H36

Client : Mosomo Consulting Engineers (Pty) Ltd

2.2(4466)

GROUNDWATER DEVELOPMENT AT NTWANE/ELANDSDOORN/MALAENENG VILLAGE: GREATER SEKHUKHUNE DISTRICT MUNICIPALITY, LIMPOPO PROVINCE

WH06105/reports

JUNE 2006

WSM LESHIKA CONSULTING (Pty) Ltd

Engineers, Geohydrologists, ISD Practitioners & Project Managers

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Memo

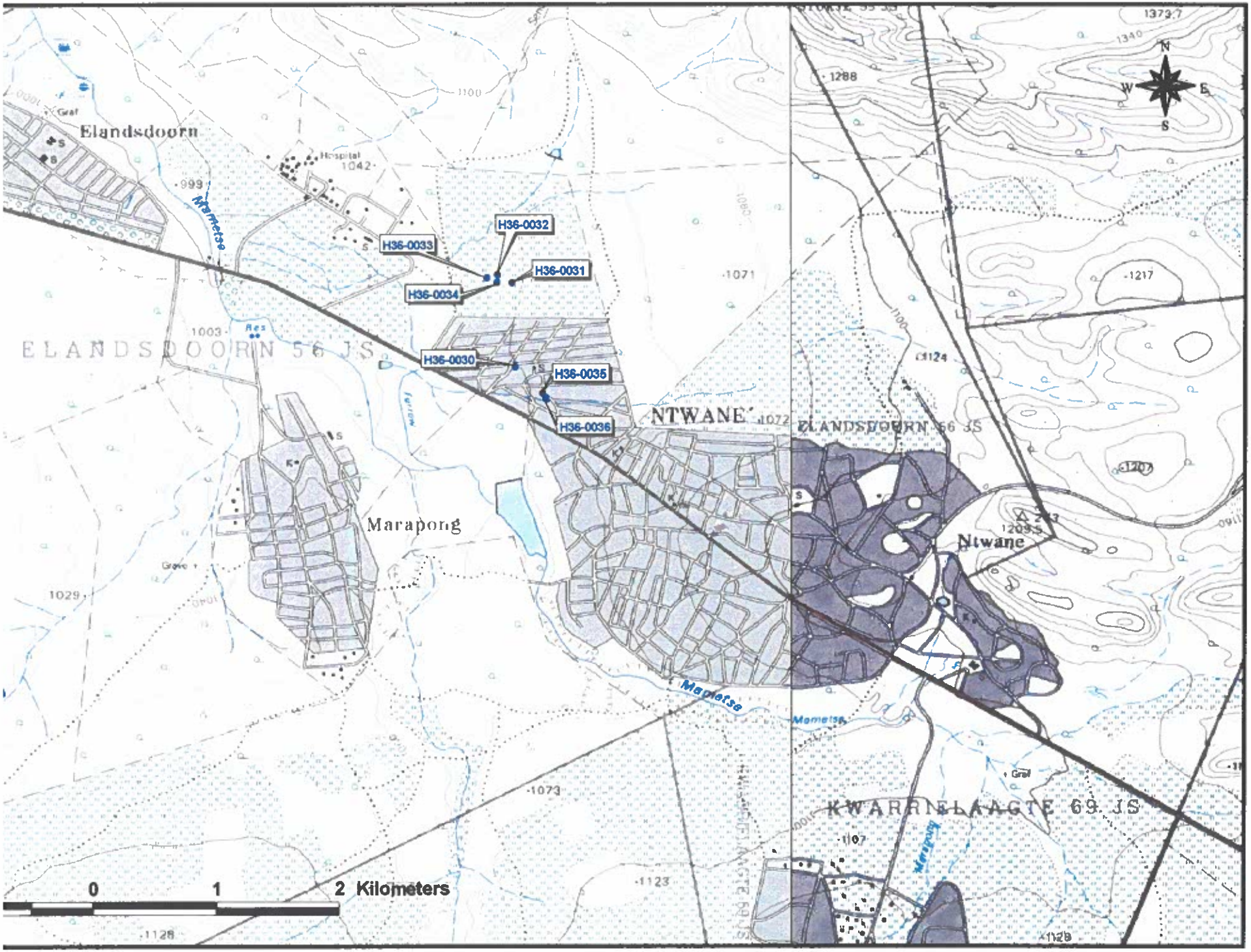
To	:	Mosomo Consulting Engineers (Pty) Ltd
Attention	:	Abrie Cilliers
From	:	Funzani Duncan Munyai
Date	:	21 June 2006
Subject	:	Ground Water Development ~ Elandsdoorn
Our Ref	:	Elandsdoorn Village Borehole Testing (WH 06105)

1. BACKGROUND

WSM Leshika Consulting (Pty) Ltd was appointed by Mosomo Consulting Engineers of Tzaneen to pump test the existing boreholes at Elandsdoorn village (Figure 1). Elandsdoorn community is located approximately 30 Km south west of Groblersdal, Greater Sekhukhune Municipal Area, Limpopo Province.

Hydrocensus was conducted and five boreholes were selected for pump testing (see attachment)

This memorandum summarizes the test pumping, water chemistry results and gives equipping recommendations for the boreholes developed under this investigation.



LESHIKA (Pty) Ltd

ELANDSDOORN/NTWANE BOREHOLE LOCALITY MAP

FIGURE 1

2. TEST PUMPING RESULTS

Summarized in Table 1 are results pertaining to the testing of the 4 boreholes (H36-0030, H36-0031, H36-0032 and H36-0033). One borehole H36-0036 could not be tested as it had collapsed. Attached are the plotted data (log – normal) for reference. A description of the test data is as follows:

H36-0030

A four by 60-minute step test was carried out at 0.5 l/sec, 1.08 l/sec, 2.77 l/sec and finally at 5 l/sec, reaching the drawdown of 13.40 m. The 24-hour constant rate test was conducted at 3.57 l/sec reaching a final drawdown of 10.75 m on completion of the test. Recovery is moderate at 97 % after the pumping period (T/T' = 2.00 or 24 hours). Specific capacity is calculated at 0.4 l/sec/m drawdown and transmissivity at 28.23 m^2/day.

The recommended pumping rate is 1.06 l/sec for 20 hours/day ~ 76 Kl/day. The pump inlet is to be set at 25 mbgl and the dynamic head calculated at 14 m @ 1.06 l/sec.

H36-0031

A two by 60-minute step test was conducted at 0.7 l/sec, 1.6 l/sec, and finally, reaching pump suction within 8 minutes of the 3rd and final step at a drawdown of 33.18 m. The 24-hour constant rate test was conducted at 1.33 l/sec reaching a final drawdown of 14.90 m on completion of the test. Recovery is good at 99 % after the pumping period (T/T' = 2.00 or 24 hours). Specific capacity is calculated at 0.29 l/sec/m drawdown and transmissivity at 9.14 m^2/day.

The recommended pumping rate is 0.46 l/sec for 20 hours per day ~ 33 Kl/day. The pump is to be set at 40 m below ground level and the dynamic head is calculated at 25 mbgl.

