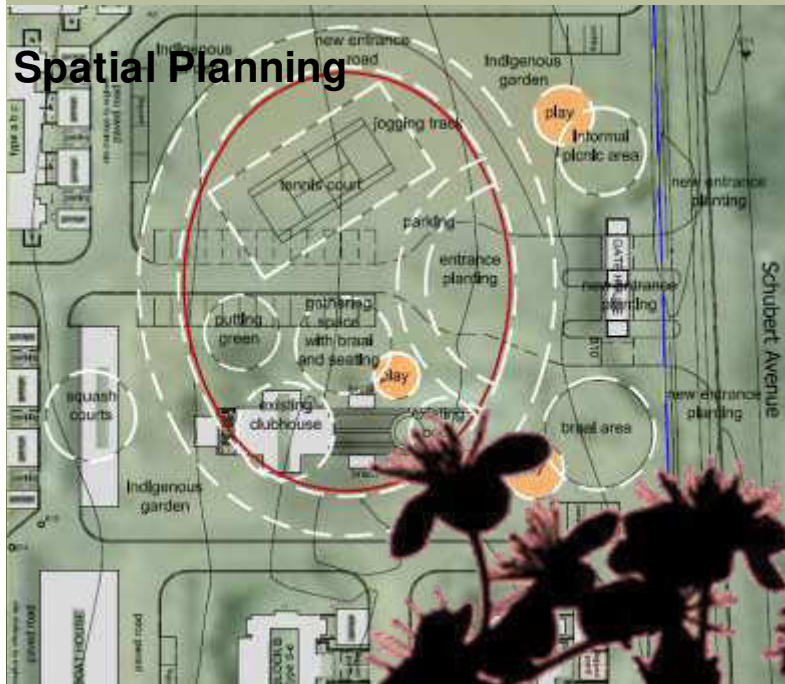
01 Valpre Bottling Plant, Heidelberg



05 Landscape Projects– Current

051 Commercial

02 Melodie Waters, Hartebeespoortedam



Streetscape

Indigenous Planting

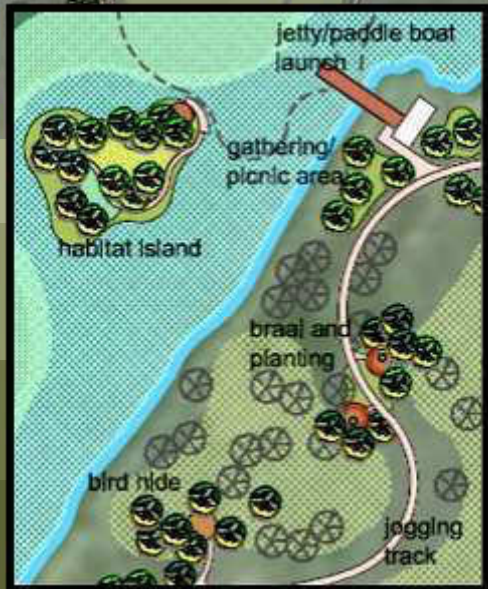


05 Landscape Projects – Current

052 Commercial/Recreational



02 Melodie waters, Hartebeestpoortdam



Rehabilitation



Area Layout



05 Landscape Projects– Current

052 Commercial/Recreational

03 Grain Building, Pretoria



Bokamoso

05 Landscape Projects– Completed

053 Offices

04 Ismail Dawson offices, Pretoria



Bokamoso

05 Landscape Projects – Conceptual

053 Offices

05 Celtic Manor, Pretoria

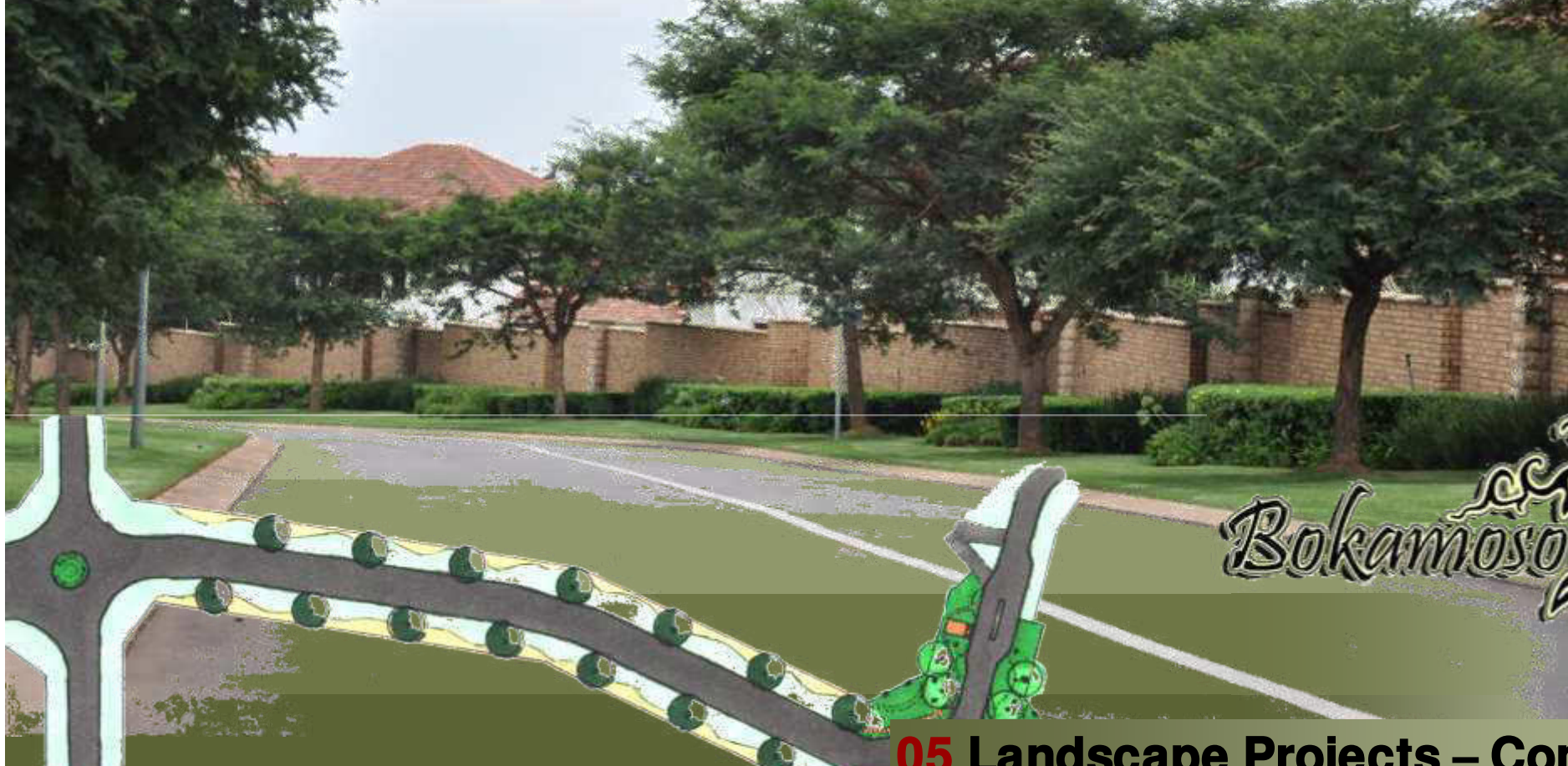


Bokamoso

05 Landscape Projects - Completed

054 Complex Development

06 The Wilds, Pretoria



Bokamoso

05 Landscape Projects – Completed

054 Complex Development

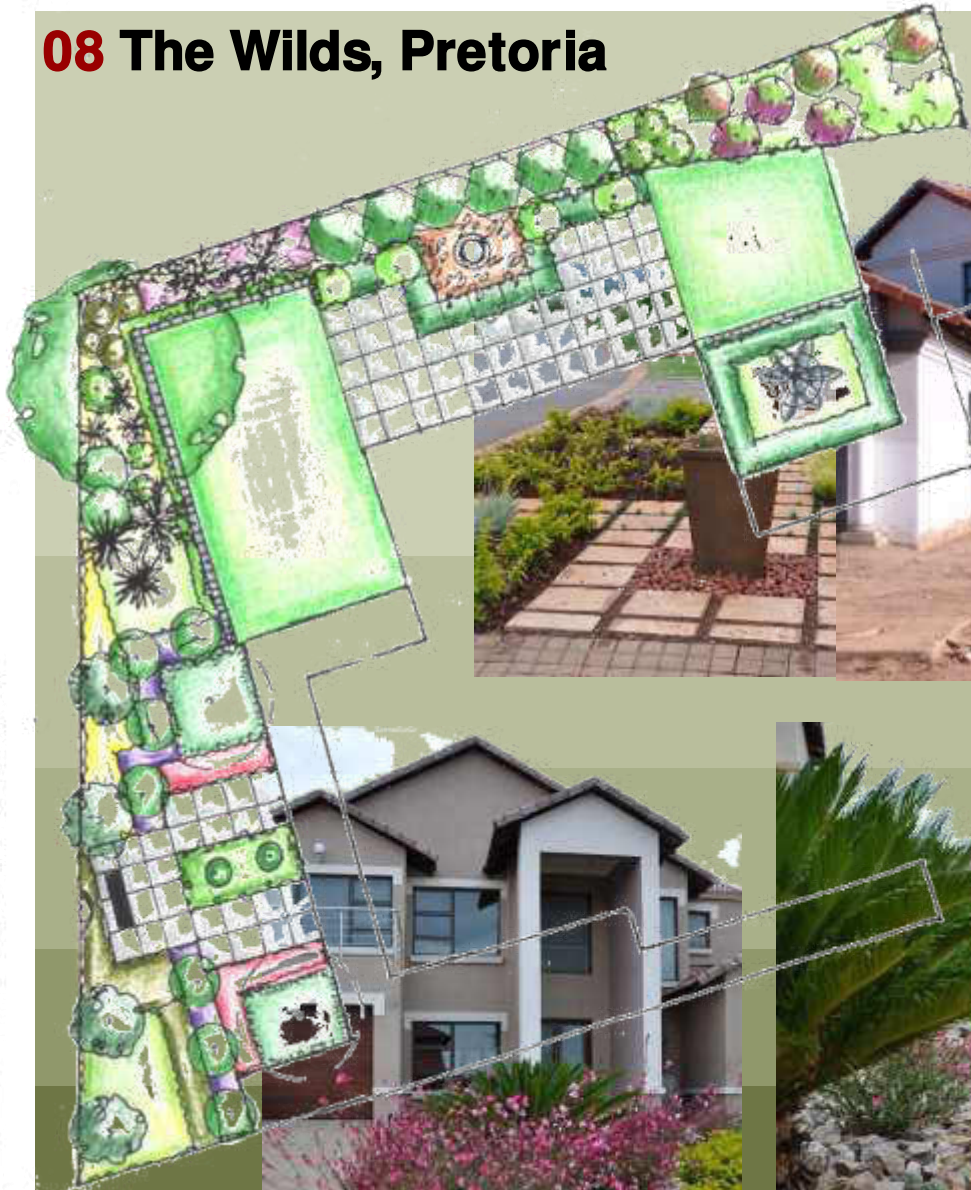
07 The Wilds, Pretoria



05 Landscape Projects – Completed

055 Residential

08 The Wilds, Pretoria



Bokamoso

05 Landscape Projects – Completed

055 Residential

09 The Wilds, Pretoria



Bokamoso

05 Landscape Projects – Completed

055 Residential

010 The Wilds, Pretoria



Bokamoso

05 Landscape Projects – Completed

055 Residential

011 Governor of Reserve Bank's Residence, Pretoria



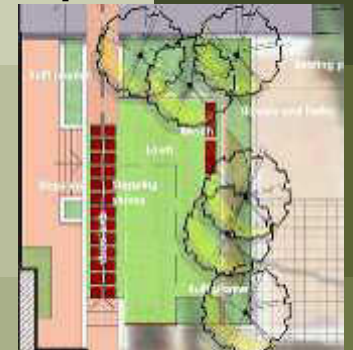
Plant Palette



Option 1



Option 2



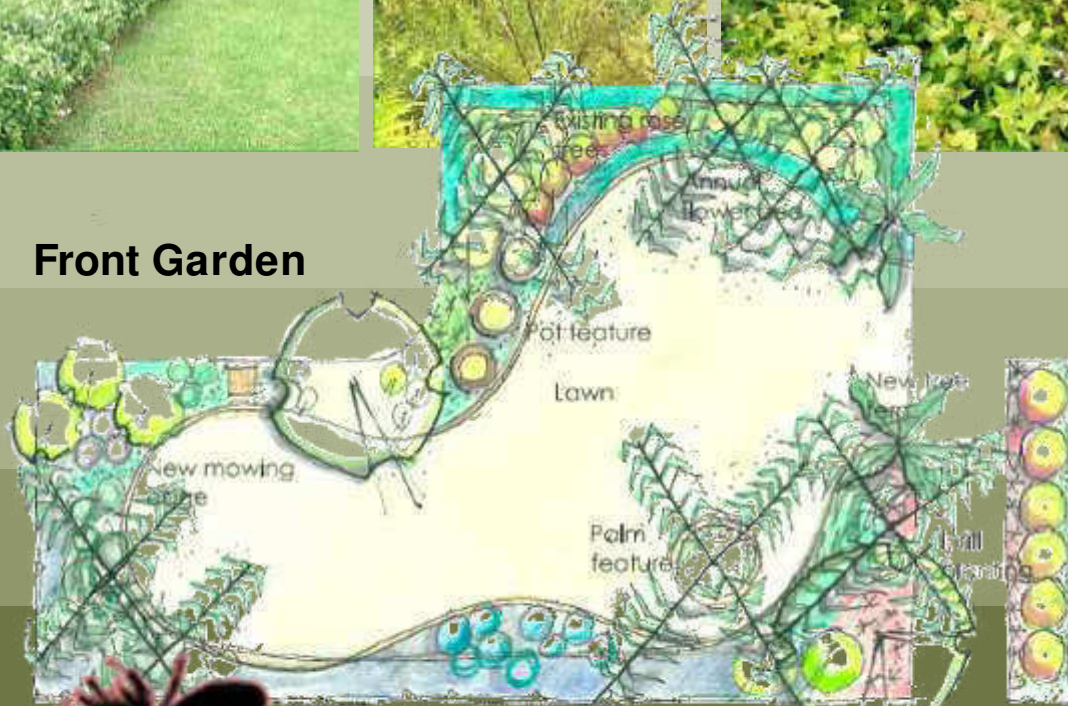
05 Landscape Projects – Conceptual

055 Residential

012 House Ismail, Pretoria



Front Garden

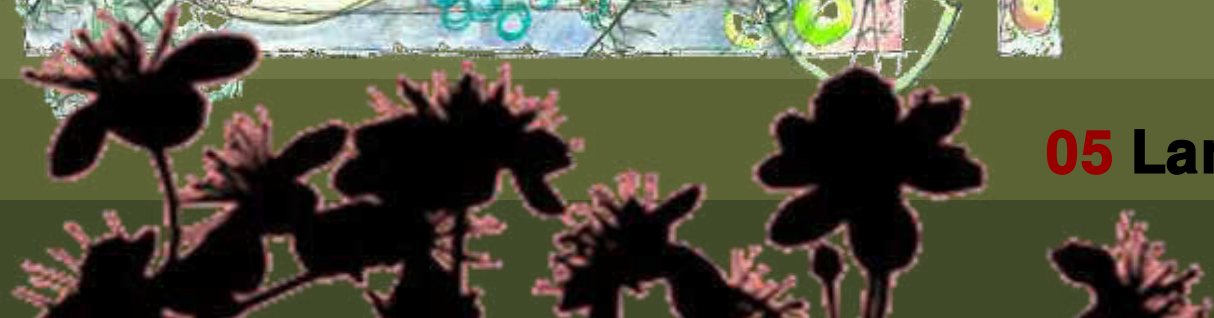


Back Garden



05 Landscape Projects - Conceptual

055 Residential



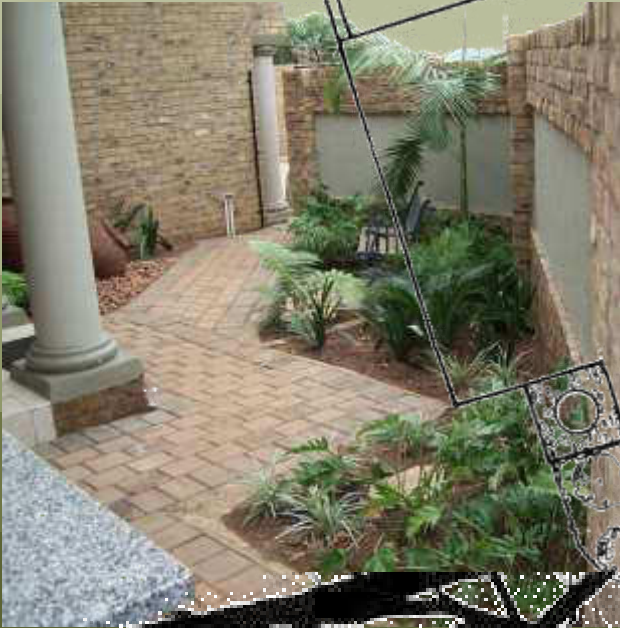
013 Forest Garden, Pretoria



05 Landscape Projects – Completed

055 Residential

015 Forest Garden, Pretoria



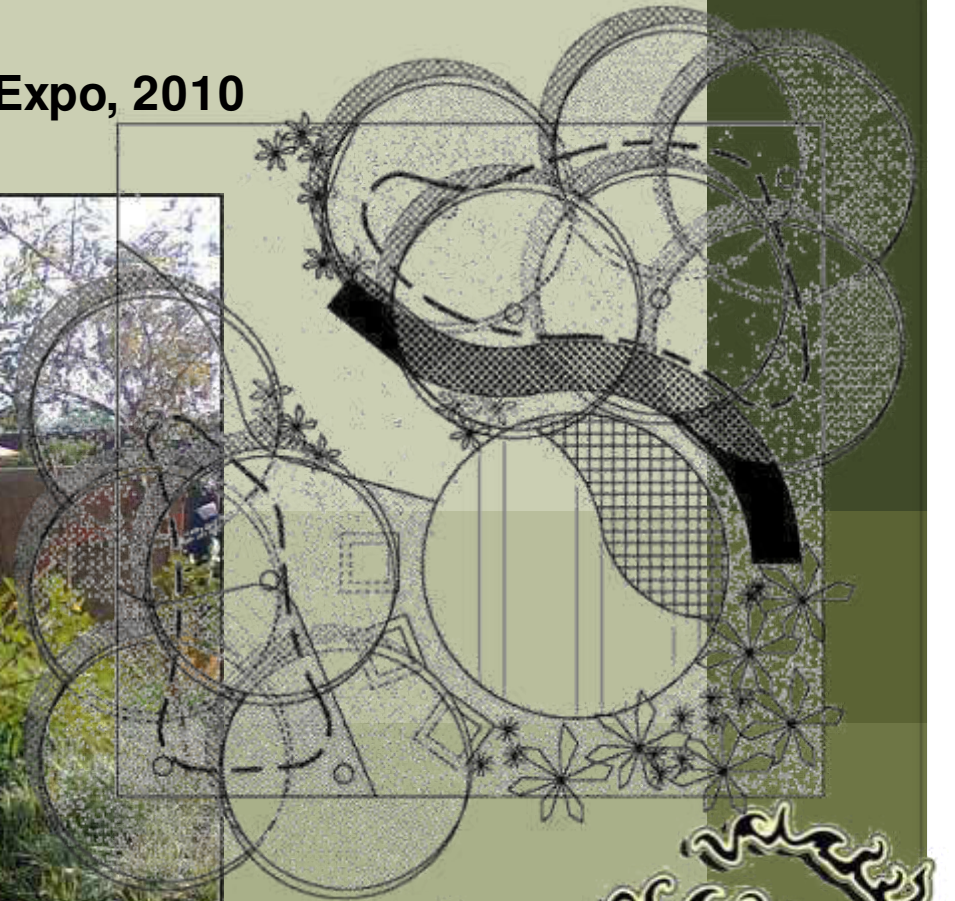
Bokamoso

05 Landscape Projects - Completed

055 Residential

01 Safari Garden Expo

Received a Silver Certificate at the Safari Garden Expo, 2010



Bokamoso 

06 Corporate Highlights

061 Awards

02 UNISA Sunnyside Campus, Pretoria

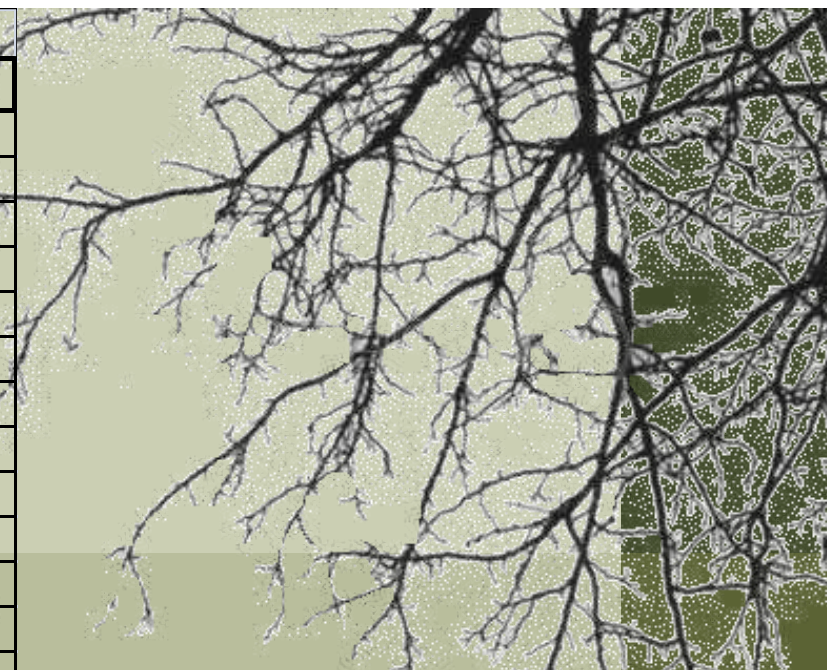
