Gh REPORT NO. 3495

BOREHOLE/IRRIGATION SURVEY AND GROUND-WATER EVALUATION OF THE DORINGLAAGTE DRAINAGE BASIN, DENDRON (N. TVL)

BY

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DEPARTMENT OF WATER AFFAIRS

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SYNOPSIS

The Directorate: Geohydrology was approached by the Northern Transvaal Regional Development Advisory Committee to investigate the ground-water resources of the Dendron Area. A borehole and irrigation survey was undertaken in the Doringlaagte catchment, an area studied previously by Abtmaier (1969) and Dziembowski (1976).

Comparative results from the three surveys showed the following changes;

	1969	1976	1986
Area under irrigation (ha)	1 319	1 474	3 579
Volume of ground-water abstracted (10^6 m^3)	9,2	8,5	21,7
Average ground-water level (m)	18	30	43

The aquifer, subdivided into a weathered granite aquifer and a lower fractured granite aquifer, has a total estimated storage of 124.10^6 m^3. Based on a calculated 4% rainfall recharge figure and existing abstraction rates the lifespan of the aquifer is only 13 years. The calculate safe yield of the aquifer ($8,6.10^6$ m^3/year) is 2,5 times lower than the present yearly abstraction volume. Unless the abstraction rate is greatly reduced or unless large scale artificial recharge projects are introduced, the ground-water situation will become critical.

SINOPSIS

Die Noord-Transvaal-streeksontwikkelingsraad het die Direktoraat: Geohidrologie genader om 'n grondwater evaluasie van die Dendrongebied uit te voer. 'n Boorgat- en besproeiingsopname is uitgevoer in die Doringlaagte-dreineringsgebied. Hierdie dreineringsgebied is tevore deur Abtmaier (1969) en Dziembowski (1976) ondersoek.

Uitslae van die drie opnames het die volgende veranderings uitgewys:

	1969	1976	1986
Gebied onder besproeiing (ha)	1 319	1 474	3 579
Volume van grondwateronttrekking (10^6 m^3)	9,2	8,5	21,7
Gemiddelde grondwaterdiepte (m)	18	30	43

Die akwifer, verdeel in 'n verweerde graniet akwifer en 'n laer gebrokke graniet akwifer, het 'n totaal berekende berging van 124.10^6 m^3. Die leeftyd van die akwifer, gebaseer op 'n berekende reënvalaanvulling van 4% en op huidige onttrekkingsvolumes, is net 13 jaar. Die berekende veilige lewering van die akwifer ($8,6.10^6$ m^3/jaar) is 2,5 keer laer as die huidige onttrekkingsvolume per jaar. Tensy die onttrekkingsvolume baie verminder word, of tensy grootskaalse kunsmatige aanvulling gedoen word, sal die grondwatersituasie baie krities word.

1. INTRODUCTION

A survey undertaken by the Northern Transvaal Co-operative (NTC) during 1986 indicated that 17 971 ha of farmland are being irrigated in the Dendron/Vivo/Pietersburg area, using ground-water as the only source of supply. The importance of the ground-water supplies led the Northern Transvaal Regional Development Advisory Committee to contact the Department of Water Affairs and request the Directorate: Geohydrology to assist in evaluating existing ground-water usage and resources (see letter dated 22.8.85, File BG4/8/A7/2). The Northern Transvaal Potato Works Committee in the Dendron area also expressed an interest in a geohydrological evaluation of the Dendron area. The study involved a borehole and irrigation survey with the following objective:

To assess the effect of ground-water abstraction on the groundwater levels, the borehole yields and the long-term groundwater potential of the area. With this objective in mind the study aims would be:

(1) To measure water-levels which would be compared to historical data to ascertain present trends in water-levels.

(2) To collect data on present areas under irrigation, and volumes of ground-water abstracted. This together with historical data can help explain trends in water levels.

(3) To calculate a possible groundwater exploitation potential for the area.

The Directorate decided that it would be best for comparative purposes to analyse the Doringlaagte drainage basin first, since this area had been studied previously. (See References).

Studies in the Doringlaagte catchment were undertaken by Abtmaier (Gh1443,1969) and Dziembowski (Gh2878,1976). In both of these studies data were obtained on water levels, abstraction rates and areas under irrigation.

2. STUDY AREA

The Doringlaagte drainage basin is situated 60 km north of Pietersburg with the town of Dendron being situated in the centre of the basin. The basin is a sub-catchment of the Hout River catchment area, which is itself a tributary of the larger Sand River. The study area is bisected by the main Pietersburg/Alldays tar road. No railway system exists in the study area.

2.1 Topography

The Doringlaagte catchment with an area of 509 km^2, drains to the north-east having a length of 35 km and an average width of about 15 km. The Doringlaagte River is a tributary of the Sand River, the catchment being bounded by De Loskop mountain (elevation of 1437 m) in the south, Blouberg mountain ridge to the north-west (elevation of 2051 m) and the Soutpansberg range (elevation of 1705 m) to the north-east. Within the Doringlaagte catchment the north to south elevation difference is 301 m (1216-915 m), the two most prominent hills in the catchment being the Witklip Hill (elevation of 1024 m) and the Kameelkop Hill (elevation of 1216 m).

As a result of the low gradient (1:115) the catchment does not have well-defined river channels, the water flows in broad "laagtes".

2.2 Rainfall

Only one rainfall station in the catchment (Waldburg 721/618) has complete up-to-date records for more than 25 years. One evaporation station exists (Combro, A7E07) with records from 1969-1980.

The rainfall station on the farm Waldburg (721/618) has continuous records since 1919 and gives a mean annual precipitation (MAP) for the area of 354 mm, the main rainfall season being between October and March. Data from evaporation station A7E07 (Combro farm) shows a trend for the period 1969-1986 of a higher average rainfall of 461 mm a year, while the yearly Symons pan evaporation figure is 1683 mm. The monthly average data for the two stations in contained in Table 1.

TABLE 1: RAINFALL AND EVAPORATION DATA FROM WALDBURG AND COMBRO

		Monthly average												AVERAGE
	Period	J	F	M	A	M	J	J	A	S	O	N	D	MAP/MAE*
Waldburg	1919-86	66,0	57,2	42,0	16,3	7,6	2,9	3,7	2,4	9,1	23,8	54,2	68,6	353,8
Combro (RAINFALL)	1969-80	83	55	70	25	12	3	3	4	23	39	70	74	461,0
Combro (EVAPORATION)	1969-80	163	139	106	107	91	84	93	110	138	146	150	155	1683

* MAE: Mean annual evaporation

Evapotranspiration data calculated using the Thornthwaite method give a potential evapotranspiration of 961,2 mm/year. The evapotranspiration is plotted with temperature and average monthly rainfall in Figure 1. Under average rainfall conditions a water deficit occurs. It must however be born in mind that potential evapotranspiration is much higher than under actual field conditions, therefore under practical conditions a surplus can occur.

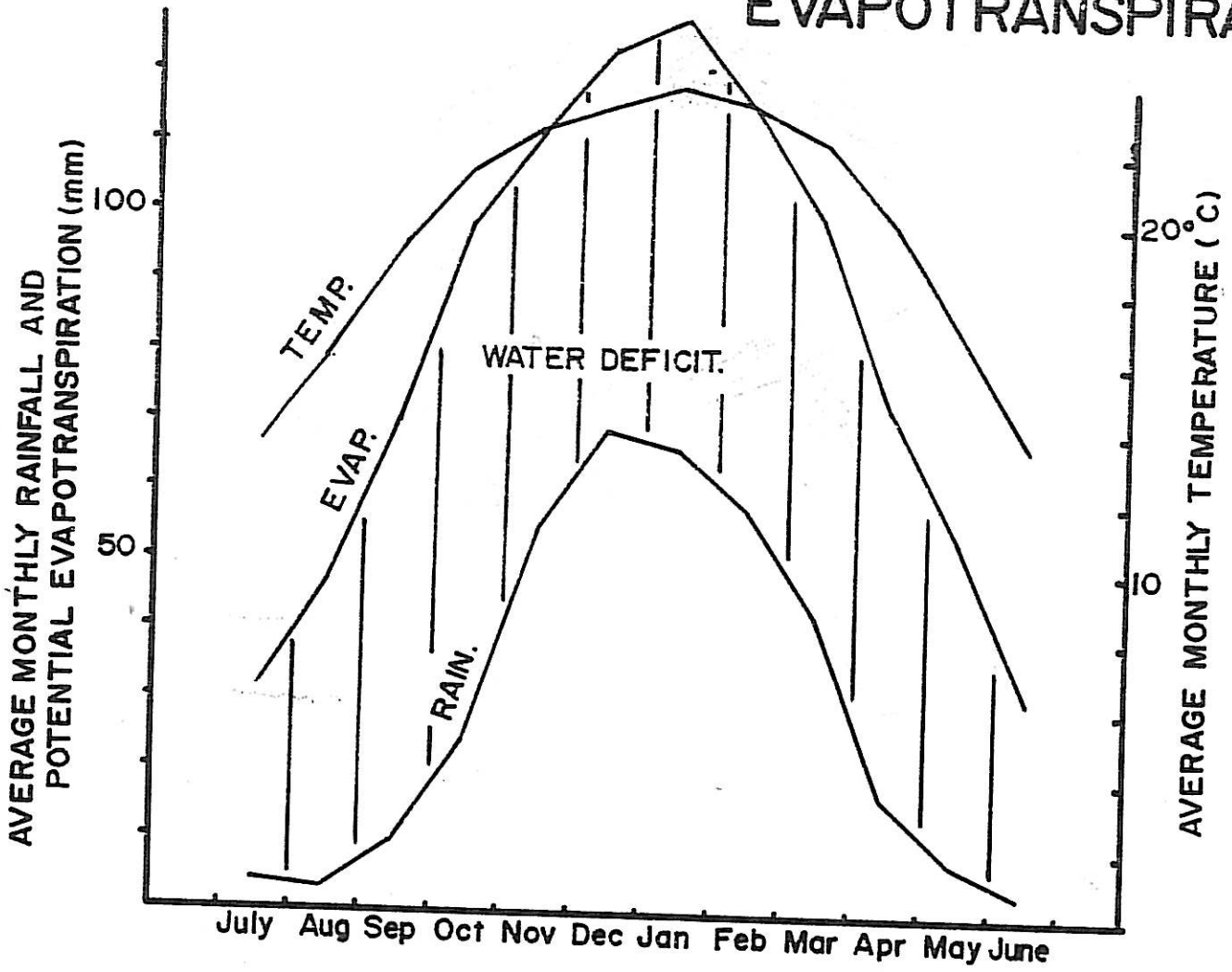
Longterm rainfall data (1957-86) from Waldburg (Station 721/618) is plotted on Figure 2. The monthly data shows quite clearly the seasonal nature of the rainfall. The cumulative departure curve shows a period of deficit from 1957-1971, with an increase from 1971-1981 and followed by a sharp decline since 1981.

Frequency and probability analyses were undertaken for all the rainfall data on Waldburg from 1919 until the present. From this a plot of annual precipitation vrs return period was obtained (see Figure 3). The precipitation total for 1980 (702 mm) has a return period of approximately 40 years.

2.3 Geology

The study area is covered by Archaean rocks of the Kaapvaal Craton. The rocks consist of leucocratic granites and gneisses of the Bandelierkop complex. The Bandelierskop Complex, together with the Beit Bridge Complex and the Sand River gneisses make up the Limpopo Metamorphic Province. Originally shales, calcareous shales, dolomitic limestones and sandstones were laid down on a granitoid basement. These rocks, together with concordant basic intrusions were folded and repeatedly metamorphosed to produce the existing para and ortho-rocks. Metamorphism was of the highest regional grade, proved by the high silimanite content of the rocks. The Bandelierskop Complex in the study area consist of the Baviaanskloof granite-gneisses and the Bandelierskop Formation. The granite-gneisses consist of pink to grey granites, the latter showing greater foliation and a more gneissic nature. The Bandelierskop Formation consists of original greenstone material which has been subjected to at least three phases of deformation, producing pelitic gneisses, mafic gneisses and metaquartzites, plus ultramafic rocks. The age of the Bandelierskop Complex varies between 2 636 and 2 657 Ma, thus making the Complex coeval with the Beit Bridge Complex. Other than the metaquartzites, outcrops are sparse, the surface cover being a red-brown sand, with minor calcrete horizons. The granites have no topographic importance, their presence under the sandy soil only indicated by feldspar and granite fragments on the surface.

DORINGLAAGTE CATCHMENT : RAINFALL, TEMPERATURE AND EVAPOTRANSPIRATION AVERAGES.