H36-0032

Four complete (60 minutes each) steps were done at 0.90 l/sec, 2.40 l/sec, 4.00 l/sec, 8.60 l/sec and finally at 12.00 l/sec, reaching pump suction within 6 minutes of the fifth and incomplete test. The final drawdown was measured at 11.99 m. The 24-hour

ABLE 1 : TEST PUMPING DETAILS

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ARM or VILLAGE NAME	BOREHOLE No	CO ORDINATES		DATE TESTED	WATER LEVEL (mbgl)	WATER STRIKE (mbgl)	DEPTH (m)	STEP TEST		CONSTANT DISCHARGE TEST				RECOMMENDATIONS				WATER QUALITY CLASS
		South	East					Time (mins)	% Recy	Duration (mins)	Rate (l/sec)	T (m3/d/m)	% Rec	Rate (l/sec)	Duty cycle (hrs/day)	Supply (Kl/day)	Pump set (mbgl)	
Elandsdoorn	H36-0030	-25.29840	29.22960	25/05/2005	12.47	Unknown	37.67	240	97	1440	3.57	28.23	97	1.06	20	76	25	CLASS II
Elandsdoorn	H36-0031	-25.29228	29.22941	25/05/2006	20.85	Unknown	34.65	128	100	1440	1.33	9.14	99	0.46	20	33	40	CLASS II
Elandsdoorn	H36-0032	-25.29171	29.22833	27/05/2006	19.35	Unknown	35.9	248	99	1440	6.66	87.77	95	3	20	216	25	CLASS II
Elandsdoorn	H36-0033	-25.29192	29.22757	27/05/2006	18.47	Unknown	99.54	240	100	1440	5	16.81	100	1.5	20	108	50	CLASS II

constant rate test was done at 6.66 l/sec and reached the drawdown of 5.51 m on completion of the test. Recovery is moderate at 95 % (T/T' = 2.00 or 24 hours).

The recommended pumping rate is 3 l/sec for 20 hours per day ~ 216 Kl/day. The pump is to be set at 25 m below ground level and the dynamic head is calculated at 21 mbgl.

H36-0033

Four complete (60 minutes each) steps were done at 0.62 l/sec, 1.71 l/sec, 3.52 l/sec, and finally at 5.45 l/sec, reaching the drawdown of 12.41 m. The 24-hour constant rate test was conducted at 5.00 l/sec and reached 52.65 m on completion of the test. Recovery is good at 100 % (T/T' = 2.00 or 24 hours).

The recommended pumping rate is 1.5 l/sec for 20 hours per day ~ 108 Kl/day. The pump is to be set at 50 m below ground level and the dynamic head is calculated at 24 mbgl.

3. WATER CHEMISTRY RESULTS

Analyses of the samples taken from the four tested boreholes are listed in Table 2. Both boreholes (H36-0030, H36-0031, H36-0032 and H36-0033) have elevated hardness levels 397.1, 385.6, 384 and 366 as CaC03 (Class II), respectively. A "brak" taste will be noticed with respect to first time users. Scale is also expected to develop on heating elements and metal fittings. The remaining constituents all fall within Class 0 – Class I category for domestic consumption. The analyses show that both samples from these boreholes are portable and can be consumed with insignificant health risk.

4. PUMP INSTALLATION DETAILS

Based on the test results, the following equipping details are recommended at the new boreholes. Specific details are:

H36-0030

Pumping Rate	1.06 l/sec @ 20 hrs/day OR 2.65 l/sec @ 8 hrs/day
Borehole Depth	37.67 m
Installation Depth	25 mbgl

TABLE 2 : WATER CHEMISTRY

ANALYSES	UNIT	H36-0030	H36-0031	H36-0032	H36-0033	CLASSIFICATION				
						Class 0	Class I	Class II	Class III	Class IV
pH		6.91	6.97	6.9	7.01	5.5 - 9.5	4.5 - 10	4 - 10.5	3 - 11	< 3 or > 11
Conductivity	mS/m	53.4	53.7	55.8	53.8	< 70	70 - 150	150 - 370	370 - 520	> 520
TDS	mg/l	359	363	375	369	< 450	450 - 1000	1000 - 2400	2400 - 3400	> 3400
Nitrate (N)	mg/l	7.73	8.02	6.94	8.73	< 6	6 - 10	10 - 20	20 - 40	> 40
Fluoride	mg/l	0.07	0.04	0.24	0.12	< 0.7	0.7 - 1	1 - 1.5	1.5 - 3.5	> 3.5
Sulphate	mg/l	72.6	37	5.3	22.3	< 200	200 - 400	400 - 600	600 - 1000	> 1000
Chloride	mg/l	23.3	20	23.3	18.3	< 100	100 - 200	200 - 600	600 - 1200	> 1200
P - Alkalinity		0	0	0	0					
M - Alkalinity		162.8	178.4	190.2	171.8					
Carbonate		0	0	0	0					
Bicarbonate		198.4	217.5	231.9	209.4					
Total Hardness	CaCo3	397.1	385.6	384	366	< 200	200 - 300	300 - 600	> 600	
Ca - Hardness		164.7	170.6	181.4	167.6					
Mg - Hardness		232.4	215	202.6	198.4					
Calcium	mg/l	66	68.3	72.6	67.1	< 80	80 - 150	150 - 300	> 300	
Magnesium	mg/l	56.4	52.2	49.2	48.2	< 70	70 - 100	100 - 200	200 - 400	> 400
Sodium	mg/l	9.5	8.2	5.4	5.5	< 100	100 - 200	200 - 400	400 - 1000	> 1000
Potassium	mg/l	1.19	0.45	0.6	0.51	< 25	25 - 50	50 - 100	100 - 500	> 500
Iron	mg/l	0	0	0	0	< .5	.5 - 1	1 - 5	5 - 10	> 10
Manganese	mg/l	0	0	0	0	< .1	.1 - .4	.4 - 4	4 - 10	> 10
WATER CLASS		CLASS II	CLASS II	CLASS II	CLASS II					
Sum Cations		8.38	8.07	7.92	7.57					
Sum Anions		8.44	8.15	7.94	7.61					

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S W L	12.47 m
Dynamic Head	14 m at 1.06 l/sec
Supply per day	76 Kl/day
WATER CLASS	**CLASS II**

H36-0031

Pumping Rate	0.46 l/sec @ 20 hrs/day **OR** 1.15 l/sec @ 8 hrs/day
Borehole Depth	58.8 m
Installation Depth	40 mbgl
S W L	20.85 m
Dynamic Head	25 m at 0.46 l/sec
Supply per day	33 Kl/day
WATER CLASS	**CLASS II**

H36-0032

Pumping Rate	3 l/sec @ 20 hrs/day **OR** 7.5 l/sec @ 8 hrs/day
Borehole Depth	35.6 m
Installation Depth	25 mbgl
S W L	19.35 m
Dynamic Head	21 m at 1.72 l/sec
Supply per day	216 Kl/day
WATER CLASS	**CLASS II**

H36-0033

Pumping Rate	1.5 l/sec @ 20 hrs/day **OR** 3.75 l/sec @ 8 hrs/day
Borehole Depth	99.54 m
Installation Depth	50 mbgl
S W L	18.47 m
Dynamic Head	24 m at 2.45 l/sec
Supply per day	108 Kl/day
WATER CLASS	**CLASS II**

5. SUMMARY & RECOMMENDATIONS

A summary of the results pertaining to the water supply to Elandsdoorn Village is as follows:

i. Borehole H36-0030 has a tested supply of 76 Kl/day. The borehole may be equipped to pump at a rate of 1.06 l/sec for 20 hours per day.

ii. Borehole H36-0031 has a tested supply of 33 Kl/day. The borehole may be equipped to pump at a rate of 0.46 l/sec for 20 hours per day.

iii. Borehole H36-0032 has a tested supply of 216 Kl/day. The borehole may be equipped to pump at a rate of 3 l/sec for 20 hours per day.

iv. Borehole H36-0033 has a tested supply of 108 Kl/day. The borehole may be equipped to pump at a rate of 1.5 l/sec for 20 hours per day.

v. Both boreholes (H36-0030, H36-0031, H36-0032 and H36-0033) have elevated hardness levels 397.1, 385.6, 384 and 366 as CaC03 (Class II), respectively.

vi. The analyses show that both samples from these boreholes are portable and can be consumed with insignificant health risk.

We recommend H36-0030 and H36-0032 as production boreholes. H36-0033 must be used as a back up to H36-0032; they should not be pumped simultaneously. These boreholes are very close to each other (see Figure 1).