Best Commercial Paving Plan in Gauteng, 1997



06 Corporate Highlights

061 Awards

Project Name	Status	Project
Environmental Impact Assessment(EIA) and Scoping Report		
Junction 21	ROD	EIA
5 O'clock site access	In Progress	EIA
Bokamoso X 1	In Progress	Scoping & EIA
Doornvallei Phase 6 & 7	In Progress	EIA
Engen Interchange	In Progress	Scoping & EIA
Erasmia X15	In Progress	EIA
Franschkloof	In Progress	EIA
K113	Amendment of ROD	EIA
K220 East	ROD	EIA
K220 West	ROD	EIA
K54 ROD conditions	In Progress	EIA
Knopjeslaagte 95/Peachtree	ROD	EIA
Knopjeslaagte portion 20 & 21	ROD	EIA
Lillieslief/Nooitgedacht	In Progress	EIA
Mooiplaats 70 (Sutherland)	In Progress	EIA
Naauwpoort 1 - 12/Valley View	In Progress	EIA
PeachTree X5	In Progress	EIA
Strydfontein 60	In Progress	EIA
Thabe Motswere	In Progress	Scoping & EIA
Vlakplaats	In Progress	EIA
Waterval Valley	In Progress	EIA
Environmental Opinion		
Doornkloof 68 (Ross)	In Progress	Opinion
Monavoni X 53	In Progress	BA & Opinion
Mooikloof (USN)	In Progress	Opinion
Norwood Mall/Sandspruit	In Progress	Opinion
Riversong X 9	In Progress	Opinion
Sud Chemie	In Progress	Opinion
USN Benjoh Fishing Resort	In Progress	Opinion



The adjacent list host the status of our current projects. Only a selected amount of projects are displayed.



07 Current Environmental Projects

071 EIA, Scoping & Opinion

Project Name	Status	Project
Basic Assessment(BA)		
Annlin X 138	In Progress	BA
Clubview X 29	ROD	BA
Darrenwood Dam	In Progress	BA
Durley Holding 90 & 91	In Progress	BA
Elim	In Progress	BA
Fochville X 3	In Progress	BA
Hartebeeshoek 251	In Progress	BA
Klerksdorp (Matlosana Mall)	In Progress	BA
Monavoni External Services	ROD	BA
Monavoni X 45	Amendment of ROD	BA
Montana X 146	In Progress	BA
Rooihuiskraal X29	In Progress	BA
Thorntree Mall	In Progress	BA

Environmental control officer (ECO)		
Grace Point Church	In Progress	ECO
R 81	In Progress	ECO
Highveld X 61	In Progress	ECO
Mall of the North	In Progress	ECO
Olievenhoutbosch Road	In Progress	ECO
Orchards 39	In Progress	ECO
Pierre van Ryneveld Reservoir	In Progress	ECO
Project Shelter	In Progress	ECO