DEPT. VAN WATERWESE DIREKTORAAT GEOHIDROLOGIE		DEPT. OF WATER AFFAIRS DIRECTORATE GEOHYDROLOGY	
TITEL: TITLE:	FIGURE 1		
GETEKEN: DRAWN	DAT.	NAGESIEN: CHECKED	DAT.
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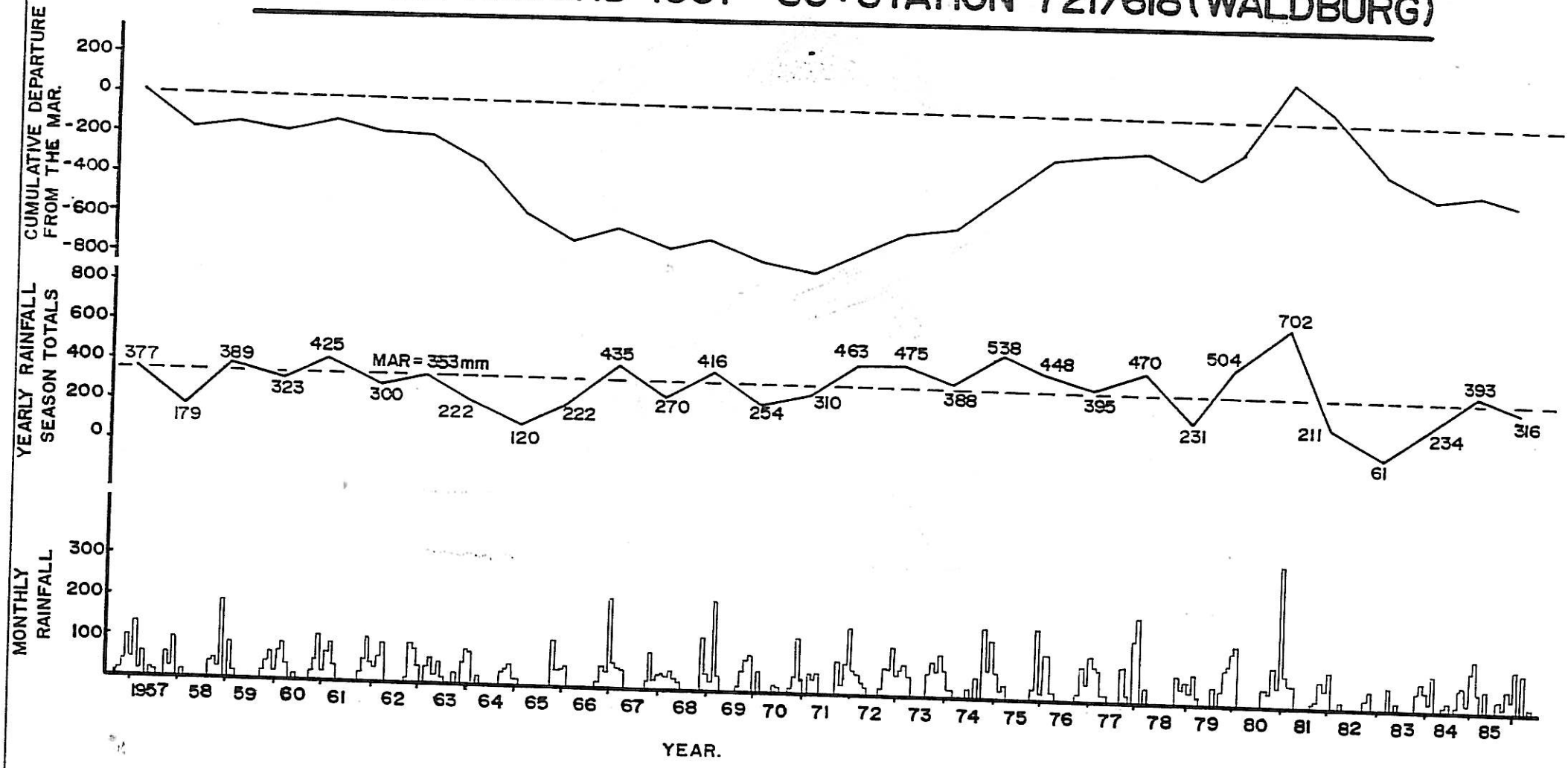
RAINFALL RECORD 1957–86 : STATION 721/618 (WALDBURG)



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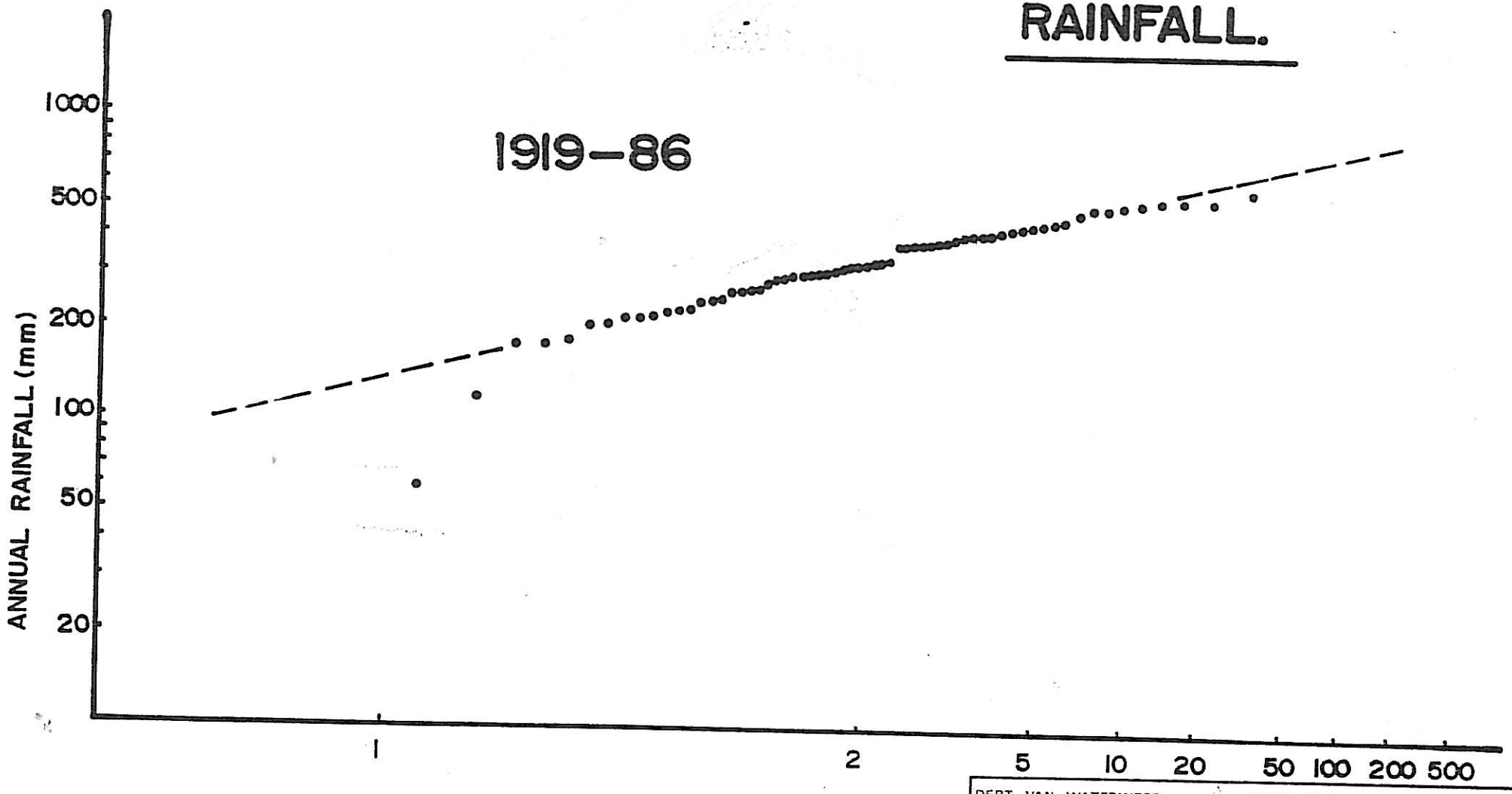
WALDBURG: RETURN PERIOD VRS ANNUAL RAINFALL.



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Intruded into the granites are ENE trending diabase dykes which vary in width from 7–20 m. Two sets of dykes occur, post-Waterberg diabase dykes and post-Karoo dolerite dykes.

The dykes were studied by Temperley (Gh 2036) using aerial photos. He produced a map (Ghp4444) suggesting four spacial units related to the number and strength of aeromagnetic anomalies in the Dendron area. No detailed geological map exists, the best map is the 1:250 000 geological map (2328 Pietersburg - 1985).

2.4 Geohydrology

Two distinct but inter-dependent aquifers exist in the area. The borehole and resistivity logs from seventy two boreholes were collected by Dziembowski showing that the granites are weathered to depths of between 12–50 m. This data is contained in envelope Ghp 598 and in Appendix H. Below the weathered zone is a zone of fracturing which in extreme cases may extend to depths of 120 m. At depths greater than 120 m little groundwater occurs. Flow patterns within the two aquifers are completely different - the weathered aquifer is unconfined to semi-confined and conforms to vertical flow patterns while the fractured rock aquifer has lateral flow along the fractures and is confined.

The fractures in the lower zone act as "collectors" or conduits which draw water from the overlying weathered formation. Pumping test results from granites in India (Rushton and Weller, 1985) show the fractured zone to have a storage co-efficient of 0,0025 and a transmissivity of 88 m^2/day, while the weathered zone has a specific yield of 0,01 and a transmissivity of 8,8 m^2/day. Results from aquifer tests in Archaean granites (Fayazi, Gh 3356, 1984) show that storage values are similar while transmissivities are higher in Archaean granites (transmissivities of 190 m^2/day for fractured granites).

With increasing depth the storage decreases, especially as the weathered zone grades into the fractured zone. For constant abstraction rates the rate of water-level drop should increase with depth.

Borehole yields in the granites vary between 0,1 and 35 l/s. Of the boreholes used for irrigation purposes (1986) 94% yield over 5 l/s while 36% yield over 20 l/s. For irrigation purposes yields of under 3 l/s are usually inadequate.

2.5 Previous studies

(1) During June and July of 1968 Abtmaier (Gh 1443) collected information from 173 farms in the Dendron/Vivo area. Within the Doringlaagte basin the area under irrigation was 1319 ha, with an abstraction volume of $9{,}3.10^6$ m^3. Data from 63 water-level measurements showed that the predominant water-level depth was between 12 and 21 m. The majority of boreholes used for irrigation yielded between 12,5 - 25 l/s. It was calculated that approximately 4% of the annual rainfall was abstracted from boreholes. In areas of high abstraction the water level dropped at a rate of 1,6 m/year.

(2) Dziembowski studied the Dendron area in 1974 (Gh 2878), concentrating specifically on the Doringlaagte drainage basin where 1474 ha were under irrigation, the groundwater abstraction volume being $8{,}5.10^6$ m^3. (Slightly lower than in 1968). Average water-levels were between 15 and 35 m, while borehole yield data was not collected. Dziembowski divided the period 1959-1975 into 3 different periods related to annual rainfall:

1959-1966: Sub-normal rainfall
1966-1971: Normal rainfall
1971-1975: Above normal rainfall

During these three periods water levels changed at the following rates:

1959-1966: 0,89 m/year (drop)
1966-1971: 0,38 m/year (drop)
1971-1975: 0,26 m/year (rise)

These rates were plotted against the average annual rainfall for the three different time periods, showing that a rainfall of 440 mm was required to recharge the aquifer under prevailing abstraction conditions for that period ($8{,}5.10^6$ m^3/year). Using this data a recharge rate of 3,8% was calculated for the Dendron area. The calculated safe yield for the Doringlaagte catchment was estimated at 6.10^3 m^3/year.

(3) Fieldwork was undertaken during 1985 (by E.R. Chipps and W. du Toit), the data being incorporated into a talk given by Mr J.R. Vegter (Gh 3393). Data showed that the average annual growth rate from 1968-1985 for the area under irrigation was 4,4% while the volume of groundwater abstraction increased at 6,9% per annum. Values for groundwater abstraction were obtained by multiplying the areas under irrigation by a irrigation requirement figure dependant on the crop type. The data for areas under irrigation (obtained from the Department of Agriculture) have since proved to be under-estimates, while the calculated abstraction values are over-estimates.

3. BOREHOLE AND IRRIGATION SURVEY RESULT 1986

The survey was undertaken by the author and his assistant (Mr G. Makau) from 28 July - 7 October 1986.

3.1 General

During the survey 39 cadastral farms were visited (subdivided into 60 different farms) and data were collected from 781 different boreholes (see Map 1 and Appendix A). Of these boreholes 335 were equipped and being used, a further 194 boreholes were open and water-levels could be measured, while the remaining 252 boreholes were either dry, blocked, had fallen in or were sealed. For each farm data were collected on the crops and hectarage under irrigation, plus the estimated ground-water abstraction. These data are contained in Appendices B and C. Boreholes were numbered on a cadastral farm basis, the maximum number of boreholes on one farm being 43 (Geluksfontein), while only one borehole occurred on the farm Tarantaalpan.

Five Lebowan farms occur within the study catchment. These farms contain 111 boreholes which are presently being used. All groundwater on these farms is used for domestic purposes or for stock watering.

3.2 Groundwater abstraction

In the study area 335 boreholes are equipped and being used - 233 for irrigation (69%), 69 for domestic use (27%) and 33 for stock watering (4%). Of the total yearly groundwater abstraction in the area, ($21,75.10^6$ m^3) irrigation makes up 95%. The majority of the area irrigated (+75%) is under centre pivot method. Pivots cover areas of between 20-30 ha and are operational for between 6-12 hours/day. Abstraction data obtained from the farmers were checked against an abstraction value based on irrigation requirements for specific crops (see Appendix C and Table 5). The two values compared favourably for the catchment as a whole, although individual farms showed great variation from the theoretical expected volumes. The variations for the farms is a result of individual farming techniques, crop types, ground-water quality and soil conditions which make a great difference to the volume of water used per hectare. The high volume/hectare figure for Klein Collie is probably related to poor ground-water quality (212 mS/m) thus requiring greater irrigation than with better quality ground-water. The theoretical abstraction total for the whole catchment (25.10^6 m^3) is higher than the actual abstraction total (21.10^6 m^3) because the theoretical total does not take into account rainfall. When MAR conditions are taken into account the theoretical value drops to 18.10^6 m^3. The actual volume of groundwater abstracted for irrigation must be lowered by two other factors

(1) The efficiency of irrigation - an assumed 70% efficiency in the Dendron area means that 30% of the abstraction is lost to evaporation or infiltrates below the crops root zone and recharges the groundwater.

(2) Irrigation return flow - this as shown above amounts to ± 20% (under conservative conditions).

If these corrections are taken into account the abstraction total is reduced to 16.10^6 m^3 per year.