If additional water is required for the community, H36-0036 can be rehabilitated and developed to serve the needs of the community.

Duncan F Munyai (Hydrogeologist)

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ATTACHMENTS

ATTACHMENT 1

HYDROCENSUS

H36-0030

H36-0031

H36-0032

H36-0033

H36-0034

H36-0035

H36-0036

Hydocensus at Ntwane/ Elandsdoorn

BH_N	Village	Latitude	Longitude	Old_Number	New_Number	Blow_Yield	Depth	Status
BH_1	Elandsdoom	-25.29840	29.22960		H36-0030			Casing only_newly drilled BH
BH_2	Elandsdoom	-25.29228	29.22941	M01-0076	H36-0031	0.3 l/s	60 m	Casing in good condition
BH_3	Elandsdoom	-25.29171	29.22833	T419216	H36-0032			Only pumphead and no Engine
BH_4	Elandsdoom	-25.29192	29.22757	M01-0077	H36-0033	0.6 l/s	100 m	Casing only
BH_5	Elandsdoom	-25.29225	29.22829	T419215	H36-0034			Vandalised = open BH filled with materials
BH_6	Elandsdoom	-25.30032	29.23162		H36-0035			Vandalised = open BH filled with materials
BH_7	Elandsdoom	-25.30072	29.23186		H36-0036			Casing inside the cement cage = check photo

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ATTACHEMENT 2

TEST PUMPING RESULTS

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PROJECT		ELANDSDOORN			DATE			25/05/2006		TIME STARTED		00h00
BOREHOLE No		H36-0030 ✓			AVAIL. DRAWDOWN			22.03 m		JOB NO		WH06105
BOREHOLE DEPTH		37.67 m			PUMP DEPTH			34.5 m		LAT		-25.2984
STATIC WATER LEVEL		12.47 m			PUMP TYPE			1302		LONG		29.2296
		STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	T/T'	RECOVERY	CD	T/T'	RECOVERY
AVERAGE YIELD (l/s)		0.50	1.08	2.77	5.00				2.31	3.57		3.57
TIME(hrs)	TIME(min)									380		
-1	0.50	-0.22	-0.88	-1.95	-5.72			481.00	-8.49	-3.10	2881.00	-7.27
	1.00	-0.24	-0.93	-2.41	-6.55			241.00	-5.27	-3.98	1441.00	-5.21
	1.50	-0.26	-0.96	-2.62	-7.29			161.00	-3.64	-4.65	961.00	-4.09
	2.00	-0.27	-0.99	-2.75	-7.76			121.00	-2.75	-5.16	721.00	-3.51
	2.50	-0.28	-1.01	-2.86	-8.20			97.00	-2.21	-5.44	577.00	-3.17
	3.00	-0.29	-1.04	-2.94	-8.57			81.00	-1.94	-5.74	481.00	-3.01
	4.00	-0.32	-1.10	-3.07	-9.02			61.00	-1.78	-6.24	361.00	-2.86
	5.00	-0.33	-1.12	-3.38	-9.33			49.00	-1.65	-6.55	289.00	-2.79
	6.00	-0.34	-1.12	-3.66	-9.47			41.00	-1.58	-6.76	241.00	-2.74
	7.00	-0.35	-1.12	-3.87	-9.63			35.29	-1.52	-6.90	206.71	-2.74
	8.00	-0.36	-1.13	-3.99	-9.76			31.00	-1.48	-7.02	181.00	-2.70
	9.00	-0.37	-1.13	-4.08	-9.92			27.67	-1.43	-7.12	161.00	-2.66
	10.00	-0.38	-1.13	-4.13	-10.07			25.00	-1.41	-7.20	145.00	-2.63
	12.00	-0.39	-1.13	-4.23	-10.34			21.00	-1.33	-7.36	121.00	-2.60
	15.00	-0.40	-1.15	-4.34	-10.59			17.00	-1.23	-7.50	97.00	-2.56
	20.00	-0.43	-1.17	-4.47	-10.85			13.00	-1.11	-7.69	73.00	-2.50
	25.00	-0.45	-1.19	-4.55	-11.10			10.60	-1.05	-7.80	58.60	-2.40
0.5	30.00	-0.45	-1.21	-4.65	-11.38			9.00	-0.97	-7.95	49.00	-2.33
	35.00	-0.46	-1.22	-4.66	-11.90			7.86	-0.88	-8.06	42.14	-2.26
	40.00	-0.48	-1.23	-4.73	-12.37			7.00	-0.86	-8.10	37.00	-2.22
	50.00	-0.49	-1.27	-4.82	-12.97			5.80	-0.78	-8.22	29.80	-2.12
1	60.00	-0.50	-1.28	-4.89	-13.40			5.00	-0.71	-8.38	25.00	-2.05
	70.00							4.43	-0.67	-8.52	21.57	-1.99
	80.00							4.00	-0.60	-8.57	19.00	-1.94
1.5	90.00							3.67	-0.57	-8.70	17.00	-1.84
	100.00							3.40	-0.54	-8.80	15.40	-1.81
2	120.00							3.00	-0.50	-8.94	13.00	-1.75
	140.00							2.71	-0.47	-9.12	11.29	-1.72
	160.00							2.50	-0.45	-9.20	10.00	-1.66
3	180.00							2.33	-0.41	-9.28	9.00	-1.55
	210.00							2.14	-0.38	-9.38	7.86	-1.43
4	240.00							2.00	-0.35	-9.49	7.00	-1.34
	270.00									-9.59	6.33	-1.32
5	300.00									-9.68	5.80	-1.20
	330.00									-9.75	5.36	-1.22
6	360.00									-9.80	5.00	-1.15
7	420.00									-9.90	4.43	-1.03
8	480.00									-10.00	4.00	-0.96
9	540.00									-10.07	3.67	-0.90
10	600.00									-10.13	3.40	-0.84
11	660.00									-10.16	3.18	-0.78
12	720.00									-10.23	3.00	-0.72
13	780.00									-10.35	2.85	-0.69
14	840.00									-10.47	2.71	-0.65
15	900.00									-10.88	2.60	-0.61
16	960.00									-10.79	2.50	-0.54
18	1080.00									-10.87	2.33	-0.50
20	1200.00									-10.50	2.20	-0.46
22	1320.00									-10.68	2.09	-0.41
24	1440.00									-10.75	2.00	-0.35

EXISTING EQUIPMENT

MOTOR :
PUMP :
CONDITION :

COLUMN SIZE :
No OF COLUMNS :

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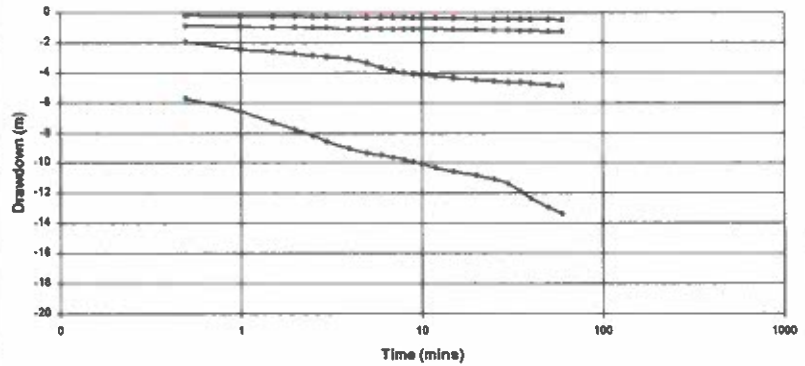
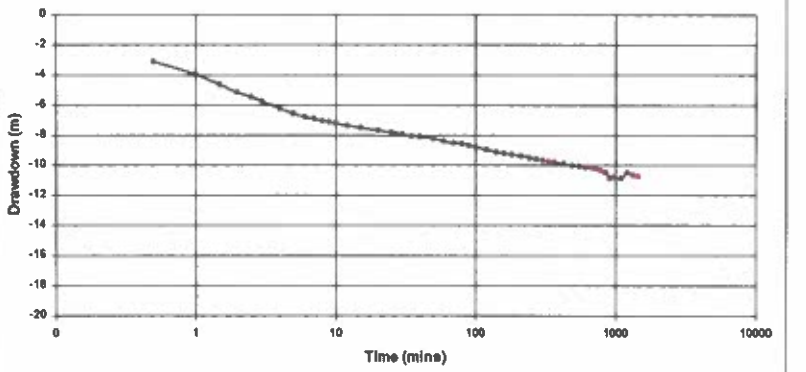
ELANDSDOORN