S24 G		
Wonderboom	In Progress	S24 G
Mogwasi Guest houses	Completed	S24 G



07 Current Environmental Projects

072 BA, ECO & S24 G

Project Name	Status	Project
Objection		
Colesberg WWTW	In Progress	Objection
Nigel Steelmill	Completed	Objection
Chantilly Waters	Completed	Objection

Development facilitation Act- Input (DFA)		
Burgersfort	In Progress	DFA & BA
Doornpoort Filling Station	In Progress	DFA & EIA & Scoping
Eastwood Junction	In Progress	DFA
Ingersol Road (Erf 78, 81 - 83)	In Progress	DFA
Roos Senekal	In Progress	DFA & EIA & Scoping
Thaba Meetse 1	In Progress	DFA & EIA & Scoping

Water Use License Act (WULA)		
Britstown Bulk Water Supply	In Progress	WULA
Celery Road / Green Channel	In Progress	WULA
Clayville X 46	In Progress	WULA
Dindingwe Lodge	In Progress	WULA
Doornpoort Filling Station	In Progress	WULA+DFA+EIA+SC
Eco Park Dam	In Progress	WULA
Groote Drift Potch	In Progress	WULA
Jozini Shopping Centre	In Progress	WULA+BA
K60	Completed	WULA
Maloto Roads	In Progress	WULA
Kwazele Sewage Works	In Progress	WULA
Monavoni External Services	In Progress	WULA+BA
Nyathi Eco Estate	In Progress	WULA
Prairie Giants X 3	In Progress	WULA
Waveside Water Bottling Plant	Completed	WULA



07 Current Environmental Projects

073 Objection, DFA & WULA

Project Name	Status	Project
Environmental Management Plan(EMP)		
Heidelberg X 12	ROD	EMP
Monavoni Shopping Centre	Completed	EMP
Forest Hill Development	Completed	EMP
Weltevreden Farm 105KQ	Completed	EMP+EIA
Raslouw Holding 93	Completed	EMP+BA
Durley Development	Completed	EMP+BA
Rooihuiskraal North X 28	Completed	EMP

Rehabilitation Plan		
Norwood Mall/Sandspruit	In Progress	Rehabilitation
Project Shelter Heidelberg	In Progress	Rehabilitation
Sagewood Attenuation Pond	ROD	Rehabilitation
Velmore Hotel	Completed	Rehabilitation
Grace Point Church	Completed	Rehabilitation
Mmamelodi Pipeline	Completed	Rehabilitation

Visual Impact Assessment		
Swatzkop Industrial Developme	Completed	Assessment +DFA
Erasmia	Completed	Assessment

Signage Application		
Menlyn Advertising	Completed	Signage
The Villa Mall	Completed	Signage+EMP+BA