The eight farms with the highest ground-water abstraction, are shown in Table 2. These eight farms (21% of the total catchment area) used 46% of the total groundwater abstracted.

Farm	Volume of ground water abstraction p.a. (10^3 m^3)	Irrigated area (ha)	Irrigation volume/area ratio (10^3 m^3/ha)
Potsdam	1616	220	7,34
York	1420	200	7,10
Claudius Hoop	1376	234	5,88
Klein Collie	1258	122	10,31
Waldburg	1227	313	3,92
Bloemetjiesvlei	1095	320	8,23
Appelfontein	988	120	4,80
Kwaggasbult	960	200	4,80

TABLE 2: FARMS WITH MORE THAN 900.10^3 m^3 OF GROUNDWATER ABSTRACTION PER ANNUM

Map 2, showing ground-water usage per farm during 1986, indicates a fairly uniform ground-water abstraction throughout the area. The farms in Lebowa and in Development Trust areas do however have limited ground-water abstraction. Lebowa, in this catchment, abstracts only 393.10^3 m^3 of ground-water (1.8% of the total) from five farms, all water being used for domestic or stock watering purposes. The greatest abstraction in Lebowa comes from two boreholes on Koniggratz (262.10^3 m^3/year) and one borehole on Wurthsdorp (95.10^3 m^3/year) which supply the black townships of Wurthsdorp, Burg and Fatima Mission with domestic water.

Recharge in the area was calculated by Dziembowski to be 3,8% of the MAP. Under average rainfall conditions (361 mm yearly) recharge in the Doringlaagte catchment (509 km^2) would amount to $7,35.10^6$ m^3 per annum. The annual ground-water abstraction from the catchment ($21,75.10^6$ m^3) is nearly three times more than the recharge - consequently the ground-water levels must drop as the volume of groundwater in storage is depleted.

3.3 Groundwater levels

Water levels were measured in 233 boreholes, 39 of which were equipped. Water levels below surface ranged from over 100 m in some boreholes to under 10 m in others. The average water level throughout the area is 44 m. The water level contour map (see Map 3) shows a water level slope of approximately (1:180) down to the north – this corresponds roughly to the slope of the surface topography. The south to north slope is complicated by lows in the water table, caused by high abstraction on certain farms. The NE-SW profile (Figure 4) shows clearly how high pumping at Appelfontein, Boomzien, Potsdam/Groothoek and in the Bornst/Ne Plus Ultra areas has resulted in large cones of depression developing. The E-W profile (Figure 5) shows cones of depression due to overpumping on Groothoek and Klein Collie, while a high occurs on Waldburg (no pumping has occurred on Waldburg since May 1986). The major zones of water-level lowering are

- Inside the 1025 m contour on the farms Appelfontein, Meanderthal, Kwaggasbult, Partyspan and Kraaifontein.
- The Bornst/Ne Plus Ultra area (inside the 900 m contour).
- Inside the 925 m contour on Klein Collie.
- Inside the 925 m contour on Groothoek.
- Inside the 975 m contour on Potsdam/Boomzien.
- The Geluksfontein-Potsdam area, centered on the main road.

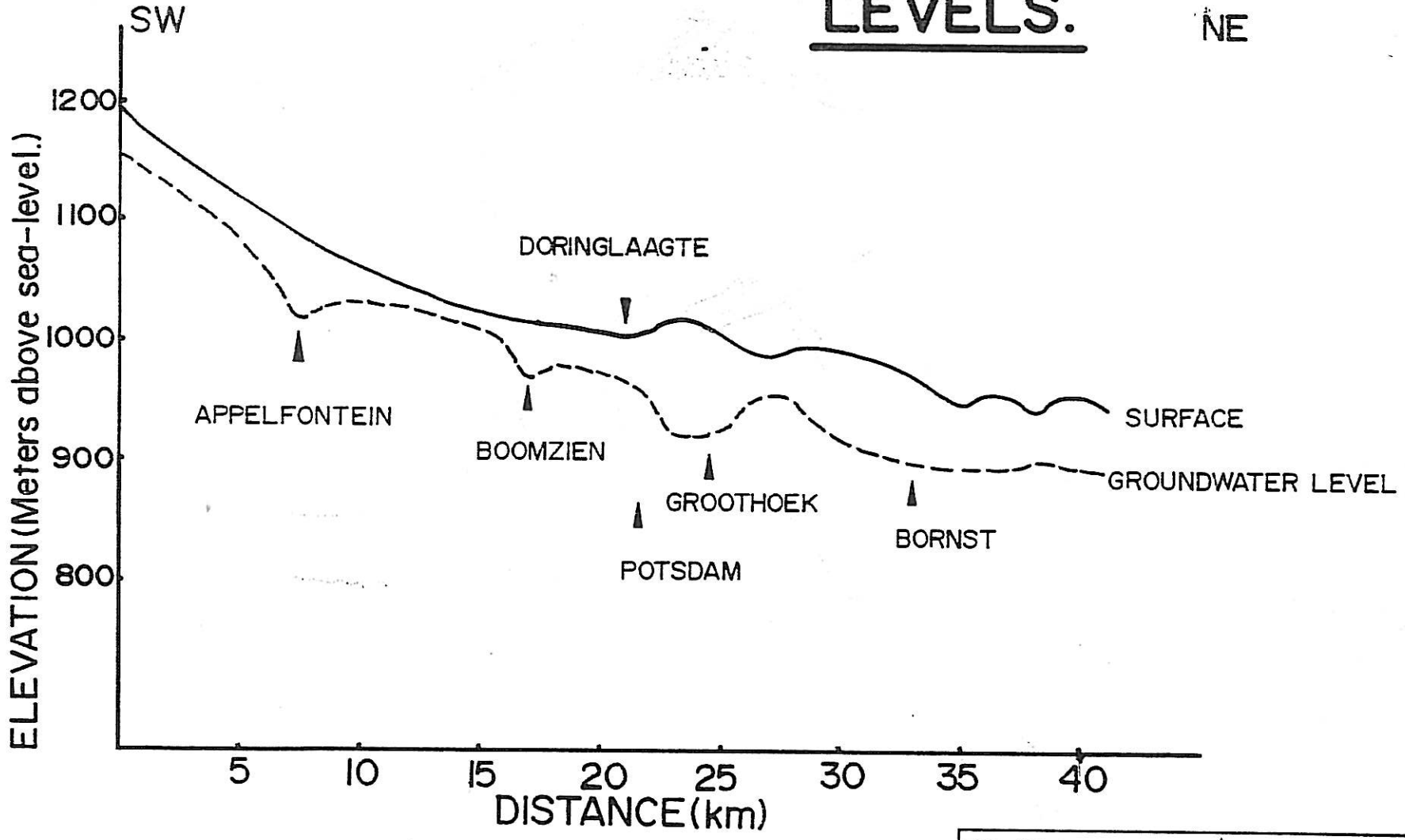
In some of these areas the water tables have dropped to levels 40 m deeper than the water levels on surrounding farms.

3.4 Areas under irrigation

During 1985-1986 3 579 ha were under irrigation, using ground-water as the only water source. The yearly irrigation volume over the 3579 ha is 20 759 m^3 (see Table 3). The volume of water used on average per hectare depends on crop type, ground-water quality, soil type, individual farming practices and method of irrigation. Over 75% of the area under irrigation is under the centre pivot system. Usually all the boreholes are connected to a central reservoir which supplies the centre pivots with between 25-35 l/s.

The five major crops under irrigation in the study area and their theoretical water requirements are (Table 4):

NE-SW TRAVERSE : GROUNDWATER LEVELS.



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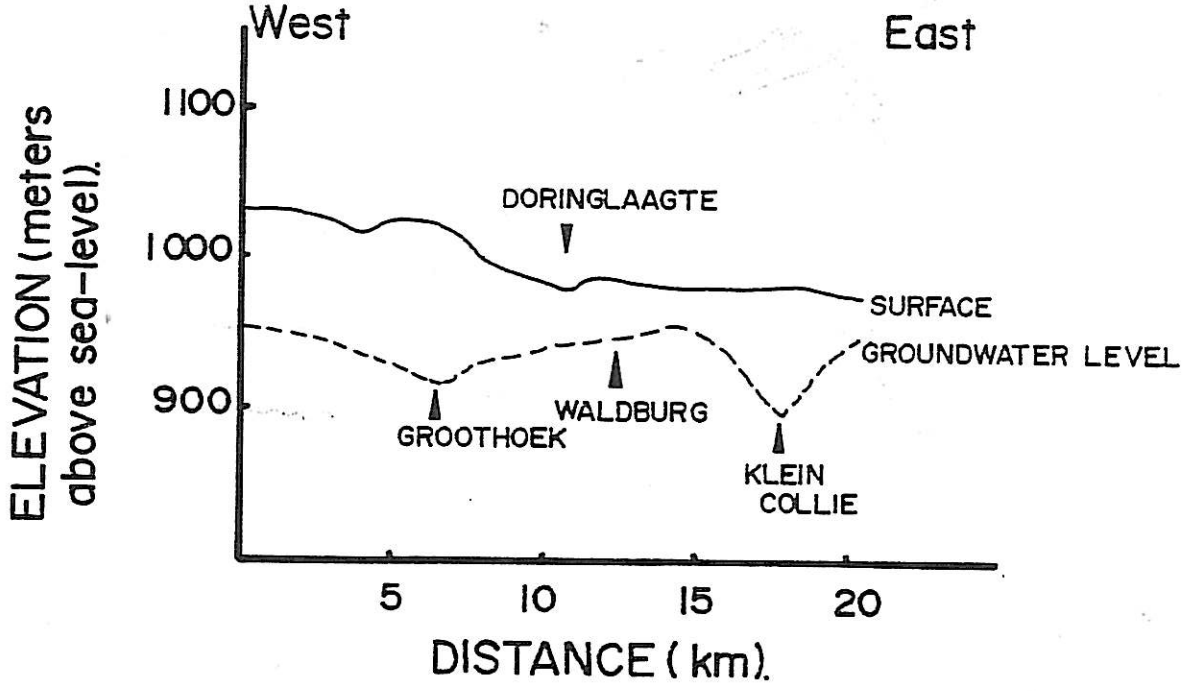
E-W TRAVERSE: GROUNDWATER LEVELS



DEPT. VAN WATERWESE DIREKTORAAT GEOHIDROLOGIE		DEPT. OF WATER AFFAIRS DIRECTORATE GEOHYDROLOGY	
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Farm name	Area under irrigation (ha)	Yearly ground-water abstraction ($x10^3m^3$)	Irrigation Volume/ area ratio ($x10^3m^3$/ ha/annum))
Altenburg	45	197	4.4
Anex Alion	79	867	10.9
Appelfontein	120	988	8.2
Baviaanspoort	-	29	-
Bellvue	51	327	6.4
Bloempiesvlei	320	1 095	3.4
Boomzien	50	308	6.2
Bornst	140	906	6.5
Burg	-	4	-
Claudius Hoop	234	1 376	5.8
Combro	45	378	8.4
Dedimus	-	35	-
Duitsland	30	313	10.4
Dendron) Municipality)	-	285	-
Geluksfontein	182	633	3.5
Groothoek	100	300	3.0
Inderhiken	62	282	4.5
Klein Collie	122	1 258	10.3
Koniggrazt	-	262*	-
Kraaifontein	50	609	12.2
Kwaggasbult	200	960	4.8
Lekkerlacht	33	157	4.7
Meanderthal	240	740	3.1
Ne Plus Ultra	130	793	6.1
New Hanover	40	113	2.8
Nimmersaut	120	746	6.2
Patryspan	80	799	9.9
Persie	-	27*	-
Potsdam	220	1 616	7.3
Redhill	90	547	6.1
Rooikop	140	926	6.6
Soho	8	75	9.4
Stettin	-	6*	-
Tarantaalpan	-	-	-
Tweefontein	35	575	16.4
Waldburg	313	1 227	3.9
Westheim	-	4*	-
Wurthsdorp	-	94*	-
York	200	1 420	7.1
Zandput	100	524	5.1
Total	3 579	21 753	
Average			5.8

Total irrigation volume 20 759x10^3 m^3
Total ground-water used by Lebowa (domestic/stock) 393 x 10^3 m^3
Total domestic/stock use (RSA) 621 x 10^3 m^3
*Lebowan farms

TABLE 3: DORINGLAAGTE DRAINAGE BASIN - IRRIGATION AND GROUND-WATER ABSTRACTION DATA

TABLE 4: MAJOR CROPS, AREAS UNDER IRRIGATION AND IRRIGATION REQUIREMENTS

Crop	Area (ha)	% of total area	Irrigation requirement*
Potatoes	1 245	34	617 mm per season
Maize	1 024	28	855 mm per season
Pumpkins	390	10	484 mm per season
Wheat	275	7	737 mm per season
Cotton	275	7	821 mm per season

* These requirements take into account evaporation, but not rainfall. Should any rainfall occur then less irrigation will be required. Data was obtained from Mr J. Veenstra, Agricultural Extention Officer, Pietersburg (01521 - 75268)

During the period July 1985 - July 1986 the 10 farms with the highest areas under irrigation were:

(1) Bloemetjiesvlei - 320 ha
(2) Waldburg - 313 ha
(3) Meanderthal - 240 ha
(4) Claudius Hoop - 234 ha
(5) Potsdam - 220 ha
(6) York and Kwaggasbult - 200 ha
(7) Geluksfontein - 182 ha
(8) Bornst and Rooikop - 140 ha
(9) Klein Collie - 122 ha

These 10 farms acount for 55% of the total area under irrigation.

3.5 Groundwater quality

Two hundred and fifty-eight boreholes were sampled and the electrical conductivity of the ground-water measured. The average conductivity only for the catchment was 135 mS/m, with a range from 70-300 mS/m. (see Table 5). Any deviations from average conditions (as shown on the conductivity contour map - Map 4) seem to be associated with;

(1) Geological conditions - metaquartzites appear to yield better quality ground-water than highly mineralized gneiss zones.