BOREHOLE NO : H36-0030

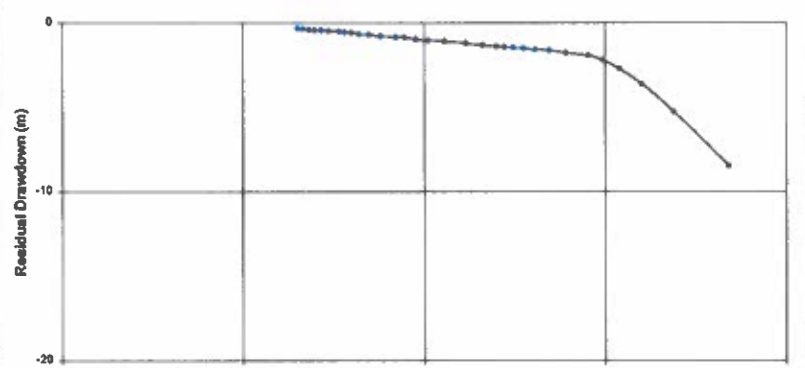
STEP TEST



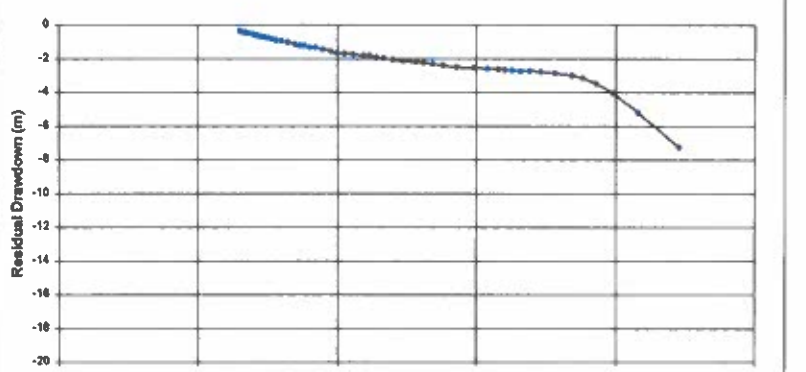
CONSTANT DISCHARGE TEST



RECOVERY STEP TEST



RECOVERY CONSTANT DISCHARGE TEST



INTERPRETATION

BOREHOLE DATA		RECOMMENDATIONS					GENERAL COMMENTS		HYDRAULIC PARAMETERS			EXISTING PUMPING EQUIPMENT
DEPTH :	37.67 m	PUMPING RATE	gal/hr	m3/hr	l/s	hrs/day	GEOLOGY :	NEBO GRANITE	T (STEP 1) :	39.53	m3/day/m	MOTOR :
S W L :	12.47 m	MAXIMUM :	2101.32	9.54	2.65	8	AQUIFER TYPE :	FRACTURED	T (RECOVERY STEP1) :	36.51	m3/day/m	PUMP :
STRIKE :	m	RECOMMENDED :	840.53	3.82	1.06	20	DRILL TARGET :	UNKNOWN	T (CONSTANT DISCHARGE) :	29.23	m3/day/m	COLUMN SIZE :
TEST PUMP TYPE :	1302	MAX ABSTRACTION PER DAY :				76 m3/day	RECOVERY :	97 %	T (RECOVERY CONSTANT DISCHARGE) :	29.23	m3/day/m	No of COLUMNS:
PUMP DEPTH :	34.5 m	PUMP SETTING (m) :				26	WATER QUALITY :	CLASS II	STORAGE COEFFICIENT :	N/A		OUTLET SIZE :
DATE TESTED :	26/05/2008	PERMISSIBLE DRAWDOWN (m) :				22	PROBLEM SPECIES :	TOTAL HARDNESS	SPECIFIC CAPACITY (after 2 hrs pumping) :	0.40	l/s per m	CONDITION :

WSM LESHIKA

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PROJECT		ELANDSDOORN			DATE			25/05/2006		TIME STARTED		00h00
BOREHOLE No		H36-0031			AVAIL. DRAWDOWN			34.65 m		JOB NO		WH06105
BOREHOLE DEPTH		58.8 m			PUMP DEPTH			55.5 m		LAT		-25.29228
STATIC WATER LEVEL		20.85 m			PUMP TYPE					LONG		29.22941
		STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	T/T'	RECOVERY	CD	T/T'	RECOVERY
AVERAGE YIELD (l/s)		0.70	1.60	2.07					1.08	1.33		1.33
TIME(hrs)	TIME(min)									2131		
-1	0.50	-0.92	-2.62	-19.59				257.00	-28.46	-2.07	2881.00	-11.20
	1.00	-1.20	-3.27	-21.46				129.00	-25.39	-2.88	1441.00	-7.23
	1.50	-1.35	-3.64	-23.00				86.33	-21.42	-3.34	961.00	-5.05
	2.00	-1.43	-3.91	-24.55				65.00	-18.75	-3.45	721.00	-3.12
	2.50	-1.54	-4.10	-26.29				52.20	-15.68	-3.81	577.00	-1.85
	3.00	-1.57	-4.28	-27.17				43.67	-12.77	-3.94	481.00	-1.15
	4.00	-1.61	-4.54	-28.41				33.00	-7.67	-4.15	361.00	-0.45
	5.00	-1.63	-4.65	-29.64				26.60	-3.91	-4.33	289.00	-0.32
	6.00	-1.64	-4.96	-30.82				22.33	-1.90	-4.42	241.00	-0.32
	7.00	-1.66	-5.38	-31.77				19.29	-1.07	-4.48	206.71	-0.32
	8.00	-1.69	-5.67	-33.18				17.00	-0.62	-4.50	181.00	-0.32
	9.00	-1.73	-5.83					15.22	-0.40	-4.52	161.00	-0.45
	10.00	-1.75	-5.94					13.80	-0.32	-4.53	145.00	-0.45
	12.00	-1.75	-7.19					11.67	-0.26	-4.55	121.00	-0.58
	15.00	-1.75	-8.10					9.53	-0.22	-4.25	97.00	-0.59
	20.00	-1.77	-9.98					7.40	-0.20	-4.25	73.00	-0.58
	25.00	-1.77	-11.64					6.12	-0.19	-4.27	58.60	-0.57
0.5	30.00	-1.79	-13.59					5.27	-0.17	-4.27	49.00	-0.55
	35.00	-1.82	-14.87					4.66	-0.16	-4.35	42.14	-0.55
	40.00	-1.82	-15.26					4.20	-0.16	-4.41	37.00	-0.53
	50.00	-1.84	-15.57					3.56	-0.15	-4.49	29.80	-0.52
1	60.00	-1.84	-16.66					3.13	-0.14	-4.53	25.00	-0.50
	70.00							2.83	-0.13	-4.56	21.57	-0.48
	80.00							2.60	-0.12	-4.59	19.00	-0.47
1.5	90.00							2.42	-0.11	-4.59	17.00	-0.46
	100.00							2.28	-0.09	-4.62	15.40	-0.46
2	120.00							2.07	-0.07	-4.66	13.00	-0.45
	140.00							1.91	-0.05	-4.71	11.29	-0.43
	160.00							1.80	-0.04	-4.76	10.00	-0.40
3	180.00							1.71	-0.03	-4.86	9.00	-0.40
	210.00							1.61	-0.03	-4.86	7.86	-0.39
4	240.00							1.53	-0.02	-4.87	7.00	-0.38
	270.00							1.47	-0.02	-4.88	6.33	-0.36
5	300.00									-4.91	5.80	-0.36
	330.00									-4.98	5.36	-0.34
6	360.00									-5.07	5.00	-0.33
7	420.00									-5.07	4.43	-0.32
8	480.00									-5.10	4.00	-0.32
9	540.00									-5.13	3.67	-0.31
10	600.00									-5.31	3.40	-0.30
11	660.00									-5.84	3.18	-0.29
12	720.00									-6.17	3.00	-0.28
13	780.00									-6.58	2.85	-0.27
14	840.00									-6.91	2.71	-0.26
15	900.00									-7.34	2.60	-0.26
16	960.00									-8.80	2.50	-0.25
18	1080.00									-10.07	2.33	-0.25
20	1200.00									-12.77	2.20	-0.24
22	1320.00									-13.86	2.09	-0.24
24	1440.00									-14.90	2.00	-0.22

