Technical Report Gh3717

HYDROCENSUS IN THE GRAAFWATER SUBTERRANEAN GOVERNMENT WATER CONTROL AREA

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1. INTRODUCTION

In addition to the current exploration drilling project in the Graafwater - Lambertsbaai area, a hydrocensus was carried out during the periods of 18-28 September and 15-17 October 1990. The census was focussed on the private groundwater development within the Graafwater Subterranean Government Water Control Area (GSGWCA) (Figure 1). The four main objectives were to collect data on: the present irrigation development, depth to the bedrock, groundwater levels and water quality.

2. BACKGROUND INFORMATION

Data from previous investigations were used where information was not obtainable in the field or was incomplete. The following reports were incorporated into the hydrocensus:

- Verslag oor die grondwaterpotensiaal van die area om Lambertsbaai (Schreuder, 1979).
- Report on a geophysical and geohydrological investigation of the groundwater potential between Lambert's Bay and Graafwater and the coastal region between Lambert's Bay and Elands Bay (Meyer et al. 1983).
- Possibilities for the development of a groundwater supply from a primary aquifer northwest of Graafwater (Timmerman, 1986).

Data from Directorate Geohydrology files and the presently unfinished exploration project in the Lambert's Bay - Graafwater area were also incorporated.

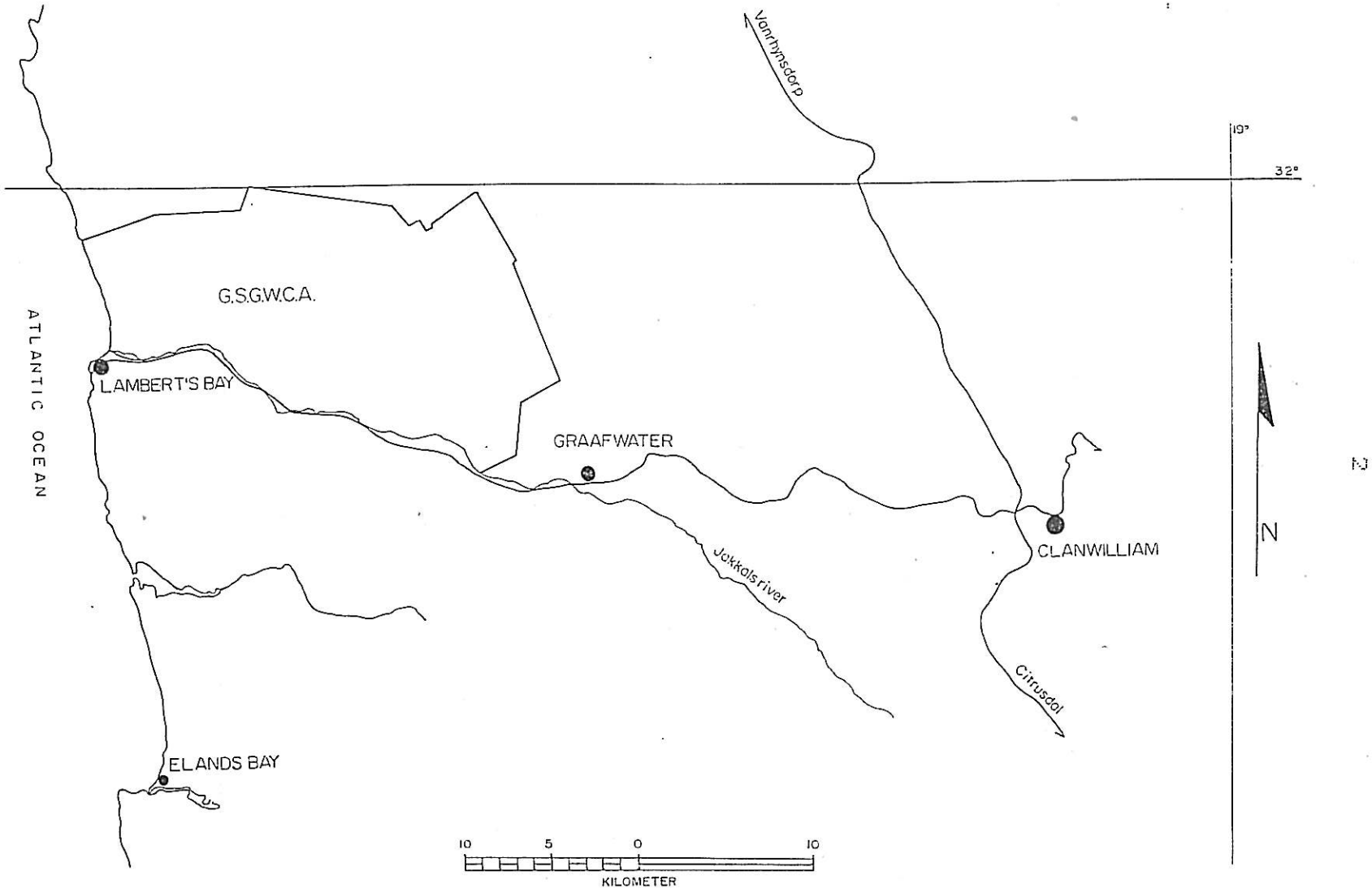

Figure 1: Location

3. CLIMATE and TOPOGRAPHY

The average annual rainfall for the area is between 200 and 300 mm and it occurs mainly during the months May to August. The Jakkals river flows only during periods of prolonged high rainfall during the winter months. The topography generally slopes towards the Jakkals river and the Atlantic ocean, with the highest point in the north-eastern part of the GSGWCA.

4. HYDROCENSUS