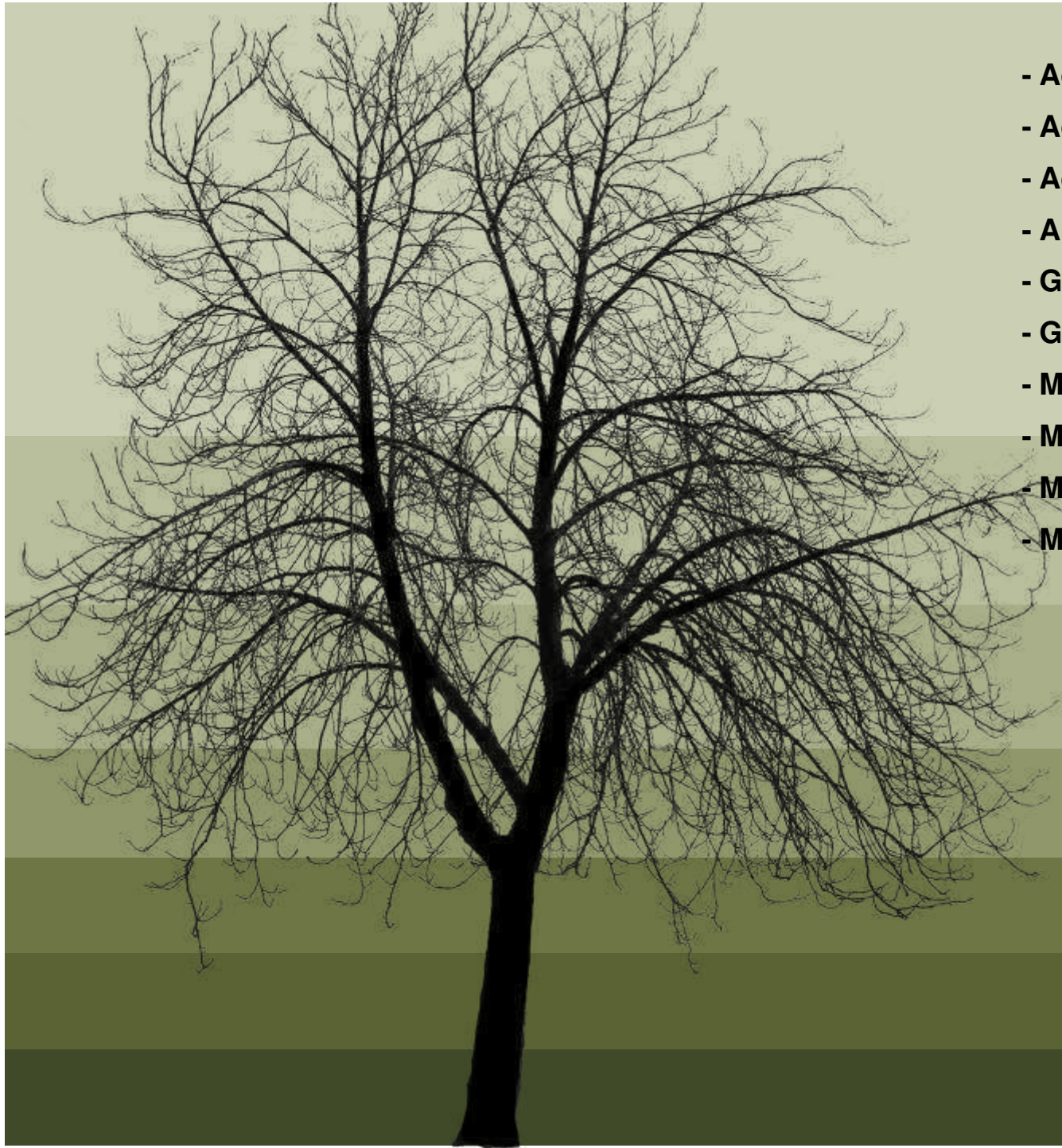
07 Current Environmental Projects

074 EMP, Rehabilitation , Waste Management & Signage Application

- Billion Property Group
- Cavaleros Developments
- Centro Developers
- Chaimberlains
- Chieftain
- Century Property Group
- Coca Cola
- Elmado Property Development
- Flanagan & Gerard
- Gautrans
- Hartland Property Group
- Moolman Group
- MTN
- M&T Development
- Old Mutual
- Property Investment Company
- Petroland Developments
- RSD Construction
- SAND
- Stephan Parsons
- Twin City Developments
- Urban Construction
- USN



08 Indicative Clients



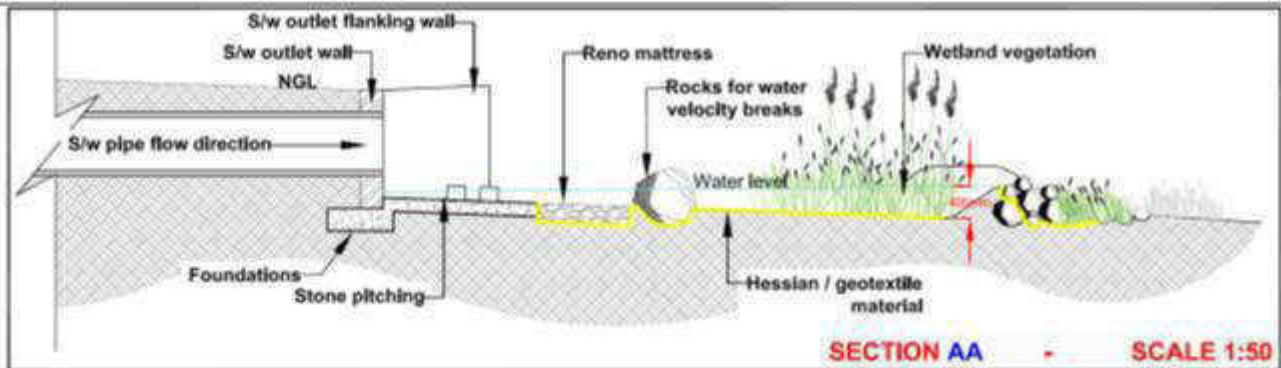
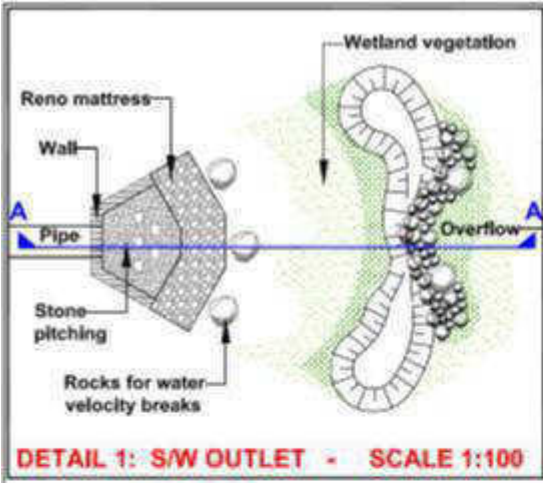
- Adobe Illustrator CS3
- Adobe Photoshop CS3
- Adobe InDesign CS3
- AutoCAD
- Google SketchUP
- GIS
- Microsoft Office Word
- Microsoft Office Excel
- Microsoft Office Publisher
- Microsoft Office Power Point