(2) Overpumping - conductivities increase in some areas where abstraction is high.

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TABLE 5: DORINGLAAGTE DRAINAGE BASIN - ELECTRICAL CONDUCTIVITY AND GROUND-WATER ABSTRACTION DATA

Farm name	Electrical Conductivity ** (mS/m)	Yearly ground-water abstraction ($x10^3 m^3$)	Farm name	Electrical Conductivity ** (mS/m)	Yearly ground-water abstraction ($x10^3 m^3$)
Altenburg	235	197	Rooikop	116	926
Anex Alion	122	867	Soho	87	75
Appelfontein	110	988	Stettin	123	6*
Baviaanspoort	87	29	Tarantaalpan	-	-
Bellvue	133	327	Tweefontein	157	575
Bloempiesvlei	151	1 095	Waldburg	193	1 227
Boomzien	124	308	Westheim	140	4*
Bornst	102	906	Wurthsdorp	132	94*
Burg	123	4	York	106	1 420
Claudius Hoop	114	1 376	Zandput	101	524
Combro	125	378			
Dedimus	140	35			
Duitsland	172	313	Average	135	
			Total		21 753
Dendron) Municipality)	172	285			
Geluksfontein	182	633			
Groothoek	130	300			
Inderhiken	123	282			
Klein Collie	212	1 258			
Koniggrazt	125	262*			
Kraaifontein	137	609			
Kwaggasbult	105	960			
Lekkerlacht	75	157			
Meanderthal	87	740			
Ne Plus Ultra	110	793			
New Hanover	186	113			
Nimmersaut	113	746			
Patryspan	89	799			
Persie	100	27*			
Potsdam	128	1 616			
Redhill	110	547			

*Lebowan farms

**Average conductivity from all the boreholes on each farm

(3) Contamination from agricultural sources.

The better quality ground-water in the south of the catchment is assocated with a number of factors - metaquartzite geology, and uncontaminated ground-water recharge from Lebowa to the south-west. Other isolated zones of high conductivity are associated mostly with high ground-water abstraction. The large NE-SW trending zone of high conductivities (Geluksfontein through to Altenburg) is probably geologically controlled, but accentuated by high ground-water abstraction.

4. COMPARATIVE RESULTS 1959-1986

Data from studies undertaken by Geological Survey (1959), Abtmaier (1969), Dziembowski (1976) and Dir. of Geohydrology (1985) was compared to the data from this survey.

4.1 Borehole data (1969 - 1986)

Comparative data from 1969-1986 is contained in Table 6.

TABLE 6: BOREHOLE DATA (1969-1986)

Borehole data	1969	1974	1986
Average water-level	18 m	30 m	43 m
Average borehole depth	46 m	47 m	76 m
Average borehole yield (used for irrigation)	19 l/s	-	12 l/s

It must however be borne in mind that the 1969 borehole census covered the whole Vivo/Dendron area while the 1974 census covered only 15 farms in the vicinity of Dendron. For the 15 farms around Dendron the number of boreholes existing rose from 129 in 1974 to 354 in 1986. During the 1986 survey 335 of the total of 781 boreholes were in use. (Irrigation - 233, Domestic - 69, stock - 33). A further 194 borehole were unused and open, while 252 were blocked or had fallen in. Of those boreholes used for irrigation (1986) 94% yielded over 5 l/s, while 36% yielded between 20 - 45 l/s (see Map 5). The boreholes yielding under 3 l/s were usually used for stock or domestic purposes.

4.2 Area under irrigation and volume of ground-water abstraction.

Since 1968 the total area irrigated, using groundwater, in the Doringlaate catchment has risen from 1319 ha to 3579 ha in 1986. This is an increase of 171% (i.e. 2,7 times greater). The results are contained in Table 7 and shown on Figure 6. Coupled with the increase in area under irrigation is an increase in the volume of groundwater used for irrigation. From 1968 to 1986 the volume of irrigation rose from $9,3.0^6$ m^3 per year to $21,7.10^6$ m^3 per year. This is an increase of 133% (i.e. 2,3 times greater), showing that the irrigation volume per hectare has decreased slightly since 1968. The data collected during 1985 appear to be slightly anomalous - when compared to the curves in Figure 6 it appears that the irrigation volume was over-estimated, while the area under irrigation was under-estimated. The greatest increase in both irrigation volume and area appears to be post 1975.

4.3 Ground-water levels

For the analysis of the groundwater levels data were grouped into four categories.

(1) Continuous records for individual boreholes 1959-1986.
(2) Average water levels for specific farms and for the total area 1969-1986.
(3) Records for individual boreholes 1976-1986.
(4) Automatic water level recorder (Combro) 1968-1986.

(1) Although water-level measurements exist since 1959, great difficulty was had in obtaining a continuous record since most boreholes measured in 1959 have since dried up, fallen in or are blocked. Only six boreholes had continuous records since 1959 (Figures 7 and 8). The water-levels shown in Figure 7 and 8 show a steady decline followed by a rise in 1981 related to a period of abnormally high rainfall. This rainfall (702 mm for the rainfall season) is unusually high; probability calculations show the yearly total to be a 1 in 40 year event.

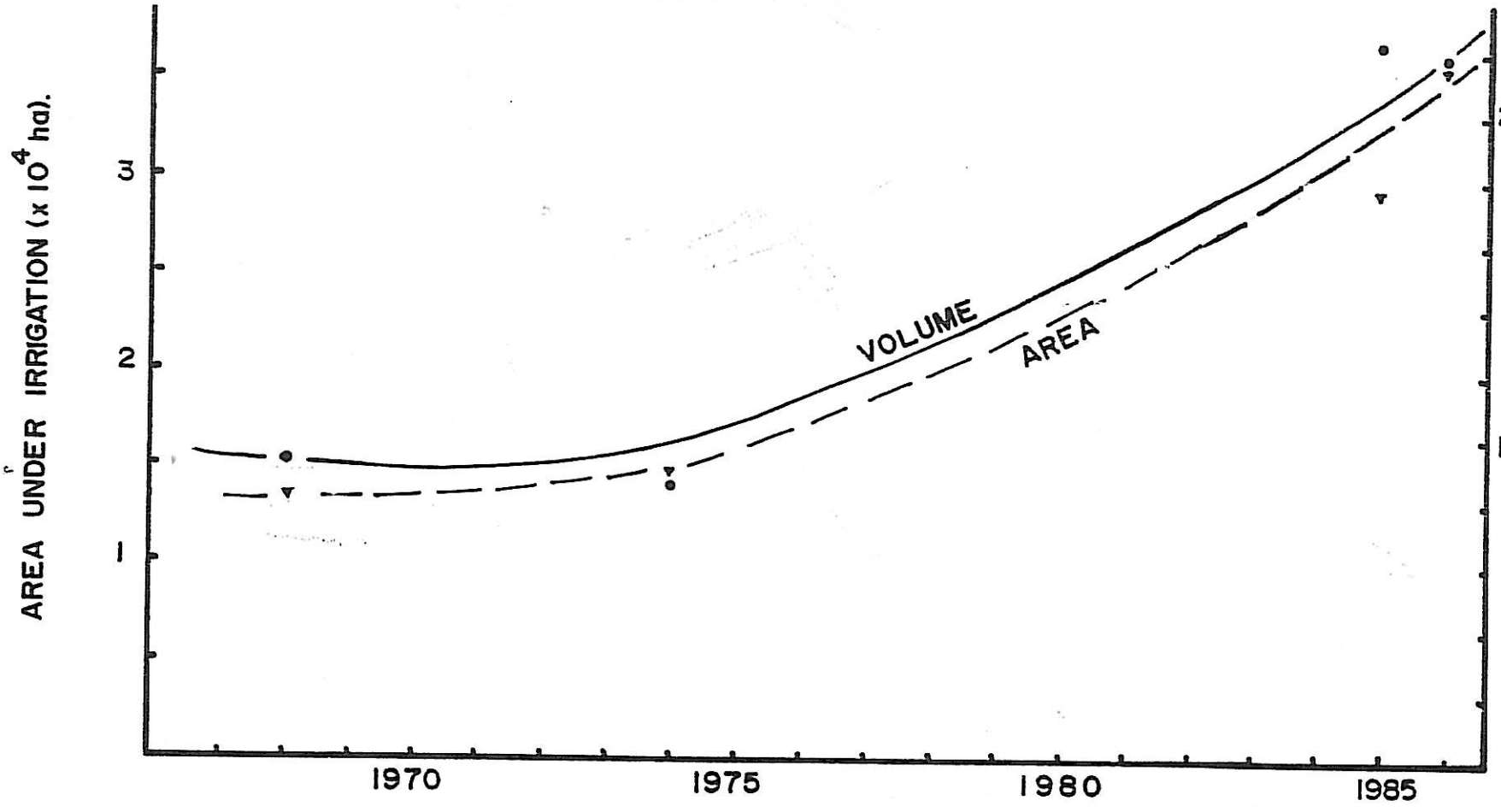
(2) Average water-levels for eight farms were calculated from 1969-1986 (Table 8). The data show a decline in average water-levels of 16 m since 1969. Histograms showing the depth to the ground-water table for the whole catchment for the periods 1969, 1976 and 1986 also point to a decline in average water levels (see Figure 9).

(3) Since 1976 water levels in certain boreholes have been measured on a fairly regular basis. The data are contained in Table 9, while the graphs of all the boreholes are contained in Appendix F. The trend since 1976 has been of decreasing water-levels interrupted by a rise during 1981 and then following by an even sharper decline after 1981. On average water-levels have declined about 10 m since July 1981 i.e. a decline of 2 m per year.

TABLE 7: DORNINGLAAGTE DRAINAGE BASIN - HISTORICAL DATA ON IRRIGATION VOLUMES AND AREAS UNDER IRRIGATION

Farm Name	AREA UNDER IRRIGATION AND IRRIGATION VOLUMES							
	1968		1974		1985		1986	
	Area (ha)	Volume x 10^3 m^3	Area(ha)	Volume x 10^3 m^3	Area(ha)	Volume x 10^3 m^3	Area (ha)	Volume x 10^3 m^3
Altenburg	17,1	164,0	5,6	47,5	13	133	45	197
Anex Alion	50,2	182,0	53,0	299,5	40	409	79	867
Appelfontein	4,3	13,6	0	0	240	1 273	120	988
Baviaanspoort	39,1	182,0	0	0	0	-	0	29
Bellvue	4,3	36,4	12,8	81,1	80	766	51	327
Blinkwater	8,6	100,0	0	0	42	-	-	-
Bloemetjiesvlei	26,0	113,6	20,0	104,0	40	308	320	1 095
Boomzien	34,6	136,3	17,0	107,8	20	204	50	308
Bornst	147,3	1 363,6	166,8	601,8	100	803	140	906
Burg	?	963,6	129,0	817,3	0	-	0	4
Claudius Hoop	193,0	907,1	86,0	531,3	113	770	234	1 376
Combro	?	100,0	60,0	326,3	0	0	45	378
Dedimus	5,1	182,0	3,0	19,0	46	443	0	35
Dendron Dorpsgebied	0	0	0	0	0	250	0	285
Duitschland	25,9	91,0	30,0	156,0	20	184	30	313
Geluksfontein	86,6	454,5	50,0	306,3	390	1 293	182	633
Groothoek	39,1	182,0	12,0	76,1	260	2 538	100	300
Inderhiken	25,9	136,4	19,0	98,8	0	-	62	282
Klein Collie	1,7	163,6	8,0	191,0	60	542	122	1 258
Koniggratz	0	0	0	0	0	250	0	262
Kraaifontein	24,3	136,3	57,0	311,3	115	960	50	609
Kwaggasbult	17,3	90,9	0	0	300	1 573	200	960
Lekkerlacht	0	0	0	0	35	409	33	157
Meanderthal	?	36,4	68,0	530,9	188	1 647	240	740
Ne Plus Ultra	51,9	372,7	60,0	312,0	46	470	130	793
New Hanover	14,3	200,0	11,5	69,5	50	421	40	113
Nimmersault	25,9	450,0	51,4	325,9	90	920	120	746
Patryspan	13,7	100,0	46,6	277,6	110	851	80	799
Potsdam	43,3	204,6	138,0	743,0	95	820	220	1 616
Redhill	43,3	372,7	86,0	345,3	80	818	90	547
Rooikop	34,6	236,3	50,3	277,6	80	604	140	926
Soho	?	13,6	0	0	6	30	8	75
Stettin	?	0	0	0	0	0	0	6
Tarantaalpan	?	0	0	0	0	0	0	0
Tweefontein	34,7	136,4	35,0	182,0	100	1 170	35	575
Waldburg	95,3	363,6	36,0	135,2	50	511	313	1 227
Westheim	0	0	0	0	0	0	0	4
Wuthsdorp	130,0	772,7	143,0	836,8	0	0	0	94
York	77,1	327,2	77,1	407,5	50	382	200	1 420
Zandput	5,2	13,6	2,6	19,6	50	589	100	524
TOTAL	1 319,7	9 298,7	1 474,7	8 541,5	2 909	22 341	3 579	21 753

DORINGLAAGTE DRAINAGE BASIN: IRRIGATION VOLUMES AND AREAS UNDER IRRIGATION (1968–86).