The hydrocensus was carried out on the 10 cadastral farms, or parts thereof, that form the GSGWCA, with the Jakkals river as the southern boundary of the control area. Although the survey intended to collect information about the private boreholes, the government(G) boreholes were also included. A total of 73 private groundwater points (boreholes, wells and fountains) and 40 G-boreholes were noted. (Figure 2).

4.1. PRIVATE GROUNDWATER SOURCES

The private groundwater sources include; 52 boreholes , 10 wells and 11 fountains, mainly used for domestic and stockwatering purposes. The yields of the boreholes range between 0.1l/s and

3.9l/s, except for borehole KN20 which yields 12.1l/s. Borehole KN20 is drilled into Table Mountain Sandstone next to the Jakkals river. The fountains are generally very weak and yields are approximately 0.1l/s or less. (Appendix A). The boreholes are in a poor condition and it seems that the lack of proper development of the boreholes, shortens the life of the boreholes, e.g. caving in of sand walls.

4.2. G - BOREHOLES

A total of 40 government boreholes were drilled during previous projects and the present exploration project (Appendix B).

- Timmerman, June 1986, 6 boreholes (G33111 to G33116).
- CSIR, February 1983, 9 boreholes (G30989, G30990, G30994, G30995, G31002, G31007, G31016, G31261 and G31274).
- DWA files, Nortier experimental farm (local water supply), 2 boreholes (G31260 and G32997.)
- Jolly, 1989/1990, (G33720 - G33735, G33745 - G33749, G33920 and G33921) - This project is uncompleted, further boreholes will be drilled.

4.3. IRRIGATION

Irrigation only takes place on a very small scale with 5 boreholes used therefor. Borehole KN20 is used only for irrigation, while the other boreholes are used conjunctively for domestic and stockwatering purposes.

Table 1 shows estimates of average yearly groundwater abstraction, as supplied by the farmers.

Table 1 : Irrigation data

Borehole number	Pumping yield(l/s)	Abstraction (m^3/year)	Area under irrigation	Crops
KN7	0.6	3370	1	Potatoes
KN8*	1.5	8424		
KN20	4.5	25272	10	Potatoes, lucern
KN21	1.8	8087	1	Vegetables
GG32997	2.8	31450	5	Nursery, field plants

* Boreholes KN7 and KN8 are used simultaneously.