EXISTING EQUIPMENT

MOTOR :
PUMP :
CONDITION :

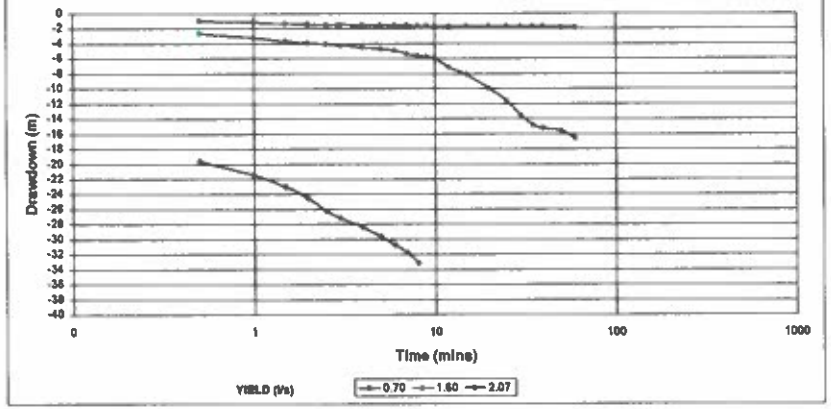
COLUMN SIZE :
No OF COLUMNS :

WSM LESHIKA CONSULTING (Pty) Ltd

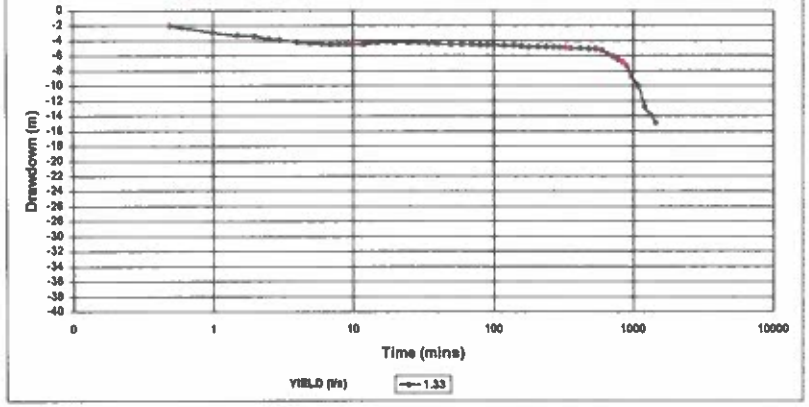
ELANDSDOORN

BOREHOLE NO : H38-0031

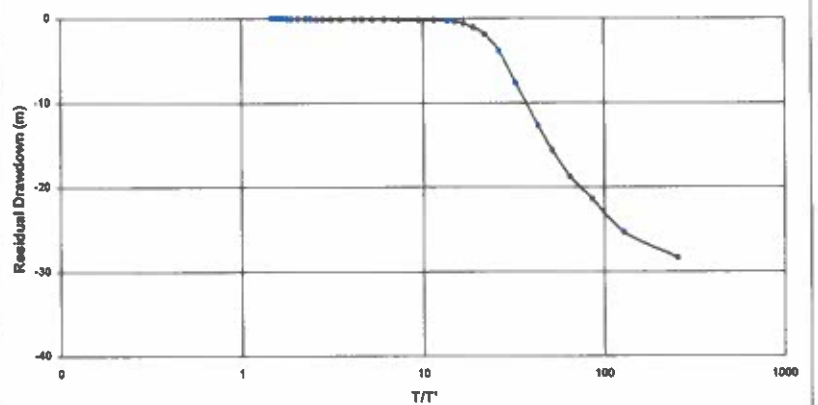
STEP TEST



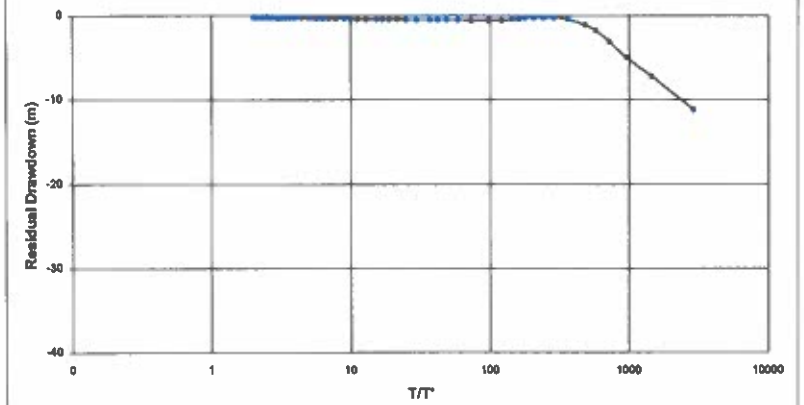
CONSTANT DISCHARGE TEST



RECOVERY STEP TEST



RECOVERY CONSTANT DISCHARGE TEST



BOREHOLE DATA		RECOMMENDATIONS					INTERPRETATION: GENERAL COMMENTS		HYDRAULIC PARAMETERS			EXISTING PUMPING EQUIPMENT
DEPTH :	56.6 m	PUMPING RATE	gal/hr	m3/hr	l/s	hrs/day	GEOLOGY :	NEBO GRANITE	T (STEP 1) :	18.45	m3/day/m	MOTOR :
S W L :	20.85 m	MAXIMUM :	911.89	4.14	1.15	8	AQUIFER TYPE :	FRACTURED	T (RECOVERY STEPS) :	34.13	m3/day/m	PUMP :
STRIKE :	m	RECOMMENDED :	364.76	1.66	0.46	20	DRILL TARGET :	UNKNOWN	T (CONSTANT DISCHARGE) :	9.14	m3/day/m	COLUMN SIZE :
TEST PUMP TYPE :	0	MAX ABSTRACTION PER DAY :				33 m3/day	RECOVERY :	99 %	T (RECOVERY CONSTANT DISCHARGE) :	210.32	m3/day/m	No of COLUMNS:
PUMP DEPTH :	55.5 m	PUMP SETTING (m) :				40	WATER QUALITY :	CLASS II	STORAGE COEFFICIENT :	N/A		OUTLET SIZE :
DATE TESTED :	25/05/2006	PERMISSIBLE DRAWDOWN (m) :				35	PROBLEM SPECIES :	TOTAL HARDNESS	SPECIFIC CAPACITY (after 2 hrs pumping) :	0.29	l/s per m	CONDITION :