Bokamoso 

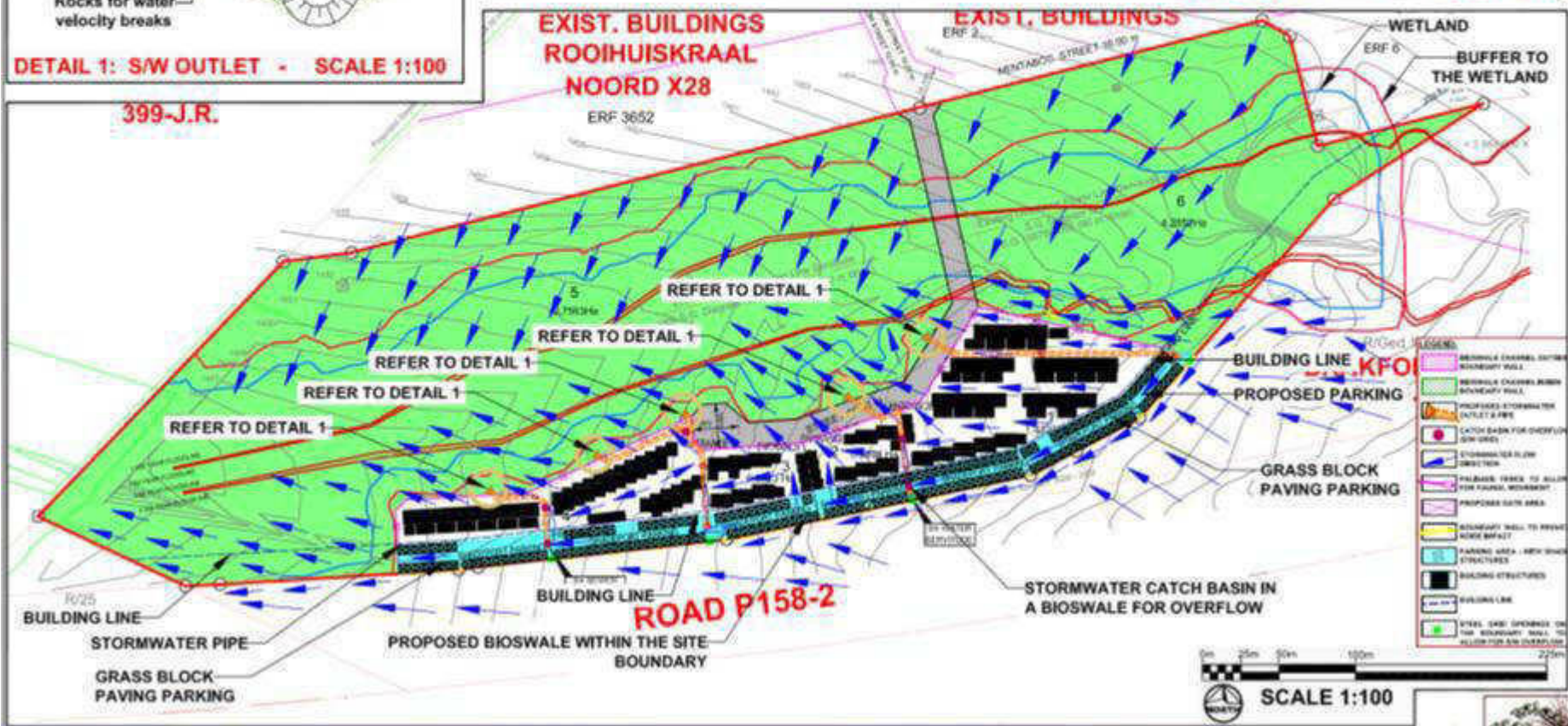


Appendix Iii

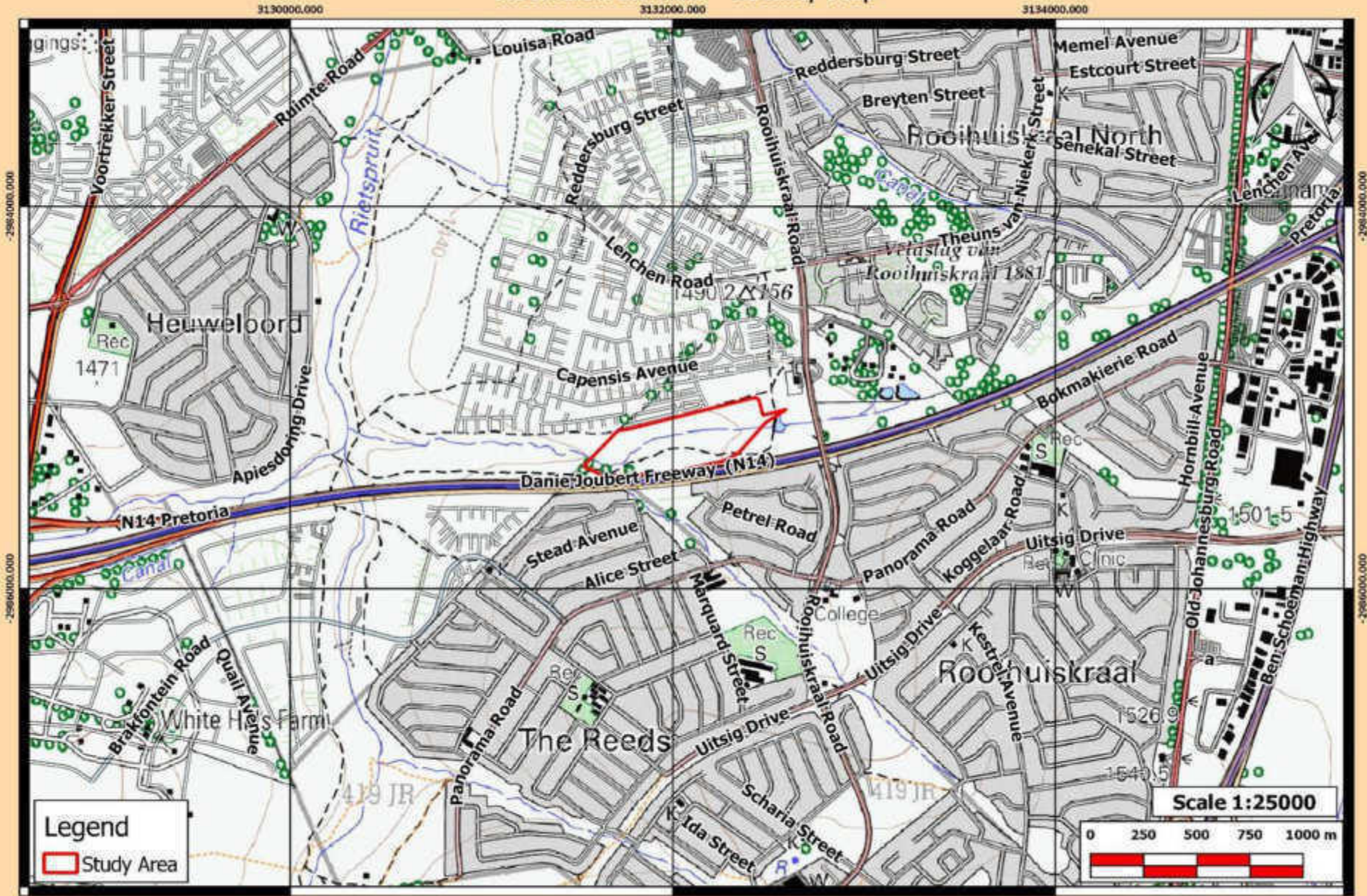
Enlarged Figures



399-J.R.

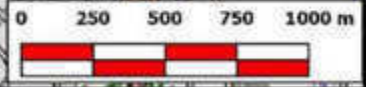


Rooihuiskraal X29 - Locality Map



Legend
 Study Area

Scale 1:25000



Projection - Transverse Mercator
 Datum - Hartbeeshoek 1994
 Reference Ellipsoid - WGS 1994
 Datum - Hartbeeshoek 1994

Bokamoso Environmental Consultants
 Website: www.bokamoso.net
 E-Mail: Lizelleg@mweb.co.za

Rooihuiskraal X29 - Aerial Map

3132000,000



-2996000,000

3132000,000

-2996000,000

Projection - Transverse Mercator
Datum - Hartbeeshoek 1994
Reference Ellipsoid - WGS 1984
Datum - Hartbeeshoek 1994

Bokamoso Environmental Consultants
Website: www.bokamoso.net
E-Mail: Lizelleg@nwweb.co.za