5. GEOLOGY and GEOHYDROLOGY

5.1. GEOLOGY

The area is covered by alluvial sands of Cenozoic age, underlain by sedimentary rocks of the Table Mountain Group. Along the course of the Jakkals river, outcrops of the Piekenierskloof Formation are well exposed. A fault zone is present in the Piekenierskloof Formation, along the Jakkals river on the farms Kookfontein 98 and Suurfontein 527. The higher ground in the northwest of the control area, on the farm Roodeklipheuvel 85, consist of rocks of the Graafwater and Peninsula Formations. On the Nortier experimental farm small outcrops of the Piekenierskloof Formation are exposed. Dune sands are present on the Nortier experimental farm and Suurfontein 527. (Figure 3). East of Lambert's Bay an intrusive pipe is situated and according to aeromagnetic surveys there is a possibility of another occurence of this feature to the north.

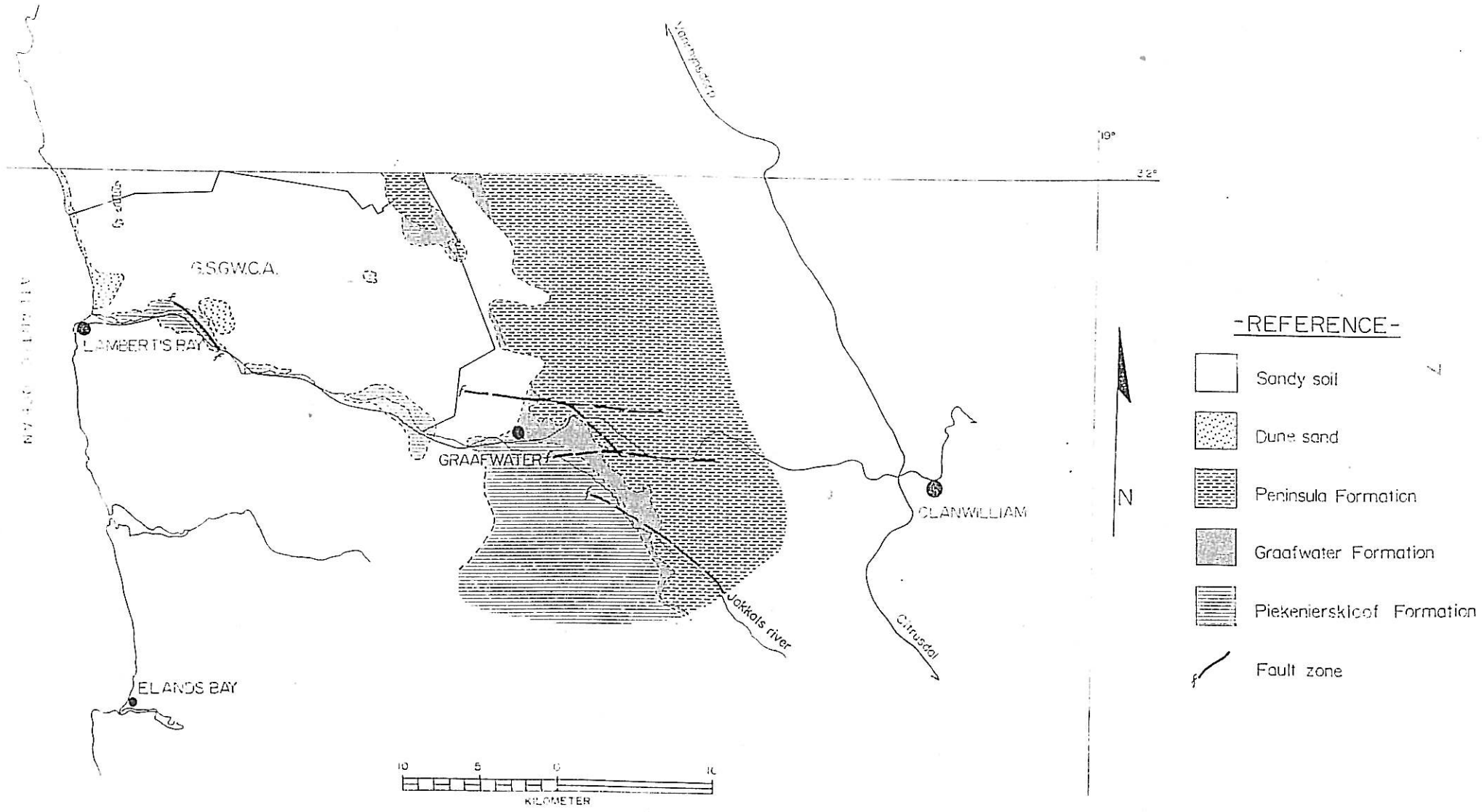

Figure 3: Geology

Isopachs of the bedrock (Figure 4) shows a definite paleo-valley with a east-west strike and an approximate depth of 130m at places. In the east the valley forms a sharp gradient, while towards the west the gradient becomes less and the valley wider. There is not enough information to determine if the isopachs should be closed at the eastern and western sides of the valley, or if there are in- and outlets to the paleo-valley.

5.2. WATER LEVELS

Water levels were measured in as many boreholes as possible and a water level contour map is provided which shows the contours in meters above mean sea level (m.a.m.s.l), (Figure 5). As there is not much abstraction taking place the groundwater levels measured are expected to be fairly accurate, i.e. represent static rather than pumping levels. A watershed is situated in the central part of the area. The groundwater south of the watershed flows towards the Jakkals river and north of the watershed the flow is in a westerly direction. The presence of the fountains along the northern bank of the Jakkals river is attributable to the natural flow of groundwater to the river and the outcrop of Piskeniersksloof sandstone acting as a barrier to flow. The fault zone along the Jakkals river near Lambert's Bay may also be the reason for the springs and the artesian boreholes in the area. As the flow of groundwater towards the Jakkals river occurs only as far as the farm Suurfontein 527 in the west it suggests that there is no deep exit of the paleo-valley towards the Atlantic ocean.