WSM LESHIKA (Pty) Ltd

B3024 25209 AC

PROJECT		ELANDSDOORN ✓			DATE			27/05/2006		TIME STARTED		00h00
BOREHOLE No		H36-0032			AVAIL. DRAWDOWN			12.15 m		JOB NO		WH06105
BOREHOLE DEPTH		35.9 m			PUMP DEPTH			31.5 m		LAT		-25.29171
STATIC WATER LEVEL		19.35 m			PUMP TYPE					LONG		29.22833
		STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	T/T'	RECOVERY	CD	T/T'	RECOVERY
AVERAGE YIELD (l/s)		0.90	2.40	4.00	8.60	12.00			7.04	6.66 0931		6.66
TIME(hrs)	TIME(min)											
-1	0.50	-0.25	-0.87	-2.11	-3.52	-8.21		493.00	-2.64	-1.27	2881.00	-3.08
	1.00	-0.25	-0.95	-2.24	-3.52	-8.99		247.00	-1.83	-1.40	1441.00	-2.40
	1.50	-0.25	-0.97	-2.32	-3.61	-9.61		165.00	-1.66	-1.48	961.00	-2.16
	2.00	-0.31	-0.99	-2.38	-3.65	-10.06		124.00	-1.51	-1.57	721.00	-2.05
	2.50	-0.35	-1.01	-2.42	-3.69	-10.35		99.40	-1.41	-1.60	577.00	-1.99
	3.00	-0.36	-1.04	-2.43	-3.73	-10.63		83.00	-1.32	-1.74	481.00	-1.94
	4.00	-0.38	-1.09	-2.47	-3.79	-10.94		62.50	-1.20	-1.94	361.00	-1.90
	5.00	-0.40	-1.16	-2.50	-4.18	-11.68		50.20	-1.11	-2.20	289.00	-1.88
	6.00	-0.41	-1.27	-2.52	-4.60	-11.99		42.00	-1.03	-2.81	241.00	-1.87
	7.00	-0.42	-1.30	-2.54	-4.60			36.14	-0.97	-3.22	206.71	-1.86
	8.00	-0.43	-1.31	-2.56	-5.11			31.75	-0.93	-3.40	181.00	-1.84
	9.00	-0.44	-1.31	-2.60	-5.45			28.33	-0.88	-3.47	161.00	-1.82
	10.00	-0.45	-1.32	-2.60	-5.57			25.60	-0.83	-3.53	145.00	-1.8
	12.00	-0.49	-1.34	-2.63	-5.72			21.50	-0.78	-3.60	121.00	-1.77
	15.00	-0.50	-1.36	-2.65	-5.73			17.40	-0.70	-3.76	97.00	-1.71
	20.00	-0.52	-1.37	-2.66	-5.92			13.30	-0.64	-3.89	73.00	-1.67
	25.00	-0.53	-1.38	-2.69	-6.10			10.84	-0.56	-3.92	58.60	-1.57
0.5	30.00	-0.54	-1.55	-2.72	-6.20			9.20	-0.54	-3.95	49.00	-1.48
	35.00	-0.54	-1.57	-2.75	-6.28			8.03	-0.53	-3.99	42.14	-1.45
	40.00	-0.54	-1.59	-2.77	-6.42			7.15	-0.50	-4.04	37.00	-1.42
	50.00	-0.55	-1.64	-2.81	-6.49			5.92	-0.48	-4.09	29.80	-1.34
1	60.00	-0.56	-1.68	-2.85	-6.55			5.10	-0.42	-4.14	25.00	-1.27
	70.00							4.51	-0.39	-4.18	21.57	-1.24
	80.00							4.08	-0.37	-4.20	19.00	-1.21
1.5	90.00							3.73	-0.35	-4.25	17.00	-1.15
	100.00							3.46	-0.33	-4.27	15.40	-1.12
2	120.00							3.05	-0.30	-4.33	13.00	-1.05
	140.00							2.76	-0.27	-4.40	11.29	-1.01
	160.00							2.54	-0.22	-4.45	10.00	-0.97
3	180.00							2.37	-0.19	-4.48	9.00	-0.94
	210.00							2.17	-0.17	-4.55	7.86	-0.91
4	240.00							2.03	-0.15	-4.60	7.00	-0.83
	270.00							1.91	-0.13	-4.67	6.33	-0.79
5	300.00									-4.73	5.80	-0.75
	330.00									-4.78	5.36	-0.73
6	360.00									-4.78	5.00	-0.70
7	420.00									-4.87	4.43	-0.67
8	480.00									-4.98	4.00	-0.62
9	540.00									-5.01	3.67	-0.57
10	600.00									-5.05	3.40	-0.53
11	660.00									-5.10	3.18	-0.48
12	720.00									-5.17	3.00	-0.43
13	780.00									-5.21	2.85	-0.41
14	840.00									-5.26	2.71	-0.39
15	900.00									-5.30	2.60	-0.37
16	960.00									-5.36	2.50	-0.35
18	1080.00									-5.47	2.33	-0.33
20	1200.00									-5.47	2.20	-0.31
22	1320.00									-5.51	2.09	-0.29
24	1440.00									-5.51	2.00	-0.27

EXISTING EQUIPMENT

MOTOR :
PUMP :
CONDITION :

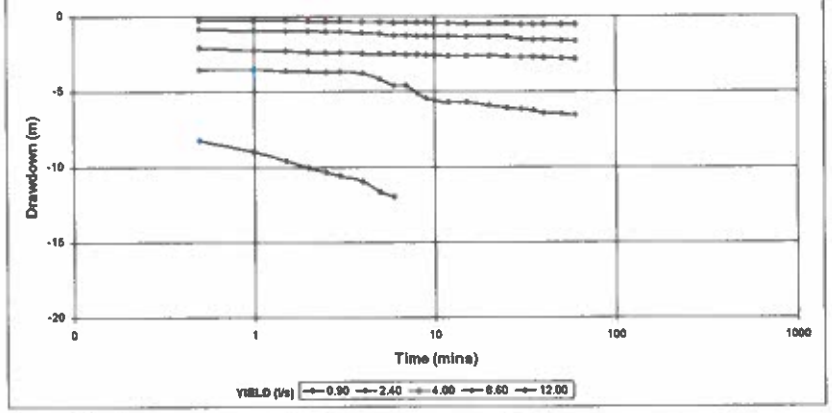
COLUMN SIZE :
No OF COLUMNS :