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TITEL TITLE	FIGURE 6		
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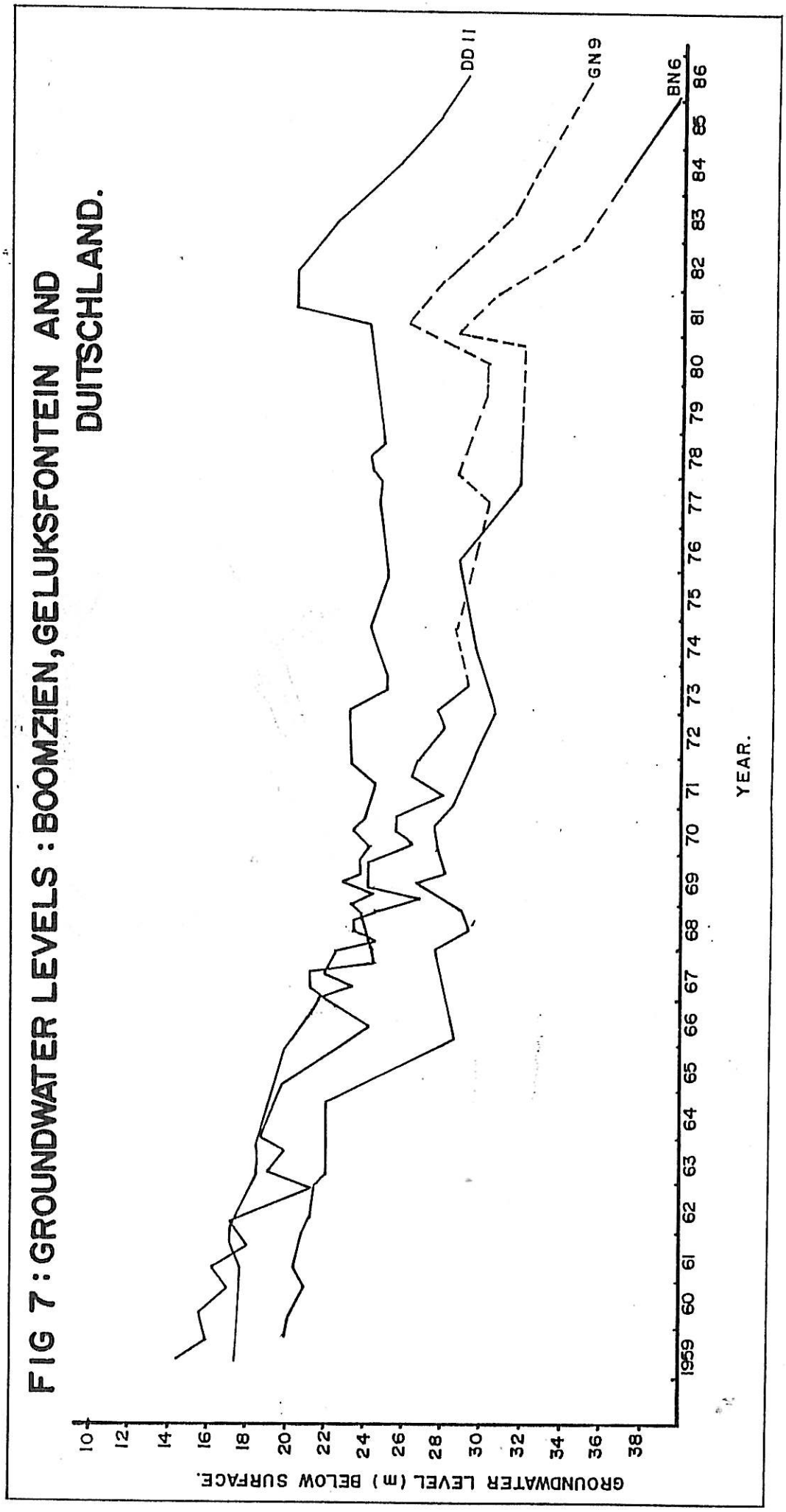
FIG 7 : GROUNDWATER LEVELS : BOOMZIEN, GELUKSFONTEIN AND DUITSCHLAND.
GROUNDWATER LEVEL (m) BELOW SURFACE.
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FIG 8 : GROUNDWATER LEVELS: ANEX ALION, BAVIAANSPOORT AND KRAAIFONTEIN.

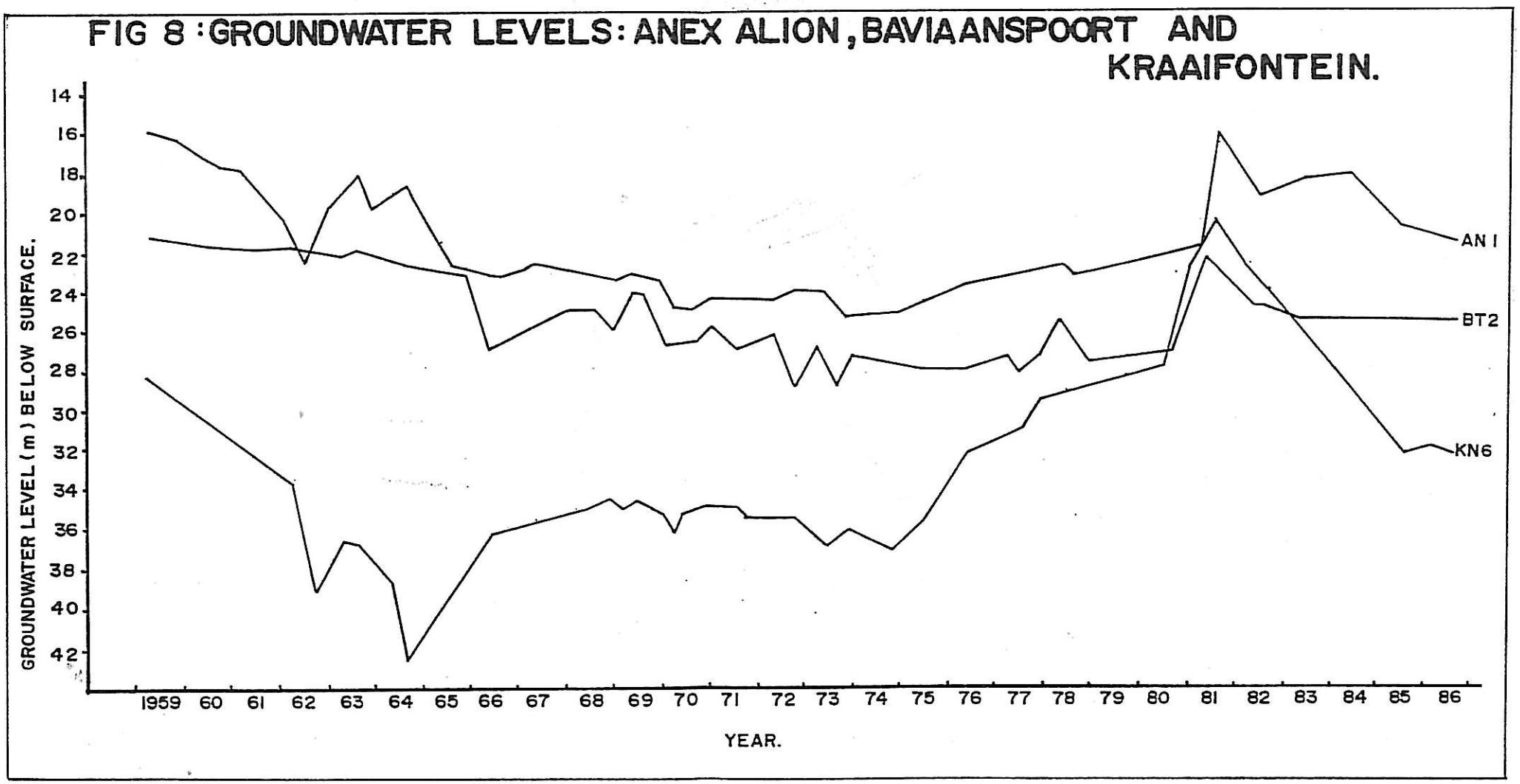
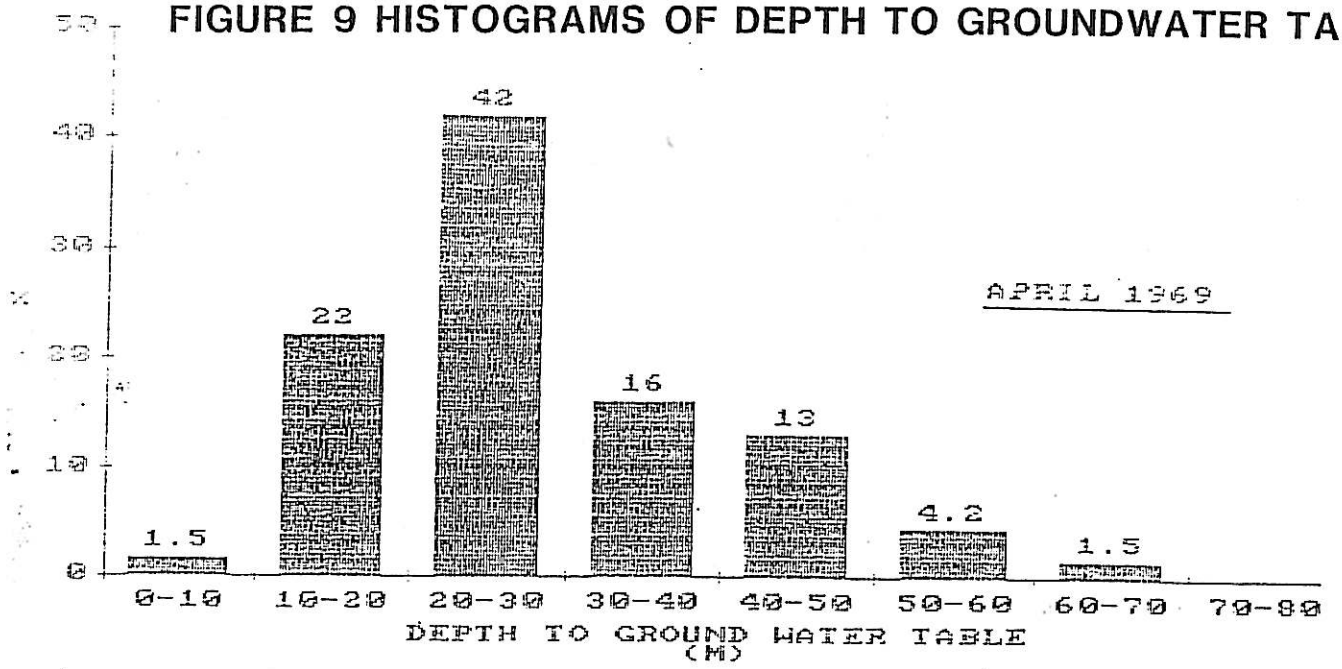
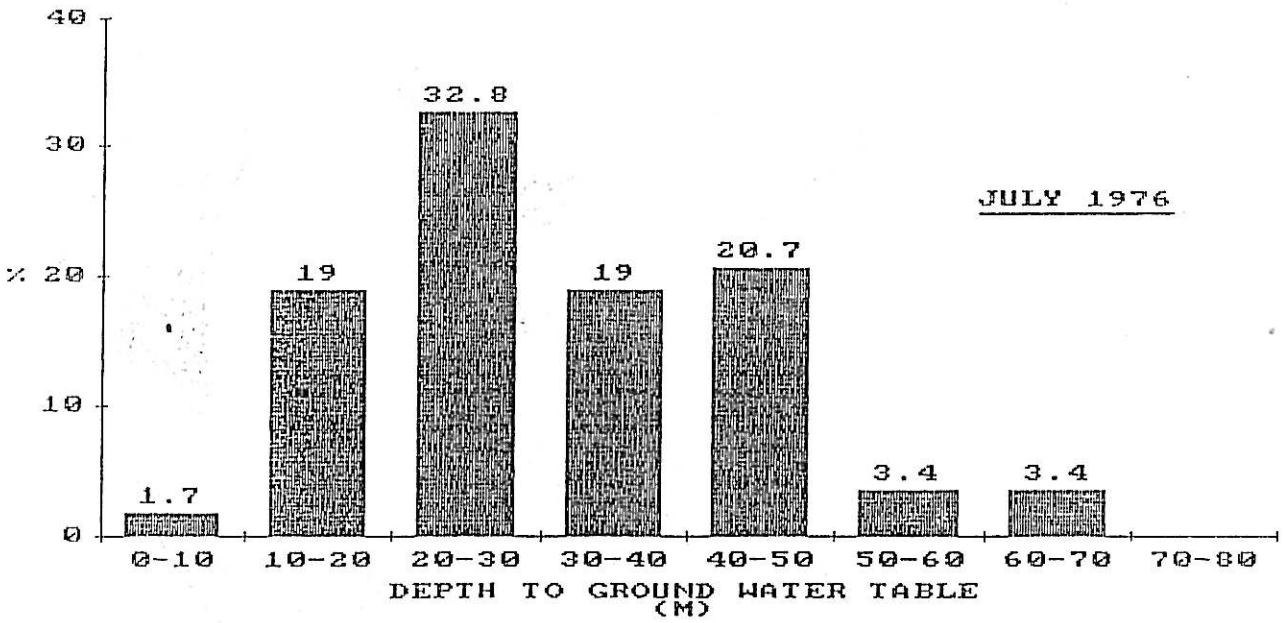