5.3. WATER QUALITY

The electrical conductivity of the groundwater (in mS/m) was measured where possible. Most of the water points were equipped with windpumps and therefore it was not always possible to get fresh samples if there was no wind. In these cases measurements were taken from the water in the reservoirs. The conductivity of the groundwater from the latest G-boreholes (1990), was not measured, but obtained from drilling records. It is often impossible to ascertain if groundwater samples originate from the sands or from the bedrock - the water quality map (Figure 6) is limited by this problem. The uncertainty arises from the fact that it is often difficult to define the horizon between the weathered bedrock and the Cenozoic sand deposits, especially from the private borehole information. It appears that groundwater with lower electrical conductivities coincides with areas of thick sediment deposits. Timmermàn (1986) reached the same conclusion.

6. CONCLUSION

The private borehole development is mostly restricted to windpumps in relatively shallow holes, used mainly for domestic and stock watering purposes. Only a total of 17ha are irrigated - mostly potatoes and experimental farming (Nortier experimental farm). The average yield for the private boreholes and the G-boreholes is approximately 0.8l/s. A wide east-west trending paleo-valley is situated across the control area, with unconsolidated sediments up to 130m deep. The main groundwater flow is towards the west along the paleo-valley, and south towards the Jakkals river, indicative of a water divide. The water quality deteriorates towards the higher ground in the north.

REFERENCES

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APPENDICES

KEY TO APPENDICES A AND B

COORDINATES

-(D,M,S) - Degrees, minutes, seconds

SITE TYPE

B - Borehole
D - Dugwell
F - Fountain

EQUIPMENT

W - Windpump
M - Monopump
G - Gravity suction
N - None/Open borehole
R - Automatic waterlevel recorder

APPLICATION

D - Domestic
G - Garden
S - Stock watering
I - Irrigation
DWA - Department of Water Affairs

ELEVATION

All the groundwater sources elevations were interpolated from the 1:50 000 topographical map, except boreholes 633112 - 633116, 633720A - 633722, 633725 - 633735 and 633745A - 633747 that were surveyed.

APPENDIX A : Private groundwater sources data.