WSM LESHIKA CONSULTING (Pty) Ltd

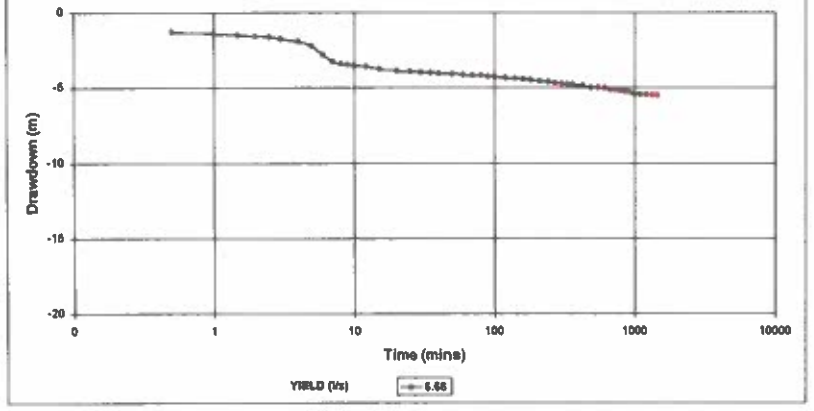
ELANDSDOORN

BOREHOLE NO : H36-0032

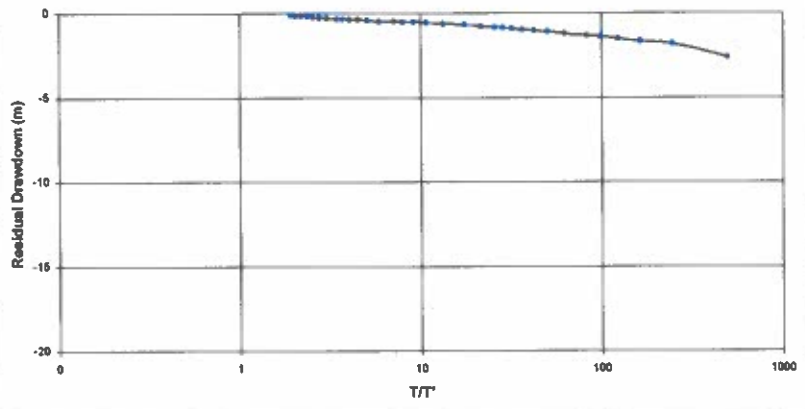
STEP TEST



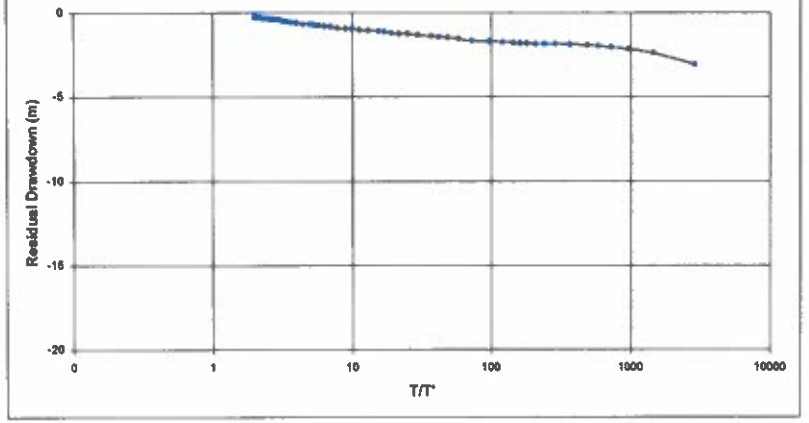
CONSTANT DISCHARGE TEST



RECOVERY STEP TEST



RECOVERY CONSTANT DISCHARGE TEST



BOREHOLE DATA			RECOMMENDATIONS					INTERPRETATION						EXISTING PUMPING EQUIPMENT
								GENERAL COMMENTS		HYDRAULIC PARAMETERS				
DEPTH :	36.9	m	PUMPING RATE	gal/hr	m3/hr	l/s	hrs/day	GEOLOGY :	NEBO GRANITE	T (STEP 1) :	71.16	m3/day/m	MOTOR :	
S W L :	19.36	m	MAXIMUM :	5947.14	27.00	7.50	8	AQUIFER TYPE :	FRACTURED	T (RECOVERY STEPS) :	139.10	m3/day/m	PUMP :	
STRIKE :		m	RECOMMENDED :	2378.85	10.80	3.00	20	DRILL TARGET :	UNKNOWN	T (CONSTANT DISCHARGE) :	87.77	m3/day/m	COLUMN SIZE :	
TEST PUMP TYPE :	0		MAX ABSTRACTION PER DAY :				216 m3/day	RECOVERY :	98 %	T (RECOVERY CONSTANT DISCHARGE) :	105.32	m3/day/m	No of COLUMNS:	
PUMP DEPTH :	31.5	m	PUMP SETTING (m) :				25	WATER QUALITY :	CLASS II	STORAGE COEFFICIENT :	N/A		OUTLET SIZE :	
DATE TESTED :	27/06/2006		PERMISSIBLE DRAWDOWN (m) :				12	PROBLEM SPECIES :	TOTAL HARDNESS	SPECIFIC CAPACITY (after 2 hrs pumping) :	1.54	l/s per m	CONDITION :	

WSM LESHIKA (Pty) Ltd

B32H 2529AC

PROJECT		ELANDSDOORN			DATE			27/05/2006		TIME STARTED		00h00
BOREHOLE No		H36-0033			AVAIL. DRAWDOWN			55.03 m		JOB NO		WH06105
BOREHOLE DEPTH		99.54 m			PUMP DEPTH			73.5 m		LAT		-25.29192
STATIC WATER LEVEL		18.47 m			PUMP TYPE			11.05		LONG		29.22757
		STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	T/T'	RECOVERY	CD	T/T'	RECOVERY
AVERAGE YIELD (l/s)		0.62	1.71	3.52	5.45				2.79	5.00		5.00
TIME(hrs)	TIME(min)									0801		
-1	0.50	-0.29	-1.09	-1.96	-5.46			481.00	-7.53	-2.84	2881.00	-3.53
	1.00	-0.39	-1.30	-2.47	-6.04			241.00	-4.49	-4.10	1441.00	-3.52
	1.50	-0.43	-1.45	-3.07	-6.72			161.00	-2.23	-5.11	961.00	-1.25
	2.00	-0.45	-1.51	-3.55	-7.27			121.00	-1.88	-5.62	721.00	-1.29
	2.50	-0.46	-1.54	-3.83	-7.53			97.00	-1.05	-6.00	577.00	-0.89
	3.00	-0.47	-1.57	-4.04	-7.88			81.00	-0.84	-6.45	481.00	-0.57
	4.00	-0.54	-1.60	-4.24	-8.28			61.00	-0.66	-6.72	361.00	-0.40
	5.00	-0.56	-1.57	-4.35	-8.31			49.00	-0.58	-7.10	289.00	-0.62
	6.00	-0.56	-1.64	-4.45	-9.15			41.00	-0.53	-7.40	241.00	-0.30
	7.00	-0.57	-1.65	-4.50	-9.47			35.29	-0.51	-7.50	206.71	-0.89
	8.00	-0.57	-1.66	-4.45	-9.69			31.00	-0.48	-7.63	181.00	-0.86
	9.00	-0.58	-1.67	-4.50	-9.90			27.67	-0.46	-7.80	161.00	-0.33
	10.00	-0.59	-1.67	-4.61	-10.07			25.00	-0.45	-7.90	145.00	-0.31
	12.00	-0.60	-1.70	-4.68	-10.30			21.00	-0.43	-7.99	121.00	-0.28
	15.00	-0.60	-1.72	-4.82	-10.55			17.00	-0.43	-8.12	97.00	-0.96
	20.00	-0.61	-1.75	-5.02	-10.77			13.00	-0.40	-8.38	73.00	-0.92
	25.00	-0.62	-1.76	-5.08	-10.95			10.60	-0.38	-8.46	58.60	-0.90
0.5	30.00	-0.63	-1.77	-5.11	-11.07			9.00	-0.35	-8.56	49.00	-0.88
	35.00	-0.63	-1.78	-5.14	-11.46			7.86	-0.35	-8.65	42.14	-0.85
	40.00	-0.64	-1.79	-5.16	-11.64			7.00	-0.32	-8.76	37.00	-0.83
	50.00	-0.64	-1.81	-5.22	-12.29			5.80	-0.30	-8.89	29.80	-0.80
1	60.00	-0.65	-1.82	-5.26	-12.41			5.00	-0.28	-8.97	25.00	-0.77
	70.00							4.43	-0.27	-9.13	21.57	-0.74
	80.00							4.00	-0.25	-9.89	19.00	-0.72
1.5	90.00							3.67	-0.24	-10.46	17.00	-0.70
	100.00							3.40	-0.23	-10.64	15.40	-0.67
2	120.00							3.00	-0.22	-10.64	13.00	-0.65
	140.00							2.71	-0.20	-10.78	11.29	-0.62
	160.00							2.50	-0.18	-11.16	10.00	-0.60
3	180.00							2.33	-0.18	-11.50	9.00	-0.58
	210.00							2.14	-0.17	-12.04	7.86	-0.55
4	240.00							2.00	-0.16	-12.82	7.00	-0.53
	270.00									-13.60	6.33	-0.48
5	300.00									-14.89	5.80	-0.40
	330.00									-16.10	5.36	-0.44
6	360.00									-17.19	5.00	-0.42
7	420.00									-20.94	4.43	-0.37
8	480.00									-23.96	4.00	-0.36
9	540.00									-25.60	3.67	-0.34
10	600.00									-27.50	3.40	-0.31
11	660.00									-30.72	3.18	-0.29
12	720.00									-33.41	3.00	-0.27
13	780.00									-35.98	2.85	-0.25
14	840.00									-38.15	2.71	-0.22
15	900.00									-41.36	2.60	-0.20
16	960.00									-44.41	2.50	-0.18
18	1080.00									-46.68	2.33	-0.16
20	1200.00									-48.77	2.20	-0.14
22	1320.00									-50.57	2.09	-0.12
24	1440.00									-52.65	2.00	-0.09