FIGURE 9 HISTOGRAMS OF DEPTH TO GROUNDWATER TABLE





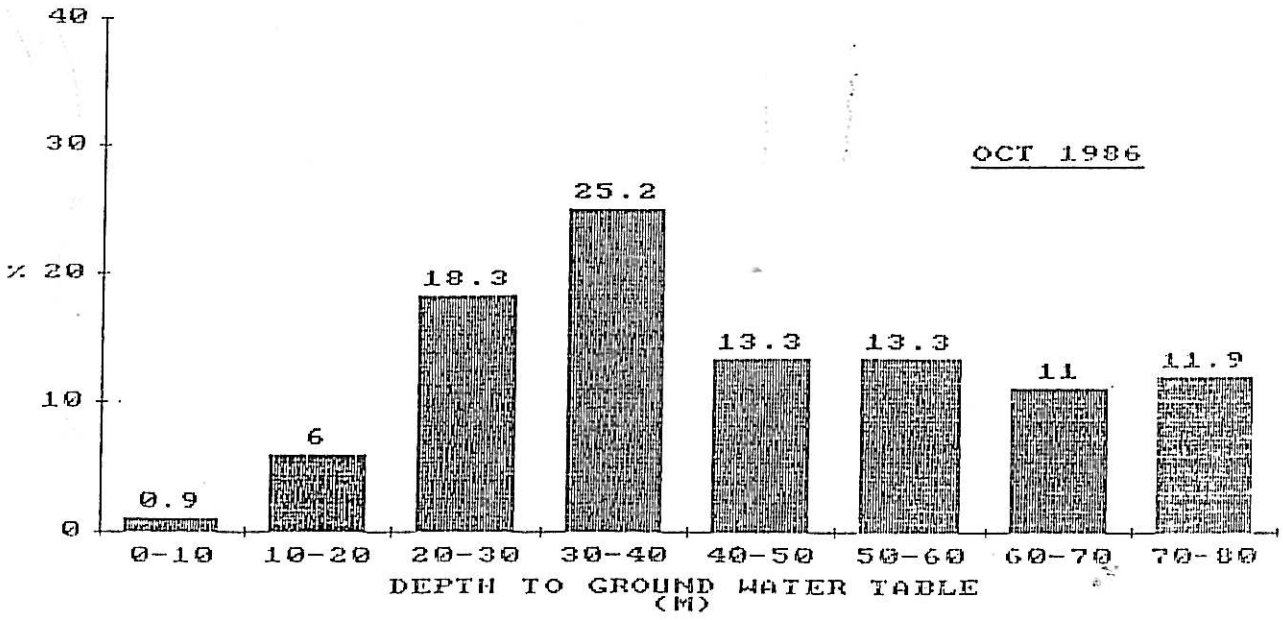


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TABLE 8: DORINGLAAGTE DRAINAGE BASIN

AVERAGE GROUNDWATER LEVELS MEASURED ON EIGHT FARMS FROM 1969-1986

Farm	Average water levels*		
	1969	1977	1986
Altenburg	21,0	26,4	25
Bornst	34,4	41,7	56
Klein Collie	32,1	33,4	39
New Hanover	19,8	16,0	28
Patryspan	47,8	55,1	73
Rooikop	30,8	40,3	47
Redhill	38,5	46,6	55
York	20,4	36,1	45
Average	30,6	36,9	46

Average groundwater-level drop: from 1969-1979 was 6,35 m
: from 1977-1986 was 9,05 m

* Average groundwater-levels obtained from all the water levels measured on each specific farm during that survey.

Farm name	Borehole number	GROUNDWATER LEVELS (m) BELOW SURFACE																
		July 1976	May 1977	July 1977	Sept. 1977	Nov. 1977	Feb. 1978	April 1978	Aug. 1978	March 1981	July 1981	April 1982	May 1983	June 1984	June 1985	May 1986	Aug. 1986
Altenburg	AG1	26,85	26,41	26,50	28,13	27,32	26,17	26,06	26,84	24,39	-	-	-	-	-	-	26,68
Anex Alion	AN1	23,88	23,20	23,23	23,27	23,14	23,03	22,78	23,19	22,07	16,25	19,75	18,44	18,23	20,90	21,06	21,62
Anex Alion	AN6	13,53	13,85	14,00	14,42	14,66	14,47	13,92	14,39	13,85	6,82	10,29	12,53	14,14	12,80	-	-
Baviaanspoort	BT2	28,00	27,65	27,60	27,77	28,37	27,21	25,42	27,64	-	22,29	25,56	25,61	25,41	25,49	25,55	25,69
Bellvue	BE2	9,73	9,65	9,75	9,91	9,95	9,51	9,65	9,79	7,63	8,32	9,84	8,79	9,21	9,66	9,96	-
Bellvue	BE6	30,71	30,49	30,33	30,22	31,14	30,87	30,71	30,98	30,64	28,05	30,69	27,59	27,70	28,00	28,12	-
Bellvue	BE7	28,43	27,20	27,20	27,20	37,10	37,05	38,86	36,18	37,02	24,66	24,69	26,55	24,71	24,87	25,13	24,25	-
Bloemetjiesvlei	BI4	15,11	15,25	15,45	15,83	16,23	15,44	8,65	11,57	-	-	-	14,30	19,36	20,84	21,64	-
Bloemetjiesvlei	BI6	15,18	15,03	15,24	15,38	15,45	13,01	12,05	11,80	12,41	9,88	11,01	12,94	15,26	16,12	17,40	17,74
Boomzien	BN2	29,40	30,45	30,37	33,71	34,38	33,89	33,98	33,72	33,95	30,45	32,16	36,69	36,09	36,58	37,19	37,56
Boomzien	BN12	26,60	27,47	26,50	26,32	25,97	26,53	29,55	25,58	-	21,25	23,66	20,26	23,59	23,04	23,49	26,35
Boomzien	BN14	28,33	28,65	28,44	28,27	27,96	27,04	28,15	27,64	24,40	-	23,78	22,55	24,51	25,09	25,67	25,35
Boomzien	BN15	27,77	28,04	28,00	28,02	27,78	27,55	27,32	-	23,75	23,32	24,35	22,72	24,32	25,06	25,68	26,20
Bornst	BS5	48,05	47,47	47,40	47,43	47,23	46,45	46,25	45,79	44,33	42,06	44,87	44,84	46,02	-	-	58,74
Claudius Hoop	CP2	51,90	50,70	50,45	50,36	50,72	49,86	48,26	50,24	48,34	41,67	44,86	43,19	44,47	59,09	54,85	54,80
Claudius Hoop	CP9	44,57	44,50	44,54	45,00	45,57	44,43	44,70	44,50	43,83	44,46	47,51	66,16	-	66,25	58,95	-
Claudius Hoop	CP10	44,20	44,00	43,90	44,32	44,62	43,57	43,79	44,20	43,69	42,13	45,81	-	-	-	-	63,96
Combro	CO5	44,08	47,60	45,13	49,44	49,37	48,57	47,13	48,00	35,11	34,78	33,06	33,95	35,71	37,71	43,00	-
Combro	CO11	27,51	27,77	28,31	28,41	28,37	26,66	25,82	25,91	21,89	20,82	21,14	23,20	24,38	24,85	25,35	-
Dedimus	DS3	37,60	37,60	37,62	37,93	37,80	37,24	37,09	37,92	34,05	32,14	30,00	30,66	31,47	34,50	33,07	-
Duitschland	DD3	32,60	33,70	32,37	33,27	32,77	31,88	31,63	32,34	20,94	16,26	18,24	15,53	17,59	18,91	20,86	20,31
Duitschland	DD6	26,90	25,53	25,17	26,75	35,05	34,95	34,89	29,88	23,02	17,48	23,08	30,37	33,39	44,58	47,31	43,56
Duitschland	DD8	18,44	18,48	18,94	18,97	18,90	18,74	18,47	18,92	15,83	-	-	13,61	15,03	16,14	17,26	-
Duitschland	DD9	25,80	25,45	25,51	25,67	25,60	25,16	25,07	25,71	22,98	19,20	19,33	21,48	24,54	26,94	27,97	28,00
Geluksfontein	GN1	26,05	26,85	26,97	27,17	27,24	25,90	25,74	25,80	-	-	-	-	-	36,59	37,07	37,00
Geluksfontein	GN9	14,04	14,75	14,99	15,22	15,16	12,28	13,18	11,55	-	-	-	11,23	13,84	17,00	18,57	19,11
Geluksfontein	GN13	16,55	17,85	17,33	17,02	16,65	15,90	16,27	16,06	11,55	8,12	9,87	16,33	17,13	21,56	20,78	28,74
Geluksfontein	GN19	16,75	17,05	17,18	17,90	17,57	15,56	15,62	15,30	-	12,25	14,36	14,68	15,86	15,87	18,40	18,66
Geluksfontein	GN23	19,35	19,25	19,36	19,54	19,45	15,69	16,02	16,50	16,85	15,13	16,11	16,49	17,81	18,32	18,53	18,76
Groothoek	GK7	31,24	31,22	31,17	31,33	31,27	30,87	30,74	31,26	26,03	26,11	26,76	28,76	30,00	31,44	32,89	-
Groothoek	GK11	44,30	44,62	44,77	45,64	45,95	44,98	44,67	44,82	44,31	43,46	44,11	-	-	-	-	59,66
Inderhiken	IN1	25,10	24,72	24,91	25,07	25,08	24,98	24,77	25,13	23,27	22,61	21,89	22,57	22,94	23,27	23,64	23,92
Inderhiken	IN3	20,80	21,10	23,50	22,22	20,84	21,42	21,39	21,62	-	-	-	22,77	24,25	24,74	25,83	-
Klein Collie	KE9	25,90	26,40	27,86	28,98	28,86	25,50	28,75	29,20	27,96	23,48	26,46	-	33,62	36,75	37,76	-
Kraaifontein	KN5	31,64	30,80	30,23	30,19	30,19	28,98	28,18	27,98	22,05	19,79	22,32	24,86	27,70	32,00	31,74	31,49
Kraaifontein	KN6	32,06	31,23	30,65	30,61	30,63	29,15	28,60	28,65	22,08	22,28	22,81	25,34	28,17	32,46	32,18	32,62
Nimmersault	NT7	39,58	39,60	39,65	39,87	39,88	38,83	39,51	40,27	39,83	38,21	39,77	40,61	41,66	43,82	45,86	-
Nimmersault	NT8	41,53	41,47	41,63	41,90	41,80	40,93	41,56	41,89	40,69	40,17	41,96	42,76	43,90	-	47,83	-
Patryspan	PN4	67,02	65,90	68,74	71,45	71,82	67,02	66,63	71,24	-	-	-	78,11	80,33	84,67	-	-
Patryspan	PN9	52,30	51,22	54,98	58,62	58,82	52,91	52,15	53,12	69,34	-	-	63,63	68,10	70,42	69,25	-
Potsdam	PM7	27,58	28,06	28,10	28,29	28,10	28,07	27,40	27,68	26,88	25,37	24,63	26,56	28,04	29,36	31,30	-
Potsdam	PM18	23,75	24,86	24,16	25,62	27,95	27,85	24,09	24,93	22,03	21,75	24,85	24,64	32,84	37,94	40,72	-
Potsdam	PM21	20,64	21,10	21,08	20,76	20,67	20,27	20,09	20,69	-	-	-	17,70	18,42	23,85	25,40	-
Redhill	RL4	43,76	44,65	44,53	44,92	45,41	43,63	44,35	44,60	43,80	45,14	46,01	48,24	49,00	51,81	52,81	55,54
Redhill	RL7	47,27	47,72	47,20	47,23	47,19	46,83	47,18	46,74	45,72	-	-	49,72	50,72	52,58	53,94	54,57
Redhill	RL10	47,30	47,70	47,43	47,42	47,40	46,59	47,38	47,40	46,83	47,07	47,92	49,11	50,01	52,58	53,52	-
Rooikop	RP4	43,92	44,60	44,65	44,94	45,64	43,82	44,61	44,82	44,61	45,48	47,65	48,44	49,35	52,74	55,60	-
Rooikop	RP6	35,58	35,84	36,10	36,33	37,29	35,47	35,48	35,68	34,83	35,89	36,86	37,58	38,22	41,92	42,41	42,55
Soho	SO5	44,70	45,00	45,00	45,23	45,25	45,34	45,43	45,89	46,45	44,36	45,61	49,14	51,87	-	85,37	-
Soho	SO9	64,30	64,72	64,75	65,04	64,68	64,68	64,80	65,01	-	-	-	80,20	-	84,01	85,95	-
Tweefontein	TN8	15,63	15,87	16,06	17,57	16,23	15,46	14,96	16,41	9,81	9,14	9,24	10,86	12,37	14,86	16,31	17,36
Tweefontein	TN11	11,72	12,33	12,30	12,57	12,71	11,90	11,55	12,31	8,57	5,48	6,43	7,95	8,88	11,69	11,35	-
Tweefontein	TN14	27,40	26,72	26,63	26,67	26,63	26,15	25,90	26,40	21,37	20,78	20,53	30,00	31,54	35,62	-	34,54
Waldbrug	WG11	18,88	19,46	19,55	19,97	20,16	18,05	17,89	18,23	-	13,46	15,17	19,37	21,62	20,99	20,87	21,98
Waldburg	WG13	31,92	39,66	36,75	36,52	40,47	31,30	32,68	31,05	25,32	20,86	23,65	22,96	25,48	31,03	37,22	-
Waldburg	WG14	32,35	38,84	36,10	35,95	42,72	30,06	33,52	32,52	24,05	19,95	23,99	24,44	25,52	29,76	37,76	-
Westheim	WM1	31,12	31,14	33,64	34,08	33,54	31,38	28,15	32,95	22,85	24,52	23,58	27,00	30,27	34,64	31,48	27,61
York	YK2	48,80	49,07	49,77	51,82	52,19	49,03	48,83	49,27	48,27	-	-	46,15	-	-	-	54,10
Average		31,48	31,85	31,89	32,58	32,95	31,51	31,30	31,69	29,53	25,58	27,19	30,48	29,89	33,22	34,62	35,09

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TABLE 6 DORINGLAAGTE DRAINAGE BASIN: GROUNDWATER LEVELS DURING THE LAST 10 YEARS (1976-86)

(4) The continuous data from the automatic water-level recorder gives a clearer picture of the relationship between rainfall and water-level variations. The groundwater level fluctuations for the automatic recorder on Combro (Figure 10) show a long-term trend very similar to the cumulative departure curve. On a annual basis a trend of fluctuations related to the rainfall season occurs - water levels start rising in October/November and reach a high in May/June. This seasonal variation may be as much as 4 m. Usually the rise in water-levels after the start of the rainfall season is almost instantaneous, but is of a slower rate than the drop in water-level at the end of the rainfall season. Water-levels appear to continue rising up to 2 months after the end of the rainfall season, but drop quite dramatically thereafter.