Borehole number	Farm name	Coördinates Longitude (D,M,S)	Coördinates Latitude (D,M,S)	Site type	Depth (m)	Depth to bedrock	Water level below collar height	Collar height above ground level	Water level below ground level	Elevation (mamsl)	Water level (mamsl)	E.C. (mS/m)	Equipment	Yield (l/s)	Application/ remarks
CT1	Compagnies Drift 93	182529	320656	B	52	30	28.73	0.30	28.43	74.00	45.57	83	W	0.3	Stock watering
CT2	Compagnies Drift 93	182556	320657	B	24		1.72	0.30	1.42	72.00	70.58	75	N	0.6	Garden
CT3	Compagnies Drift 93	182637	320547	B	58	56	26.12	0.25	25.87	119.00	93.13	60	W	0.3	Stock watering
CT4F	Compagnies Drift 93	182557	320658	F					0.00		0.00	84	G	0.1	Garden
CT5	Compagnies Drift 93	182944	320632	B			10.31	0.40	9.91	152.00	142.09		W		Stock watering
CT6	Compagnies Drift 93	182750	320549	B			16.03	0.70	15.33	136.00	120.67	73	W		Stock watering
CT7	Compagnies Drift 93	182706	320534	D			6.95	0.50	6.45	127.00	120.55	200	W		Stock watering
HN1	Harde Vlakte Kliph. ext.	182258	320044	B	90				0.00		0.00	320	W		Stock watering
KN1	Kookfontein 88	182226	320456	D	7		6.30	0.00	6.30	40.00	33.70		W		Domestic
KN2F	Kookfontein 88	182224	320456	F					0.00		0.00	117	N		Domestic
KN3F	Kookfontein 88	182219	320455	F					0.00		0.00	85	W		Domestic
KN4F	Kookfontein 88	182219	320453	F					0.00		0.00	84	N		Domestic
KN5F	Kookfontein 88	182220	320452	F					0.00		0.00	-	N		Domestic
KN6	Kookfontein 88	182214	320450	B	110	30	6.56	0.30	6.26	58.00	51.74		N	0.9	Unused
KN7	Kookfontein 88	182345	320525	B	42	30	0.00	0.00	0.00	85.00	85.00		G		D,G,S,I
KN8	Kookfontein 88	182346	320525	B	35	34	0.00	0.00	0.00	85.00	85.00	78	G	2.3	D,G,S,I
KN9	Kookfontein 88	182326	320527	F	130	7	0.00	0.00	0.00	50.00	50.00	72	N	1.9	D,G,S,I
KN10F	Kookfontein 88	182317	320538	B					0.00		0.00		W	0.4	Domestic
KN11	Kookfontein 88	182433	320624	B	30		7.00	0.70	6.30	63.00	56.70	64	W		D,S
KN12	Kookfontein 87	182605	320234	B	30		21.36	0.60	20.76	154.00	133.24	145	W		Stock watering
KN13	Kookfontein 87	182414	320131	B			48.18	0.50	47.68	151.00	103.32	360	W		Stock watering
KN14	Kookfontein 88	182244	320219	B	123				0.00		0.00		N		Unused, (bees)
KN15	Kookfontein 88	182141	320503	B	82	0	0.00	0.00	0.00		0.00	498	N	0.4	Unused