EXISTING EQUIPMENT

MOTOR :
PUMP :
CONDITION :

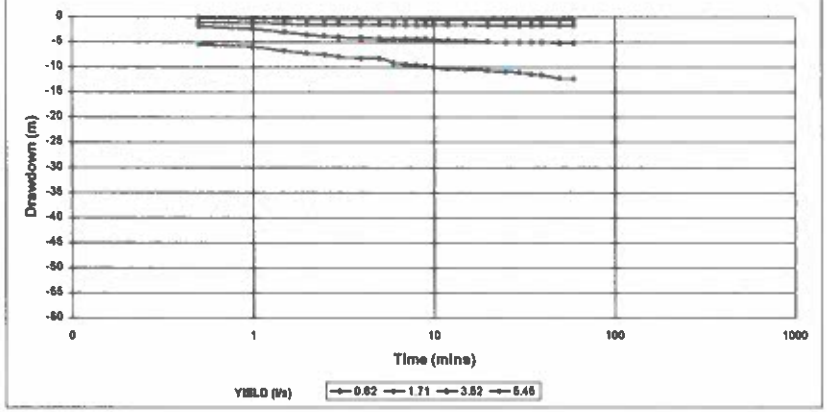
COLUMN SIZE :
No OF COLUMNS :

WSM LESHIKA CONSULTING (Pty) Ltd

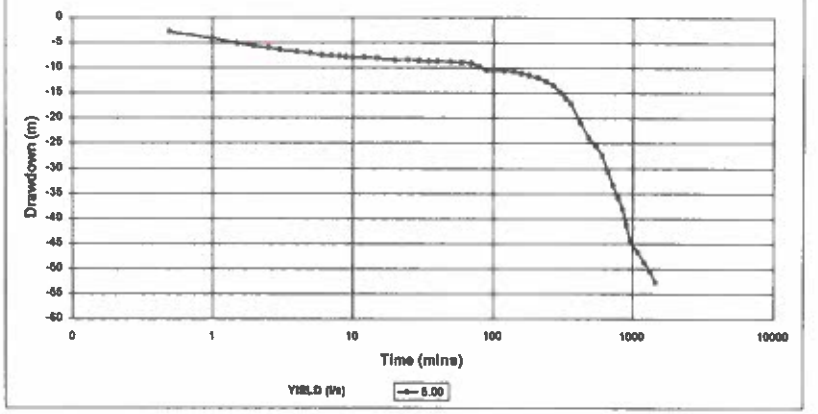
ELANDSDOORN

BOREHOLE NO : H36-0033

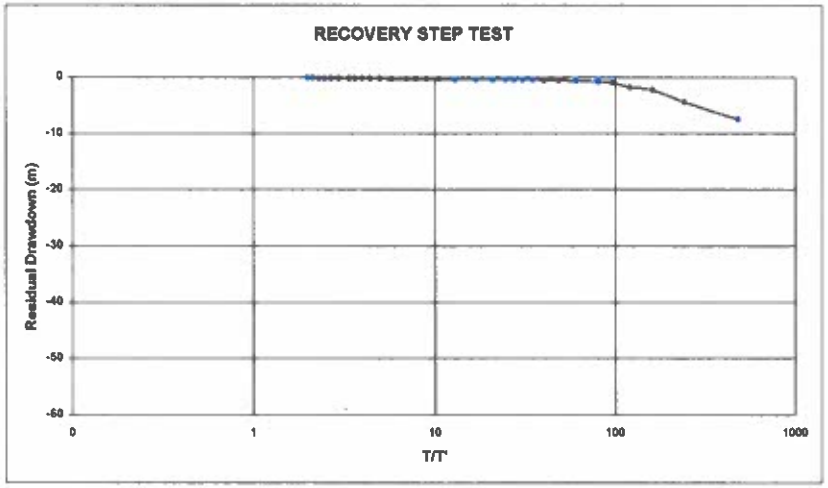
STEP TEST



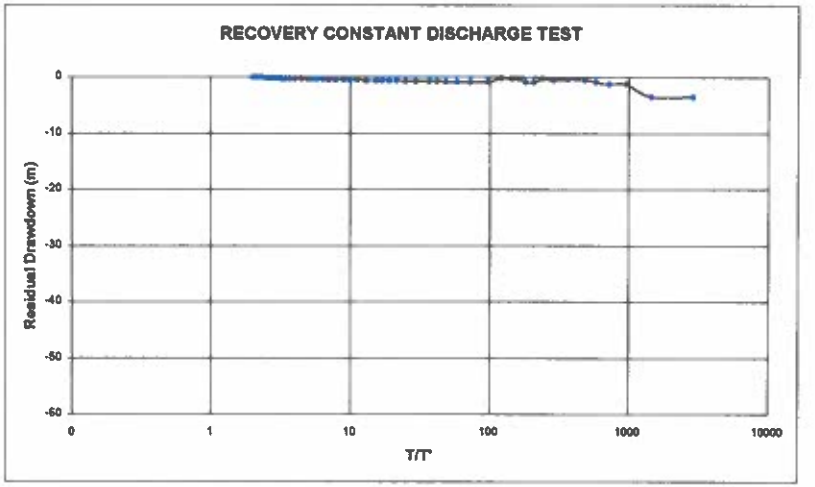
CONSTANT DISCHARGE TEST



RECOVERY STEP TEST



RECOVERY CONSTANT DISCHARGE TEST



BOREHOLE DATA			RECOMMENDATIONS					INTERPRETATION: GENERAL COMMENTS			HYDRAULIC PARAMETERS			EXISTING PUMPING EQUIPMENT	
DEPTH :	99.54	m	PUMPING RATE	gal/hr	m3/hr	l/s	hrs/day	GEOLOGY :	NEBO GRANITE		T (STEP 1) :	19.61	m3/day/m	MOTOR :	
S W L :	19.47	m	MAXIMUM :	2973.67	13.50	3.75	8	AQUIFER TYPE :	FRACTURED		T (RECOVERY STEPS) :	49.02	m3/day/m	PUMP :	
STRIKE :		m	RECOMMENDED :	1189.43	5.40	1.50	20	DRILL TARGET :	UNKNOWN		T (CONSTANT DISCHARGE) :	15.81	m3/day/m	COLUMN SIZE :	
TEST PUMP TYPE :	11.05		MAX ABSTRACTION PER DAY :				108	m3/day	RECOVERY :	100	% T (RECOVERY CONSTANT DISCHARGE) :	158.14	m3/day/m	No of COLUMNS:	
PUMP DEPTH :	73.5	m	PUMP SETTING (m) :				50		WATER QUALITY :	CLASS II	STORAGE COEFFICIENT :	N/A		OUTLET SIZE :	
DATE TESTED :	27/05/2006		PERMISSIBLE DRAWDOWN (m) :				58		PROBLEM SPECIES :	TOTAL HARDNESS	SPECIFIC CAPACITY (after 2 hrs pumping) :	0.47	l/s per m	CONDITION :	

WSM LESHIKA