Rooihuiskraal X29 - Rivers and Wetland Map

3131200.000

3132000.000

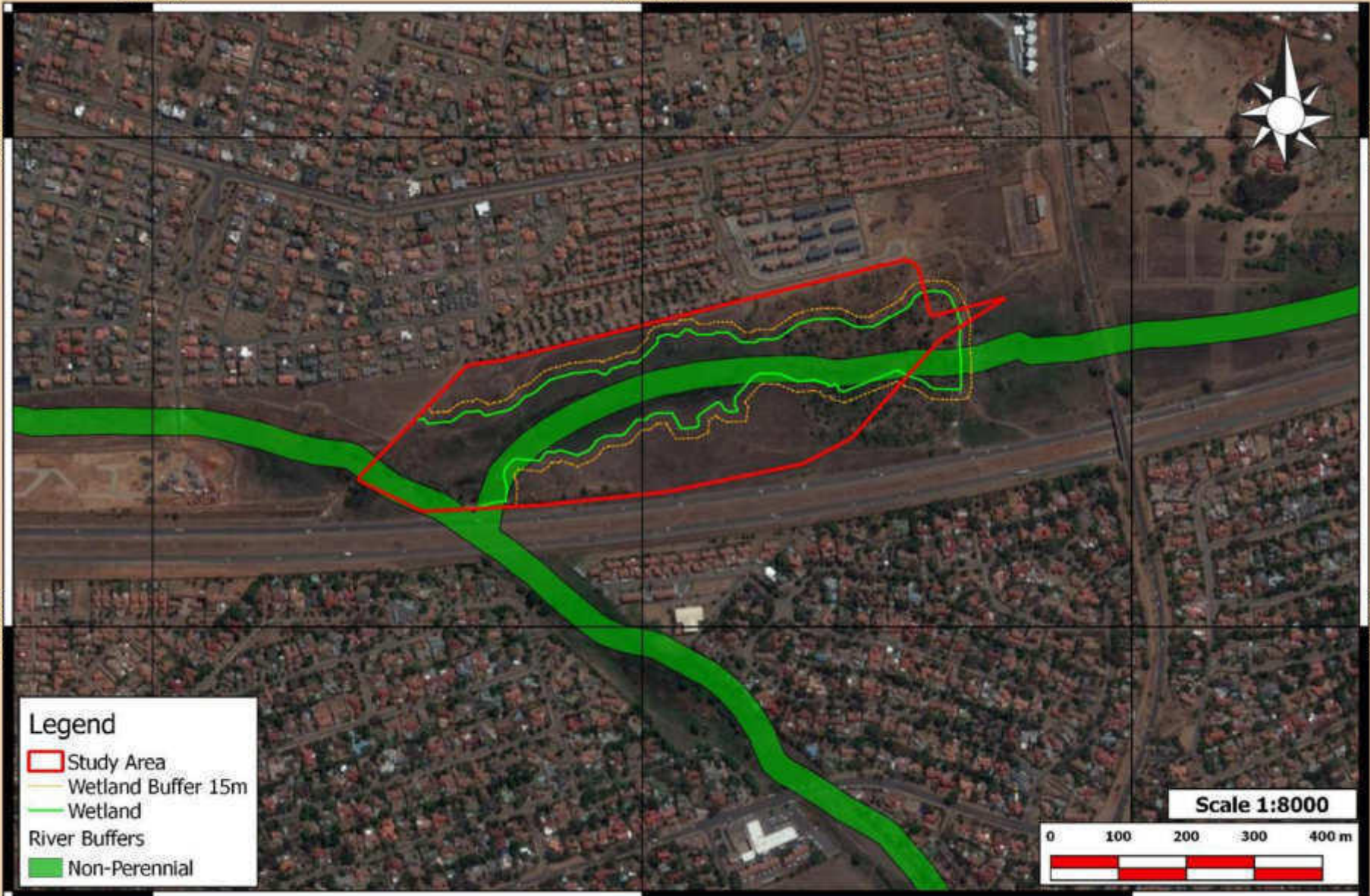
3132800.000

-2984800.000

-2984800.000

-2985600.000

-2985600.000



Legend

- Study Area
- Wetland Buffer 15m
- Wetland
- River Buffers**
- Non-Perennial

Scale 1:8000



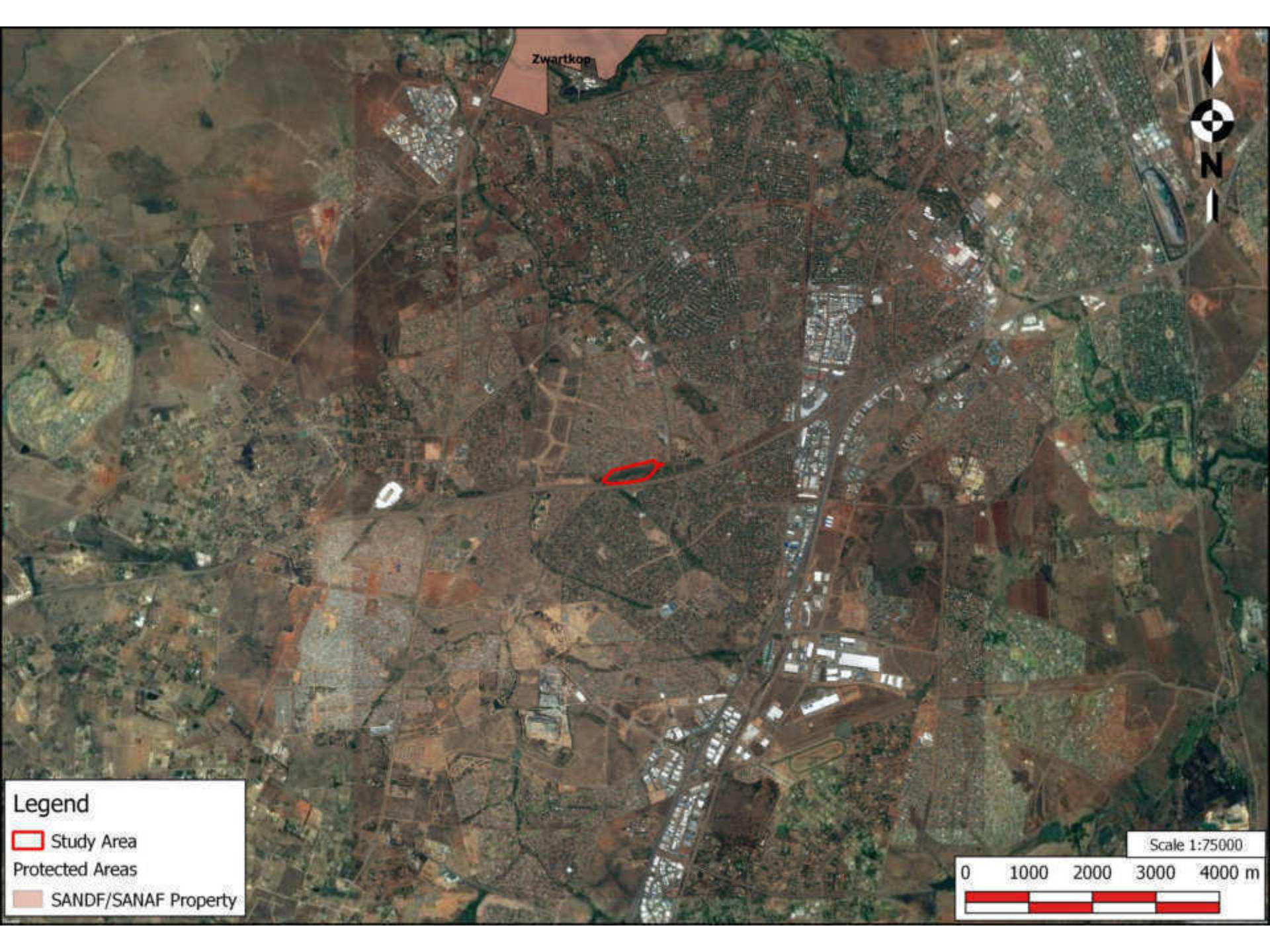
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3132000.000

3132800.000

Projection - Transverse Mercator
Datum - Hartbeeshoek 1994
Reference Ellipsoid - WGS 1984
Datum - Hartbeeshoek 1994




Bokamoso Environmental Consultants
Website: www.bokamoso.net
E-Mail: Lizelleg@mwvb.co.za



Zwartkop




Legend

-  Study Area
-  Protected Areas
-  SANDF/SANAF Property

Scale 1:75000

0 1000 2000 3000 4000 m






Rooihuiskraal X29 - C Plan Area Map

3132000,000



Legend

-  Study Area
 -  Ecological Support Area
 -  Important Area
- CPLAN AREA

Scale 1:8000



Projection - Transverse Mercator
Datum - Hartbeeshoek 1994
Reference Ellipsoid - WGS 1984
Datum - Hartbeeshoek 1994


Bokamoso Environmental Consultants
Website: www.bokamoso.net
E-Mail: Lizelleg@mwveb.co.za

Rooihuiskraal X29 - C Plan Biodiversity Map

3132000.000



Legend

 Study Area

C PLAN

 RL plant hab, OL plant hab, Prim veg

Scale 1:8000



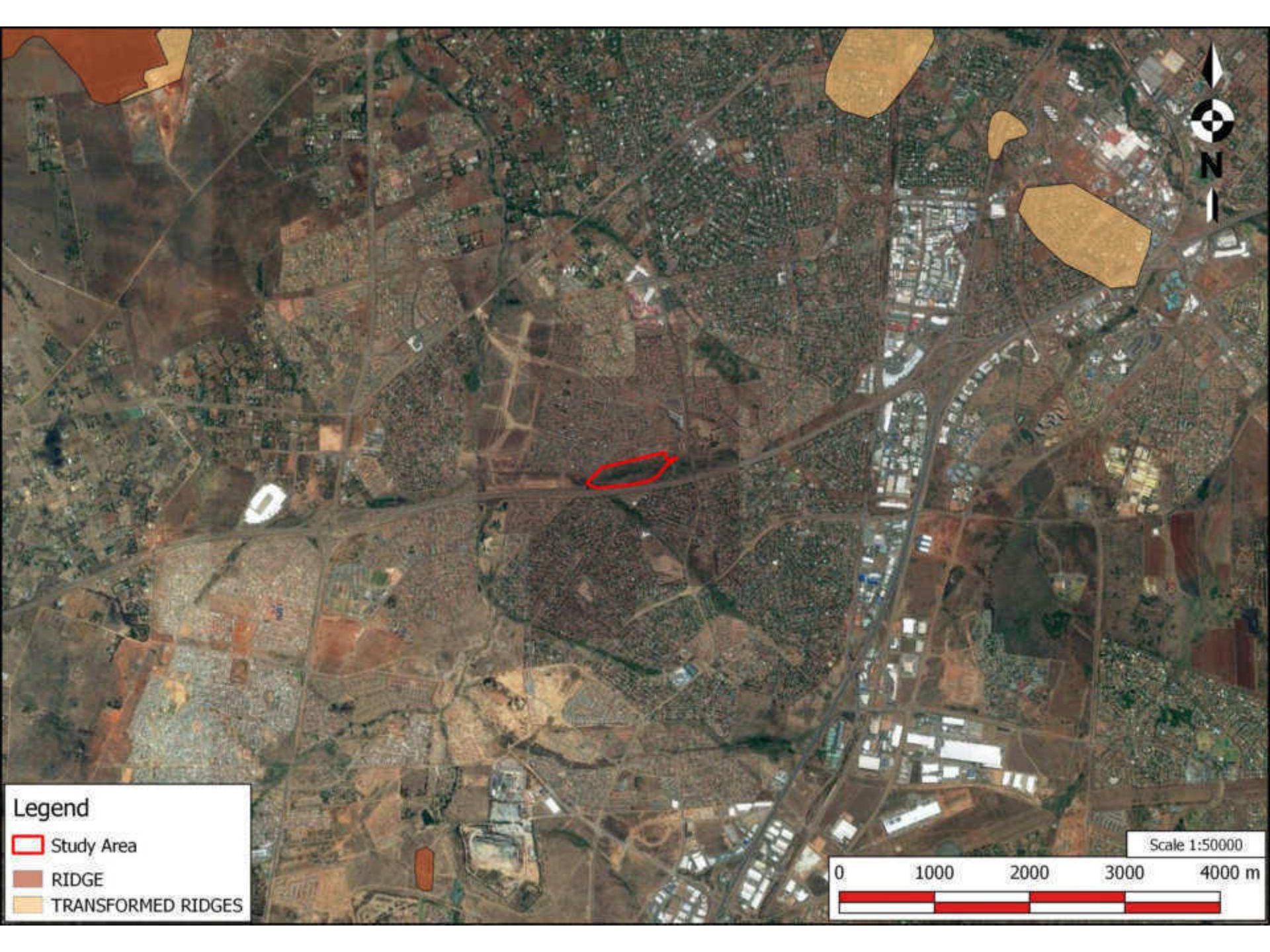
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3132000.000

-2995000.000

Projection - Transverse Mercator
Datum - Hartbeeshoek 1994
Reference Ellipsoid - WGS 1984
Datum - Hartbeeshoek 1994

Bokamoso Environmental Consultants
Website: www.bokamoso.net
E-Mail: Lizelleg@mvveb.co.za