Borehole number	Farm name	Coördinates Longitude (D,M,S)	Coördinates Latitude (D,M,S)	Site type	Depth (m)	Depth to bedrock	Water level below collar height	Collar height above ground level	Water level below ground level	Elevation (mamsl)	Water level (mamsl)	E.C. (mS/m)	Equipment	Yield (l/s)	Application/ remarks
KN16F	Kookfontein 88	182141	320502	F			1.15	0.00	1.15	20.00	18.85	142	N		Unused
KN17	Kookfontein 88	182140	320501	B	113	6	1.24	0.10	1.14	23.00	21.86	79	N	3.0	Unused
KN18	Kookfontein 88	182144	320500	B	46		3.33	0.10	3.23	26.00	22.77	118	N	0.3	Unused
KN19	Kookfontein 88	182138	320459	B	130	4	6.00	0.15	5.85	30.00	24.15	90	W	2.0	Domestic
KN20	Kookfontein 88	182147	320458	B	122	4			0.00		0.00	284	M	12.1	Irrigation
KN21	Kookfontein 88	182133	320501	B	110				0.00		0.00		M	3.5	D,S,I
KN22	Kookfontein 88	182206	320459	B	50	7			0.00		0.00		W	2.3	Domestic
KT1	Kompagniesdrift 95	182839	320613	B	20		11.13	0.40	10.73	144.00	133.27		N		Unused
KT2	Kompagniesdrift 95	182826	320608	B					0.00		0.00		W		Stock watering
PP1	Nortier experimental farm	182005	320200	B					0.00		0.00		N		Dry (bees)
PP2	Nortier experimental farm	182044	320154	B					0.00		0.00		N		Unused (bees)
PP3	Nortier experimental farm	182035	320308	B	70				0.00		0.00		N	0.8	Sealed (bees)
PP4	Nortier experimental farm	182036	320308	B	75				0.00		0.00		N	1.2	Destroyed
PP5	Nortier experimental farm	182101	320304	B	134				0.00		0.00		N		Sealed
PP6	Nortier experimental farm	182059	320308	B	134				0.00		0.00		N	0.4	Sealed
PP7	Nortier experimental farm	181906	320153	B					0.00		0.00		N		Unused (bees)
PP9	Nortier experimental farm	181909	320338	D					0.00		0.00		N		Unused
PP10	Nortier experimental farm	181911	320337	D			5.51	0.00	5.51	9.00	3.49		N		Unused
RH1	Roode Klip Heuvel 86	182729	320116	B	125		37.41	0.20	37.41	162.00	124.59	311	W	0.2	Stock watering
RH2	Roode Klip Heuvel 86	182559	320125	B	65		35.92	0.60	35.32	157.00	121.68		N		Unused
RH3	Roode Klip Heuvel 86	182523	320128	B	120				0.00		0.00	94	W	0.9	Stock watering
RH4	Roode Klip Heuvel 86	182522	320130	B	65		36.70	0.70	36.00	155.00	119.00		N		Unused
RH5	Roode Klip Heuvel 86	182555	320127	B	76	28			0.00		0.00	90	W	0.4	Stock watering
RH6	Roode Klip Heuvel 86	182616	320232	B			22.44	0.40	22.04	155.00	132.96	83	W	0.2	Stock watering

Borehole number	Farm name	Coördinates Longitude (D,M,S)	Coördinates Latitude (D,M,S)	Site type	Depth (m)	Depth to bedrock	Water level below collar height	Collar height above ground level	Water level below ground level	Elevation (mamsl)	Water level (mamsl)	E.C. (mS/m)	Equip-ment	Yield (l/s)	Application/ remarks
RK1	Roodeklipheuvel 84	192816	320305	B	55		31.52	0.55	30.97	160.00	129.03	300	W	0.2	Stock watering
RK2	Roodeklipheuvel 84	182956	320359	B	64	18	15.47	0.40	15.07	162.00	146.93	306	W	1.9	Stock watering
RK3	Roodeklipheuvel 85	183122	320154	B	80	6			0.00		0.00	157	W		D,S
RK4	Roodeklipheuvel 85	183121	320156	B	85	30	28.41	0.45	27.96	185.00	157.04	157	W	0.1	D,S
RK5	Roodeklipheuvel 84	182857	320316	B			13.74	0.45	13.29	162.00	148.71	400	W		Stock watering
RK6	Roodeklipheuvel 85	183240	320150	B	60				0.00		0.00		W		Stock watering
RK7	Roodeklipheuvel 85	183209	320219	B	90				0.00		0.00		N		Dry
RK8	Roodeklipheuvel 85	183212	320342	B	45				0.00		0.00	500	W		Stock watering
RK9	Roodeklipheuvel 84	183236	320431	D	18		12.44	0.50	11.94	190.00	178.06	330	W		Stock watering
RK10	Roodeklipheuvel 84	183119	320402	D					0.00		0.00		W		Stock watering
RN1	Rietfontein 96	193010	320717	B	80	12	24.65	0.10	24.55	130.00	105.45	82	W	0.3	Domestic
RN2	Rietfontein 96	183032	320715	B	52		25.51	0.10	25.41	138.00	112.59	70	W		Garden
RN3F	Rietfontein 96	183018	320759	F					0.00		0.00		W		Unused
RN4F	Rietfontein 96	183015	320759	F					0.00		0.00		N		Unused
RN5F	Rietfontein 96	183126	320704	F					0.00		0.00	50	W		D,S
RN6	Rietfontein 96	183317	320751	D	15		14.00	0.00	14.00	178.00	164.00	-	W		Stock watering
RN7	Rietfontein 96	183150	320840	D	10		0.50	0.40	0.10	115.00	114.90	190	W		Domestic
SF1	Suurfontein 527	182413	320140	B	82				0.00		0.00		N		Unused
SF2	Suurfontein 527	182351	320248	B	82		52.55	0.70	51.85	114.00	62.15	316	W	0.3	Stock watering
SF3	Suurfontein 527	182456	320159	B	82	42	62.67	0.50	62.17	152.00	89.83	231	W		Stock watering
SF4	Suurfontein 527	182416	320333	B					0.00		0.00		N		Destroyed
SF5	Suurfontein 527	182345	320534	B	132	9	28.21	0.20	28.01	78.00	49.99		N		Unused
SF6	Suurfontein 527	182346	320530	B	50	18	1.55	0.40	1.15	81.00	79.85		N	1.5	Unused
SF7F	Suurfontein 527	182405	320550	F					0.00		0.00	90	N		Garden
SF8	Suurfontein 527	182413	320550	D	4		1.30	0.35	0.95	77.00	76.05	110	W		Garden
SF9	Suurfontein 527	182410	320556	D	6		1.84	0.00	1.84	66.00	64.16	279	W		Garden