4.4 Groundwater quality

Chemical analyses of water samples were undertaken during 1976, while only conductivity measurements were made in 1986. Nine boreholes were sampled during both periods. All of the boreholes showed a decrease in quality over the 10 year period, with an average increase in conductivity from 91,5 mS/m to 133 mS/m (see Table 10). The decrease in groundwater quality appears related to abstraction rate. Three farms with slight increases in abstraction since 1976 (Baviaanspoort, Combro and Dedimus) have smaller decreases in quality than the farms Duitschland, Potsdam and Kraaifontein all of which have doubled their groundwater abstraction since 1976. Bloemetjiesvlei which has had a ten-fold increase in abstraction has the worst deterioration in groundwater quality.

5. EVALUATION OF GROUNDWATER POTENTIAL

5.1 Total groundwater storage

In calculating the aquifer storage one must take into account the existence of two interlinked aquifers. The top aquifer, consisting of weathered granites (s = 0,01), grades into the lower fractured granite aquifer (s = 0,0025). Geophysics and drilling have shown that the contact between the two aquifers is between 35 - 50 m while at depths of over 120 m little or no further groundwater occurs. Based on these assumptions plus a present average catchment water level of 43 m, the total volume of groundwater in storage for the Doringlaagte catchment is:

Storage = Area x thickness of aquifer x s (for each aquifer)
= $(509.10^6 m^2 \times 7m \times 0,01) + (509.10^6 m^2 \times 70m \times 0,0025)$
= $35,63.10^6 m^3 + 89,07.10^6 m^3$
= $124,7.10^6 m^3$

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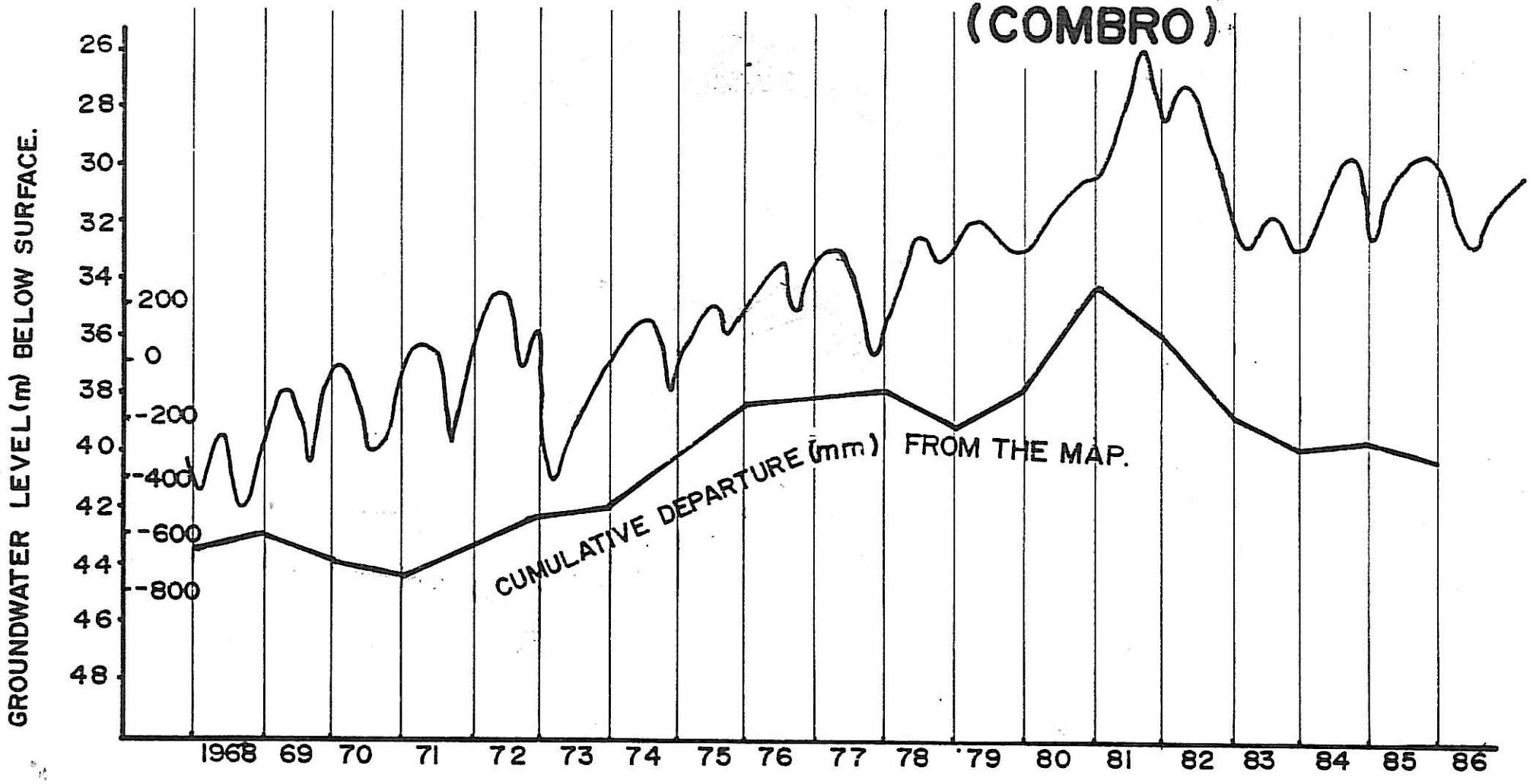
TABLE 10: DORINGLAAGTE DRAINAGE BASIN - GROUNDWATER ELECTRICAL CONDUCTIVITY (1976-1986)

Farm	Borehole number	Electrical conductivity (mS/m) 1976	1986
Baviaanspoort	6	68	100
Bloemetjiesvlei	15	41	110
Combro	6	105	130
Combro	7	95	120
Dedimus	3	90	110
Duitschland	11	85	170
Kraaifontein	10	90	150
Potsdam	41	140	170
Potsdam	28	110	140
Average		91,5	133,3

GROUNDWATER LEVELS: AUTOMATIC RECORDER A7N529. (COMBRO)



DEPT. VAN WATERWESE DIREKTORAAT GEOHIDROLOGIE		DEPT. OF WATER AFFAIRS DIRECTORATE GEOHYDROLOGY	
TITEL TITLE	FIGURE 10		
GETEKEN DRAWN	DAT.	NAGESIEN CHECKED	DAT.
NAGETREK TRACED	DAT.	VERSLAG No REPORT No.	GHP No.

Ozalid 86/378

5.2 Recharge estimates

(a) Previous calculations

Dziembowski, using calculations based on rates of water level rise and fall for different annual rainfall totals, calculated an annual recharge from rainfall of 3,8% of MAP. He stated that this was possibly an over-estimate.

Enslin (1970) devised a set of curves showing recharge percentage against rainfall total. For a MAP of 353 mm (Dendron area) the calculated recharge is 2,6% of the MAP.

(b) Water balance method

For any system the change in the volume of groundwater stored is related to the inputs and outputs in the system. For the granite aquifer, Input - Output = Change in storage, where the inputs are

(1) Recharge from rainfall
(2) Irrigation return flow (20% of irrigation)
(3) Groundwater inflow

and outputs are

(1) Groundwater abstraction
(2) Groundwater outflow
(3) Capillary evaporation (minimal)

Calculations for the groundwater inflow and outflow for the aquifer show that they are almost equal. For this reason they have been ignored from the estimate of recharge percentage. Soil moisture storage was not taken into account since the volume of moisture in storage was assumed to be fairly constant before each rainfall season.

For the period 1981-1986 the calculation of recharge is as follows:

CHANGE IN STORAGE

Change in storage = water level drop x area x storage coefficient

$$= -10 \text{ m}.509 \times 10^6 \text{ m}^2 \times 1\%$$
$$= -5{,}09.10^7 \text{ m}^3$$

INPUTS

(1) Recharge from rainfall

= Total rainfall from 1981-86 (1 215 mm) x area x % recharge

= % recharge x $6{,}18.10^8$ m^3

(2) Irrigation return flow = total irrigation volume x 20%
15.10^6 m^3 x 6 years x 20%
= 18.10^6 m^3

OUTPUTS

(1) Abstraction = 9.10^7 m^3 (1981 - 1986)

(Rainfall volume x % recharge) + (irrigation return flow) - (abstraction) = Change in storage

∴ (Rainfall volume x % recharge) + (18.10^6 m^3) - (9.10^7 m^3) = $5,09.10^7$ m^3

(% recharge x $6,18.10^8$ m^3) = 22.10^7 m^3

i.e. recharge = 3,5% of the rainfall for the period 1981 - 86 (the rainfall averaged 243 mm/year)

(c) Static water-levels

In the dry season abstraction will result in a lowering of the water table. If, after the rainfall season, water levels return to their pre-rainfall level then theoretically the rainfall recharge plus the irrigation return flow must equal the abstraction.

During the period July '78 - July '79 water levels at the Combro recording station were the same before and after the rainfall season. If conditions on Combro are taken to be representative of the whole catchment then the water-level fluctuations can be compared to conditions for the whole catchment.

Since abstraction should equal recharge then;

Abstraction = Irrigation return flow + rainfall recharge

12.10^6 m^3 = $2,4.10^6$ m^3 + (239.10^6 m^3 x % rainfall recharge)

i.e. % recharge = 4% of rainfall (470 mm)
Similar calculations were made for the periods;

1969 - 1970: 5,5% rainfall recharge
1970 - 1971: 4,3% rainfall recharge
1984 - 1985: 7,8% rainfall recharge

Up until 1976 Combro had groundwater abstractions typical for the whole catchment. However since then abstraction on Combro is low compared to average catchment conditions - the calculate recharge % for 1984-1985 is therefore an overestimate and should be about 4-5%.

(d) Change in water levels

Figure 11 shows the changes in water levels in the vicinity of Dendron, from 1985-1986. During this period the decrease in ground-water storage over the 7 farms (137.10^6 m^2) was $1,2.10^6$ m^3. During the same time the abstraction was $3,0.10^6$ m^3 and the irrigation return flow was $0,5.10^6$ m^3. The percentage of rainfall recharge can therefore be calculated from:

Change in ground-water storage = rainfall recharge + irrigation return flow - abstraction

$- 1,2.10^6$ m^3 = (% recharge x $43,3.10^6$) + ($0,5.10^6$) - $3,2.10^6$)

i.e. % recharge from rainfall = 3,8% of the yearly rainfall (316 mm)

Out of all the methods used the results from sections (b) and (c) are probably the most reliable. Based on these two it would appear that the percentage of rainfall recharged is in the vicinity of 4% of the MAP.

5.3 Depletion and replenishment rates

Considering that storage is $124,7.10^6$ m^3 while present abstraction is 21.10^6 m^3/year with recharge calculated at 4% of the MAP, plus 20% of irrigation, then the lifespan of the aquifer is: Storage - (abstraction - rainfall recharge - irrigation recharge).

Lifespan = $124,7.10^6$m^3-(21.10^6m^3/year - $7,2.10^6$m^3/year - $4,2.10^6$m^3/year)

= $124,7.10^6$ m^3 - $9,6.10^6$ m^3/year
= 12,9 years

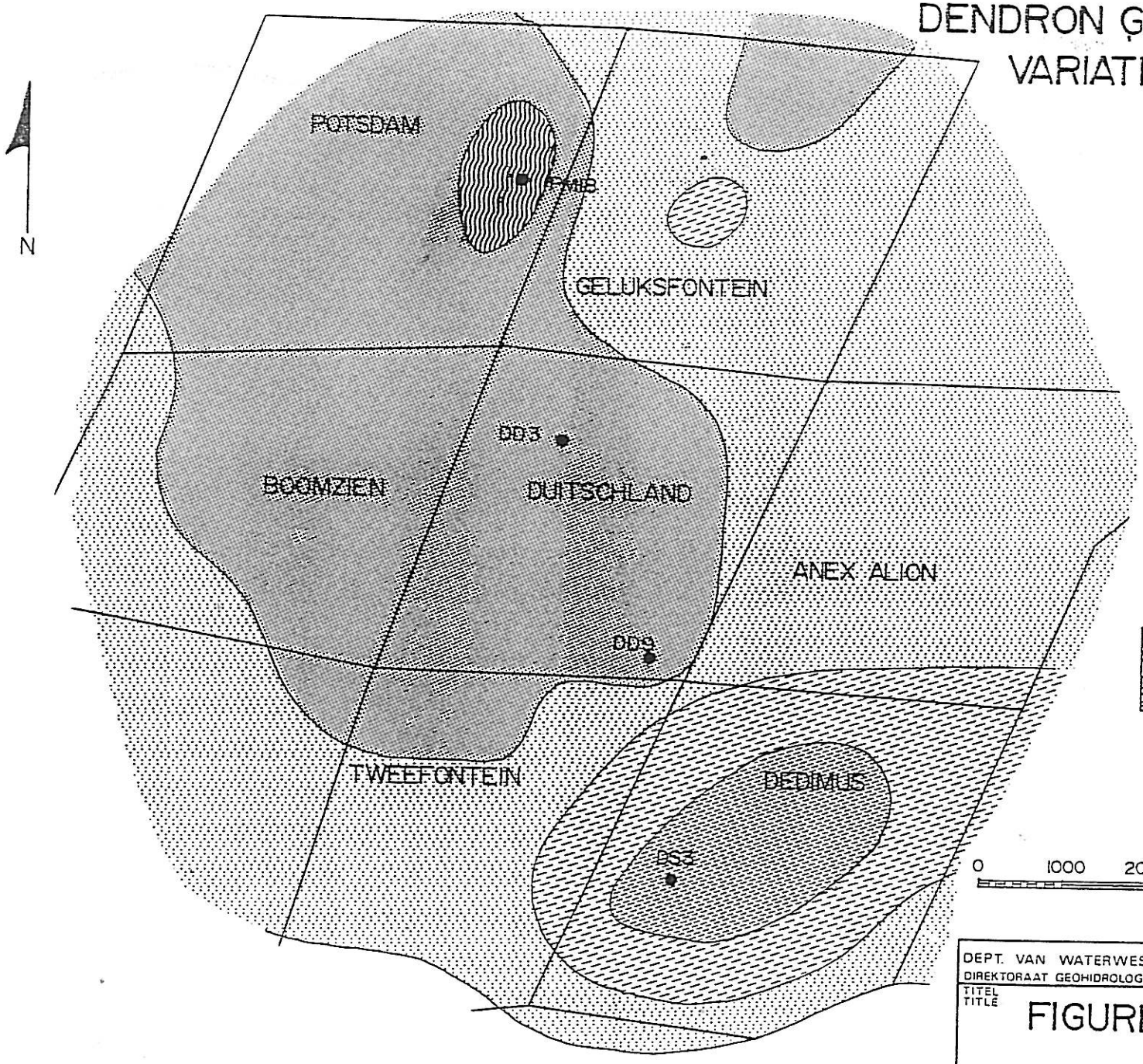
In order to recharge the aquifer and return water-levels to the 1980/81 levels (rise of 10 m) then a storage volume of $50,9.10^6$ m^3 must be replenished. At present abstraction and recharge rates it would require 5 years of rainfall at 1 035 mm/year.