Legend

-  Study Area
-  RIDGE
-  TRANSFORMED RIDGES

Scale 1:50000

0 1000 2000 3000 4000 m






Rooihuiskraal X29 -Locality Map

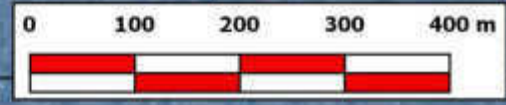
3132000,000



Legend

-  Study Area
- Agricultural Potential**
-  3.Moderate
-  5.Very Low - None

Scale 1:8000



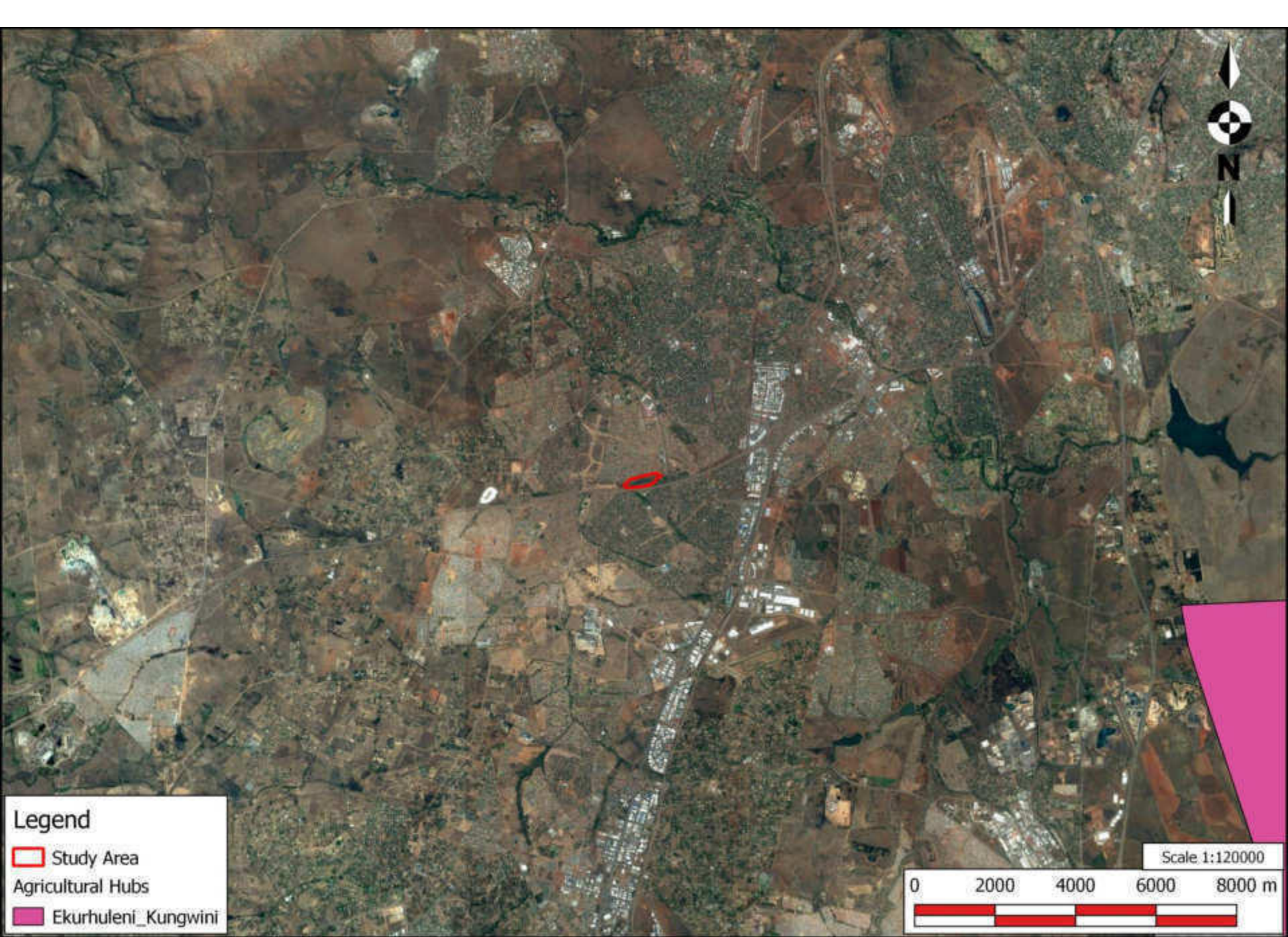
-2986000,000

3132000,000

-2986000,000

Projection – Transverse Mercator
Datum- Hartbeeshoek 1994
Reference Ellipsoid –WGS 1984
Datum- Hartbeeshoek 1994

Bokamoso Environmental Consultants:
Website: www.bokamoso.net
E-Mail: Lizelleg@mweb.co.za

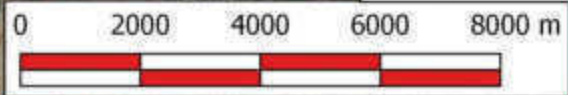


Legend

-  Study Area
-  Ekurhuleni_Kungwini

Agricultural Hubs

Scale 1:120000





Rooihuiskraal X29 - Urban Edge Map

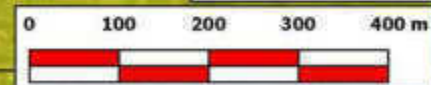
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Legend

-  Study Area
-  URBAN EDGE

Scale 1:8000



3132000.000

-29986000.000

-29986000.000

Projection - Transverse Mercator
Datum- Hartbeeshoek 1994
Reference Ellipsoid -WGS 1984
Datum- Hartbeeshoek 1994

Bokamoso Environmental Consultants
Website: www.bokamoso.net
E-Mail: Lizelleg@nwweb.co.za

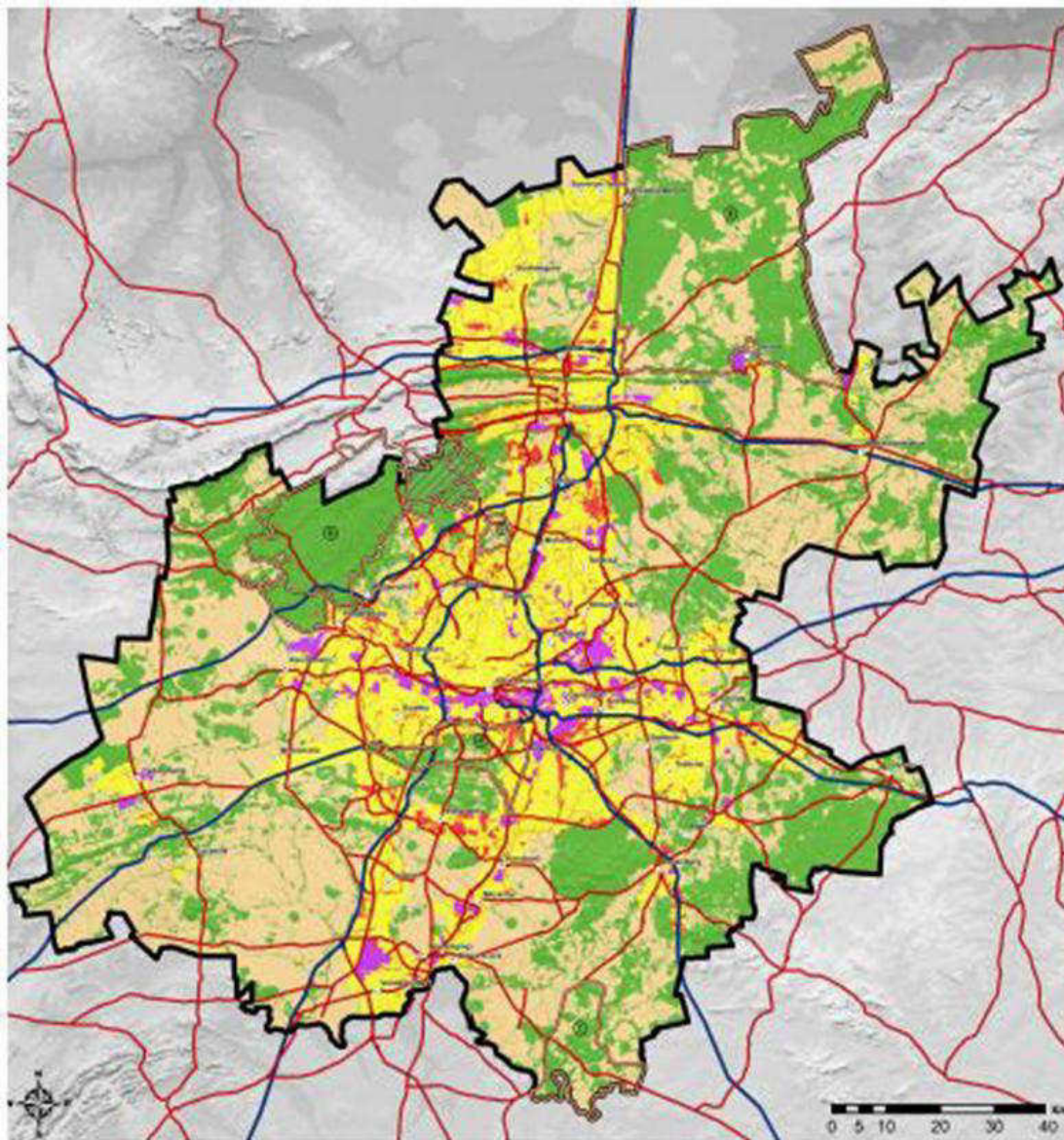
MAP LEGEND:

ENVIRONMENTAL MANAGEMENT ZONES

- Zone 1
- Zone 2
- Zone 3
- Zone 4
- Zone 5
- Special Control Zones
- Special Control Zone for Conservation, Recreation and Tourism

- Gauteng Provincial Boundary
 - Roads**
 - National Road
 - Arterial Road
- Special Control Zones:**

 - (1) Domburg
 - (2) CofRHS
 - (3) Haddon
 - (4) Job South
 - (5) Job North



Zone 1: Urban development zone

Intention
The intention with this zone is to streamline urban development activities in it and to promote development both, densification and conservation of urban development, in order to establish a more effective and efficient city region that will contribute urban spatial form and areas.

Zone 2: High control zone (within the urban development zone)

Intention
This zone is sensitive to development activities. Only construction should be allowed in this zone. Retail tourism and recreation activities must be accommodated in areas surrounding this zone.

Zone 3: High control zone (outside the urban development zone)

Intention
This zone is sensitive to development activities and in several cases also have specific values that need to be protected. Conservation and related tourism and recreation activities should dominate development in this zone.

Zone 4: Normal control zone

Intention
This zone is dominated by agricultural use outside the urban development zone. Agricultural and rural development that support agriculture should be promoted.

Zone 5: Industrial and large commercial focus zone

Intention
The intention with Zone 5 is to streamline non-producing industrial and large scale commercial (warehouses etc.) activities in areas that are already used for such purposes and areas that are severely degraded but in proximity to required infrastructure.

Protected areas (including formal protected areas and other conservation areas)

Intention
Where a management plan for a protected area is in place, it will override the OPMR. Where there is no management plan, the area must be treated as Zone 3.

Special control zones (SCZ)

Special control zones are areas that have specific additional objectives that should be taken into account in decision-making processes.