APPENDIX B : G - boreholes data.

Borehole number	Farm name	Coördinates Longitude (D,M,S)	Coördinates Latitude (D,M,S)	Site type	Depth (m)	Depth to bedrock	Water level below collar height	Collar height above ground level	Water level below ground level	Elevation (mamsl)	Water level (mamsl)	E.C. (mS/m)	Equipment	Yield (l/s)	Application/ remarks
18 AB 199 G30989	Kookfontein 88	182051	320203	B	100	43			0.00		0.00		N		Destroyed
18 AB 198 G30990	Kookfontein 88	182321	320542	B	88	5	1.17	0.30	0.87	41.00	40.13		N		Unused
18 AB 197 G30994	Nortier experimental farm	181857	320339	B	119	59			0.00		0.00		N		Dry
18 AB 196 G30995	Nortier experimental farm	181918	320427	B	100	42			0.00		0.00		N		Destroyed
18 AB 20 G31002	Nortier experimental farm	182005	320352	B	60	42			0.00		0.00		M		Unused (standby)
18 AB 195 G31007	Nortier experimental farm	181916	320222	B	124	47	36.34	0.13	36.21	45.00	8.79		N		Unused
18 AB 21 G31016	Nortier experimental farm	181853	320225	B	83	7			0.00		0.00		N		Unused
18 AB 194 G31260	Nortier experimental farm	182005	320350	B	43		11.15	0.40	10.75	15.00	4.25		N		Observasion-DWA
18 AB 23 G31261	Nortier experimental farm	181918	320431	B	81	45			0.00		0.00		N		Dry
18 AB 193 G31274	Suurfontein 527	182357	320513	B					0.00		0.00		N		Destroyed
18 BA 15 G32997	Nortier experimental farm	182005	320351	B	37	32			0.00		0.00		M		D,S,I
18 BA 359 G33111	Roodeklipheuvel 84 359	183010	320455	B	112	112			0.00		0.00		N		Unused
18 BA 12 G33112	Roodeklipheuvel 84	183140	320453	B	112	>110	15.40		15.40	178.77	163.37	98	N		Observasion-DWA
18 BA 6 G33113	Roodeklipheuvel 84	183313	320512	B	99	>99	10.49		10.49	187.44	176.95	164	R	0.2	Observasion-DWA
18 BA 358 G33114	Roodeklipheuvel 84	183109	320610	B	69	42	14.42		14.42	178.01	163.59	39	R	0.1	Observasion-DWA
18 BA 357 G33115	Graafwater 97	183436	320740	B	33	30			0.00	186.95	186.95	355	N		Unused
18 BA 11 G33116	Roodeklipheuvel 84	183346	320600	B	88	87	16.30		16.30	192.63	176.33	269	N		Observasion-DWA
18 BA 36 G33720A	Roodeklipheuvel 84	183119	320547	B	102	71	10.72	0.50	10.22	179.18	168.96	87	N	0.1	Observasion-DWA
18 BA 37 G33721	Roodeklipheuvel 84	183141	320620	B	102	23	10.53		10.53	171.94	161.41	65	N	0.1	Observasion-DWA
18 BA 38 G33722	Roodeklipheuvel 84	183122	320438	B	85	>85	14.77		14.77	177.91	163.14	90	N	0.4	Observasion-DWA
18 BA 35 G33723	Roodeklipheuvel 84	183100	320514	B	138	97			0.00		0.00	192	N	0.1	Unused

Borehole number	Farm name	Coördinates Longitude (D,M,S)	Coördinates Latitude (D,M,S)	Site type	Depth (m)	Depth to bedrock	Water level below collar height	Collar height above ground level	Water level below ground level	Elevation (mamsl)	Water level (mamsl)	E.C. (mS/m)	Equipment	Yield (l/s)	Application/ remarks
18BA 40	633724	Roodeklipheuvel 84	183306	320440	B	94	79			0.00		0.00	77	N	0.2	Observasion-DWA
18 BA355	633725	Roodeklipheuvel 84	183131	320627	B	40	30	9.82		9.82	177.58	167.76	55	N	0.5	Observasion-DWA
18 BA 42	633726	Rietfontein 96	183138	320704	B	18	9	5.11		5.11	167.51	162.40		N	0.0	Observasion-DWA
18BA 43	633727	Roodeklipheuvel 84	183007	320532	B	77	>102	15.37		15.37	173.60	158.23	142	N	0.1	Observasion-DWA
18 BA 44	633728	Roodeklipheuvel 84	183242	320447	B	103	62	13.27		13.27	188.16	174.89	125	N	1.0	Observasion-DWA
18 BA354	633729	Ratelfontein 76	183523	320416	B	78	21	17.63		17.63	213.16	195.53	179	N	0.2	Observasion-DWA
18BA353	633730	Roodeklipheuvel 84	183209	320607	B	36	34	11.71		11.71	185.47	173.76	164	N	0.2	Observasion-DWA
18 BA 47	633731	Roodeklipheuvel 84	183124	320403	B	46	33	14.06		14.06	178.05	163.99	269	N	0.1	Observasion-DWA
18BA 48	633732A	Roodeklipheuvel 84	183112	320531	B	58	>57	10.52	0.32	10.20	177.10	166.90	92	N		Observasion-DWA
18 BA 49	633733A	Roodeklipheuvel 84	183105	320557	B	60	>60	9.30	0.22	9.08	177.02	167.94	72	N		Observasion-DWA
18 BA50	633734A	Roodeklipheuvel 84	183110	320544	B	65	>69	9.80	0.17	9.63	177.63	168.00	38	N		Observasion-DWA
18BA352	633735	Roodeklipheuvel 84	183118	320540	B	66		10.16	0.09	10.07	178.30	168.23	48	N	0.5	Observasion-DWA
18 BA 52	633745A	Roodeklipheuvel 84	183103	320547	B	50		10.06	0.30	9.76	177.34	167.58		N	2.0	Observasion-DWA
18BA 53	633746D	Roodeklipheuvel 84	183119	320513	B	102	128	13.47	0.23	13.24	176.97	163.73	38	N	0.5	Observasion-DWA
18BA100	633747	Roodeklipheuvel 84	183129	320513	B	102	128	14.86	0.22	14.64	177.21	162.57	38	N	5.0	Observasion-DWA
18BA 106	633748	Kookfontein 88	182215	320408	B	148	121	47.80	0.00	47.80	93.00	45.20		N	0.1	Unused
18BA 192	633749	Suurfontein 527	182510	320519	B	84	73	3.52		3.52	95.00	91.48	64	N	0.1	Unused
18AB 191	633920	Suurfontein 527	182516	320431	B	90	88			0.00		0.00	84	N	1.0	Unused
18 AB190	633921	Kookfontein 87	182626	320306	B	102	94			0.00		0.00		N		Unused