SCZ (a) Domburg

The Domburg area has a very high potential for nature tourism activities within an area with a strong nature conservation character. Its location is unique in the urban area of Tloane and especially the O.S. Tloane International Airport, makes it an ideal area for wildlife tourism. Other activities that should be promoted include:

- Recreation (especially lodges)
- Rural development that caters for the specific needs of the area, and
- Maintenance of current agricultural activities. Activities that should be avoided as far as possible include:
- Battery farming and facilities
- Mining and sand winning
- Industrial activities, and
- Large commercial and retail developments.

SCZ (b) Circle of Humankind World Heritage Site

The purpose of this special zone is to incorporate the Circle of Humankind World Heritage Site into the Gauteng OPMR. It has its own management zones and management guidelines that must be followed.



Circle of Humankind World Heritage Site

SCZ (c) Val Dam

This area has great potential for development that focuses on the following:

- Local tourism focused on the domestic market
- Intensive recreation based on the Val Dam
- Conservation of grassland habitat in the area
- Rural development that focuses on tourism and recreation.

SCZ (d) Johannesburg South

The Johannesburg South special control zone (Johannesburg South and Foxatpan Development Zone project area) is unique in the sense that it combines several environmental and development features that can form a valuable conservation, recreation, local agricultural and related environment opportunities. It includes the SCZ and OPMR guidelines. In addition to the current OPMR guidelines that will apply to the various zones in this area, decisions should also be taken with due regard to the current initiatives in the area. This includes an emphasis on niche agriculture, hospitality tourism and recreation associated developments. These activities will focus on the nature and landscape of the area and the integration of agricultural, tourism and recreation uses.

SCZ (e) Johannesburg North (the Greater Shepherd Conservation)

The area is a rural landscape surrounding an urban area. It is important to retain its character as it provides specific services to surrounding areas including:

- Habitat for threatened species
- Recreation (the area caters for an exceptional service to the community of Debonair through their programmes with at the youth and children (children))
- Eco-tourism educational facilities
- Nature trails and hiking of nature guides
- Bird watching facilities
- Green building resource centre
- Urban agriculture projects to increase food security and create employment for neighbouring communities
- Nurseries that grow local indigenous plants and trees
- Trails for mountain biking
- Horse trails, and
- Shared equitation facilities and supporting businesses.

SCZ for conservation, recreation and tourism

This area falls mainly within the buffer area of the CofRHS. The management plan should at least comply with the minimum plan in the buffer area in the CofRHS Management Guidelines. It also has a high potential for conservation, local recreation (hiking, mountain biking, etc.) and village style hospitality. Development decision-making must take the character of this area into account to ensure its potential as an important conservation and recreation area.

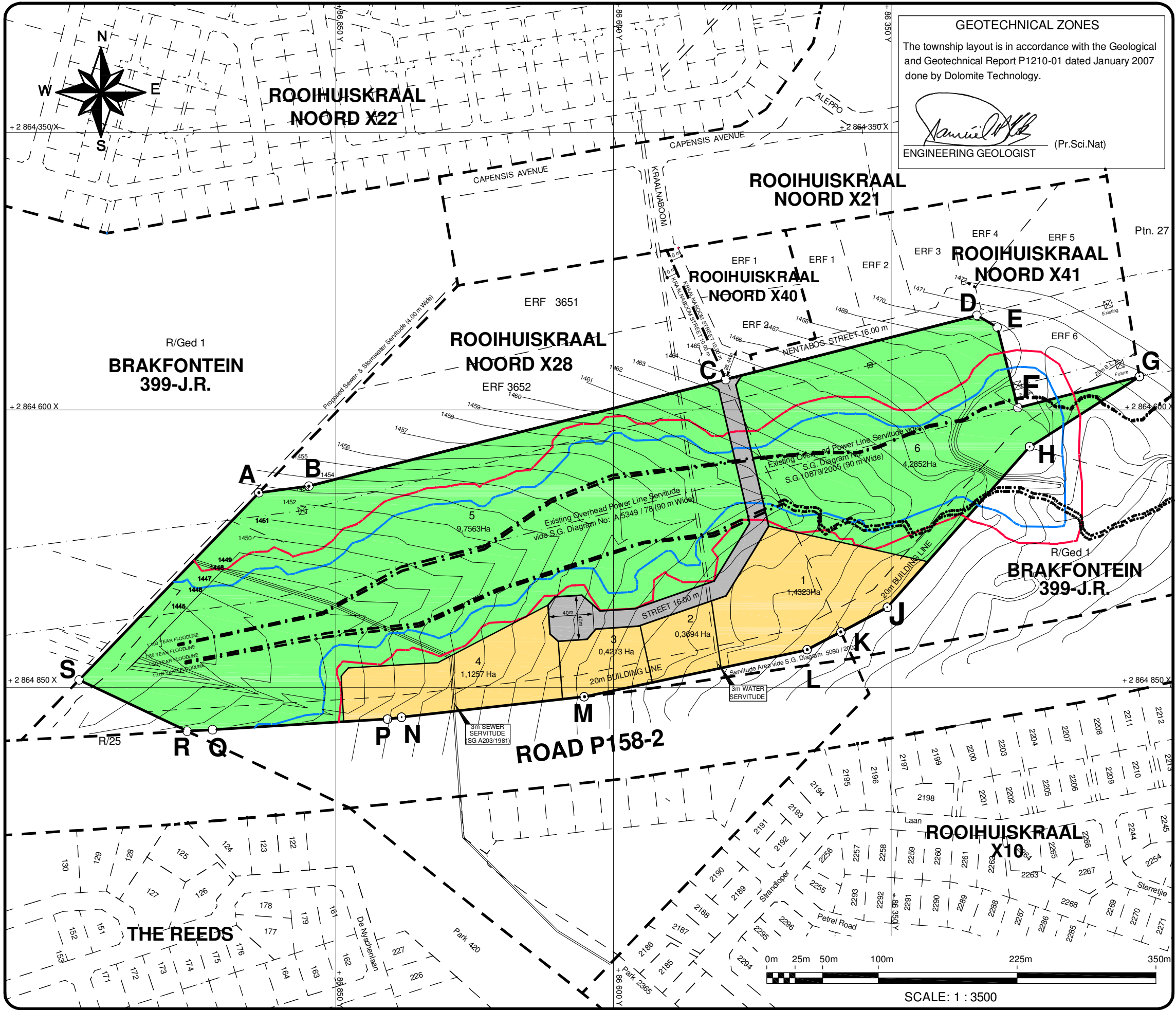
Prepared by: ENVIRONMENTAL MANAGEMENT FRAMEWORK

Prepared by: ENVIRONMENTAL MANAGEMENT FRAMEWORK

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Prepared by: ENVIRONMENTAL MANAGEMENT FRAMEWORK

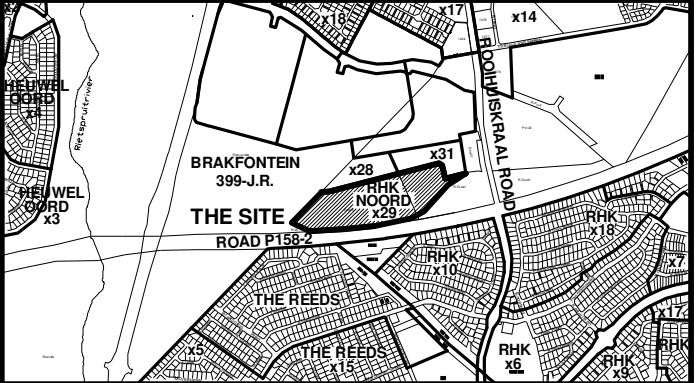
Prepared by: ENVIRONMENTAL MANAGEMENT FRAMEWORK



GEOTECHNICAL ZONES
 The township layout is in accordance with the Geological and Geotechnical Report P1210-01 dated January 2007 done by Dolomite Technology.

Samuel D. [Signature]
 ENGINEERING GEOLOGIST (Pr.Sci.Nat)

PROPOSED TOWNSHIP
ROOIHUISKRAAL NOORD EXT.29
 SITUATED ON PART OF RE OF PTN.9 AND A PART OF PORTION 145 OF THE FARM BRAKFONTEIN 399-JR



REFERENCE:

USES	ERF NO.	AMOUNT	AREA (m ²)	%
RESIDENTIAL 3	ERVEN 1-4	4	33487m ²	18,58%
PRIVATE OPEN SPACE	ERVEN 5-6	2	140415m ²	77,92%
STREET			6298m ²	3,49%
TOTAL		6	180200m²	100%

Min. Gradient of Streets: 1 : 45
 Max. Gradient of Streets: 1 : 17
 Total length of Streets: 350m

- Date: Last Amendment: NOVEMBER 2014
- NOTES:**
- 1.) The figure A to S, A denotes the township boundary.
 - 2.) All measurements are approximate.
 - 3.) The figure denotes a wetland.
 - 4.) The line represents the wetland buffer.

FLOOD LINE:
 In terms of the Regulations of Article 144 (Act 36 of 1998), is hereby stated that this township is affected by a floodline with an expected frequency of one every 50 years and one every 100 years in the public stream.

[Signature]
 PR. ING. 9.7.0.122

CONTOURS:
 The contours on this plan are in accordance with Regulation 18 (1)(a)(1) of the Townplanning- and Townships Ordinance, Ord. 15 of 1986. The contours on this plan were obtained from Jack Marczak.

LOCAL AUTHORITY'S NUMBER: RHKNX29/05

PLAN NUMBER: D1212 / 10

LOCAL AUTHORITY: CITY OF TSHWANE

PlandeV House
 Highveld Office Park
 Charles de Gaulle Crescent
 Highveld
 CENTURION
 7710, Centurion, 0046
 Tel: (012) 665-2330/1/2
 Fax: (012) 665-2333
 e-mail: plandev@africa.com

PLANDEV
 Stads- en Streekbeplanners
 Town- and Regional Planners

SCALE: 1 : 3500 DATE: NOVEMBER 2014