In order to stop any further decline in the water table under present abstraction conditions a yearly rainfall of 834 mm is required (a 1 in 150 year event).

5.4 Safe Yield

The safe yield of an aquifer is defined as the maximum continuous supply which can be obtained from an aquifer without causing any undesirable effects. For the Dendron area the safe yield would be the yield resulting for conditions when the abstraction equals the recharge. For MAP conditions (353 mm) and a 4% rainfall recharge. This recharge volume would be $7,2.10^6$ m^3/year. If a 20% irrigation return flow is taken into account the volume of water abstraction could be increased to a safe yield of $8,6.10^6$ m^3/year.

DENDRON GROUNDWATER VARIATIONS 1985-1986



DEPT. VAN WATERWESE
DIREKTORAAT GEOHIDROLOGIE

DEPT. OF WATER AFFAIRS
DIRECTORATE GEOHYDROLOGY

TITEL
TITLE

FIGURE 11

GETEKEN: DRAWN	DAT	NAGESIEN CHECKED	DAT
NAGETREK TRACED	DAT	VERSLAG NO REPORT NO.	GHP No.

5.5 Discussion

Discussion so far have shown that the groundwater abstraction is nearly 2,5 times greater than the safe yield for the area. Groundwater levels have, since 1981, dropped at an average rate of 2 m/year. As water levels drop below the weathered granites into the zone of fractured granites this rate of drop will increase drastically. If abstraction rates remain constant then the expected life span of the aquifer is in the order of 13 years. At present only rainfall of over 834 mm/year (1:150 year event) can stop the drop in water level. This is shown more clearly on the aquifer lifespan nomogram (Figure 12). This nomogram allows the calculation of the aquifer lifespan based on conditions prevailing over the last year. If the yearly rainfall total, yearly abstraction total (for the whole catchment) and the existing average water-levels are known then the aquifer lifespan can be calculated. By following the arrows from a MAP of 353 mm, via an abstraction of 21.10^6 m^3/year and then via a water level of 43 mm a lifespan of 13 years is arrived at. To calculate what rainfall is required to replenish the aquifer, one starts at the aquifer replenishment line, working from a known abstraction of 21.10^6 m^3/year, via a 4% recharge rate to a rainfall of 834 mm. If a 10% recharge rate was used for the same abstraction rate then a year rainfall of 340 mm is required to replenish the aquifer. It appears therefore that increasing the percentage of rainfall recharge is the best way to replenish the aquifer, thus stopping the drop in water levels (see Appendix I).

Figure 13 shows the effect of water levels dropping below the weathered granite zone. As water levels drop (for a constant abstraction rate) so the rate of water level drop increases. It is therefore important to stop the water level from dropping below the weathered zone.

6. CONCLUSIONS

Data from the borehole and irrigation survey has been analysed and results show a total ground-water abstraction during 1985-86 of 21.10^6 m^3. This greatly exceeds the aquifer's safe yield of $8{,}6.10^6$ m^3/year, with the result that water-levels have declined rapidly. Since the heavy rains of 1980-81 the rate of water level decline has been 2 m/year. At present water-levels are fast approaching the weathered granite/fractured granite contact - once water levels drop below this contact the water level decline will increase dramatically. On some farms this has already occurred. At present abstraction rates the lifespan of the aquifer is approximately 13 years. To increase the aquifer life span it is necessary to either

(a) decrease abstraction rates, or

(b) to increase rainfall recharge from 4% to 10%. With the use of artificial recharge projects (spreading ponds, infiltration dams etc) this is possible.

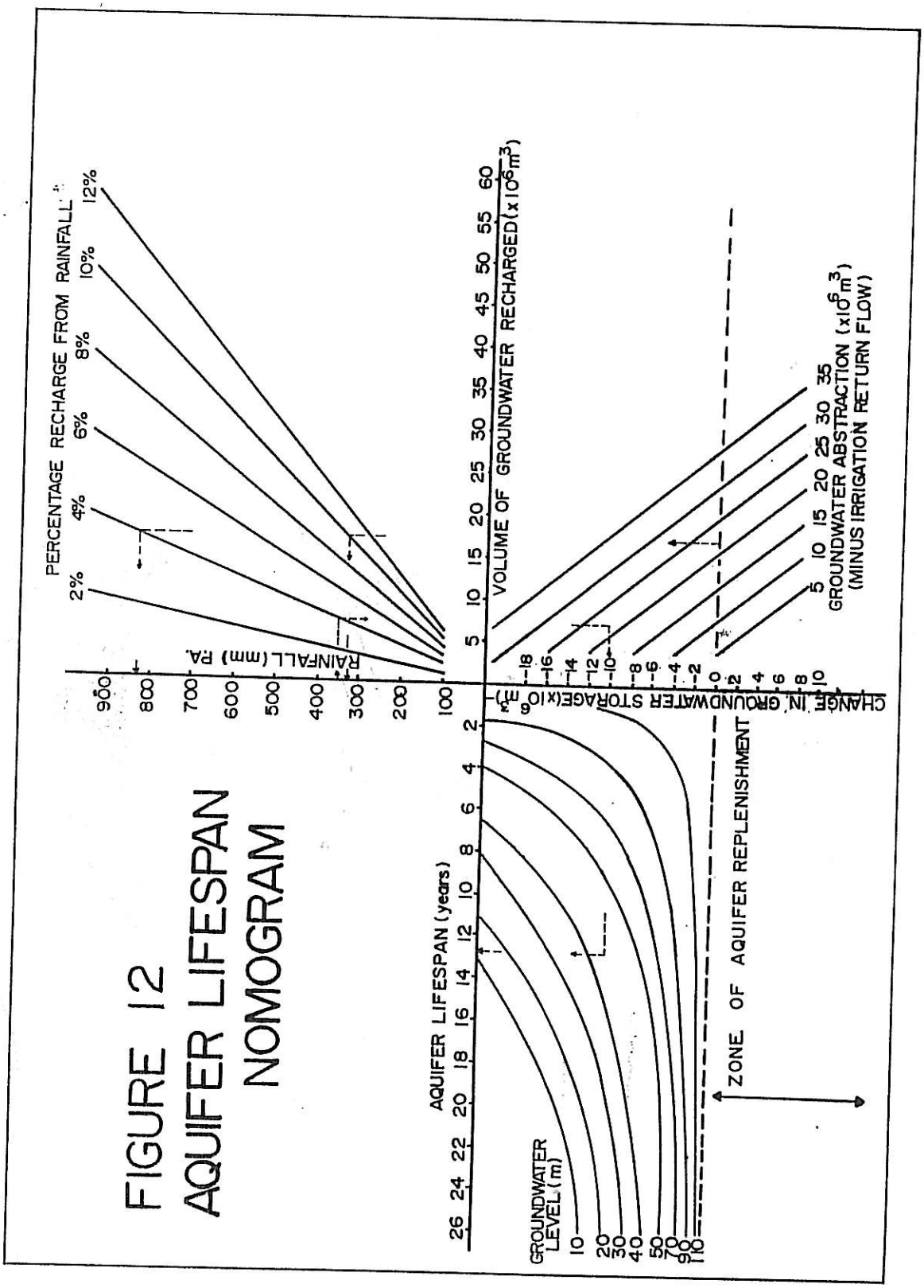


FIGURE 12
AQUIFER LIFESPAN
NOMOGRAM

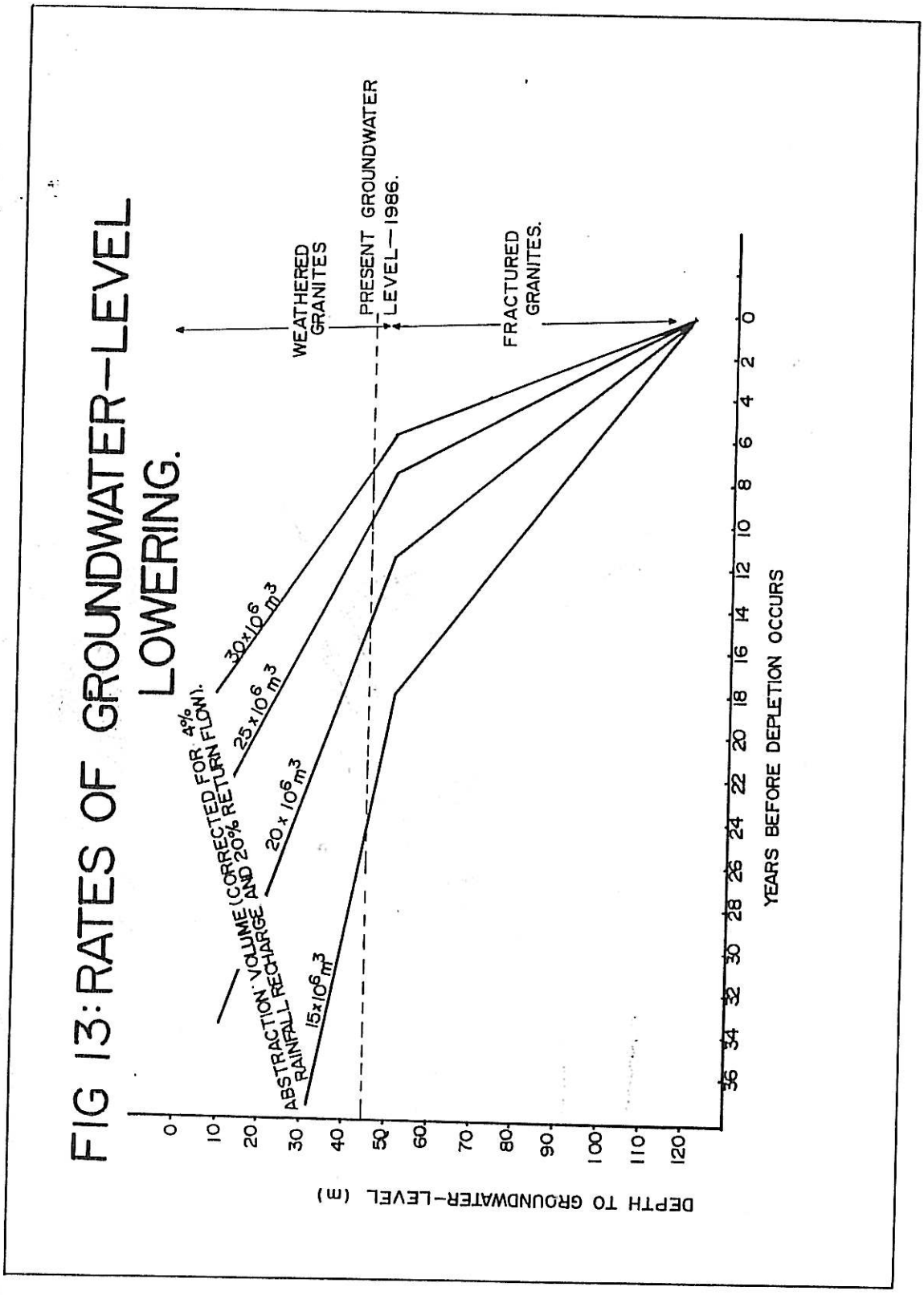


FIG 13: RATES OF GROUNDWATER-LEVEL LOWERING.
WEATHERED GRANITES
PRESENT GROUNDWATER LEVEL—1986.
FRACTURED GRANITES.
ABSTRACTION VOLUME (CORRECTED FOR 4% RAINFALL RECHARGE AND 20% RETURN FLOW).
30x10⁶ m³
25x10⁶ m³
20x10⁶ m³
15x10⁶ m³
DEPTH TO GROUNDWATER-LEVEL (m)
YEARS BEFORE DEPLETION OCCURS

6.1 Recommendations

It is therefore recommended that for their own good the farmers must try and decrease their groundwater abstraction volume, and they must make a concerted effort to increase the recharge of rainfall to the aquifer. Without this action it is estimated that the water-levels in the Dendron area will (at present abstraction rates) drops to a depth of 120 m by 1998 (13 years time). If this should occur borehole yields will be low, storage minimal and costs of groundwater abstraction will be prohibitive. A serious attempt must be made to stabilize the water-level decline before the water-level drops into the low storage zone of fractured granites. A Management Committee should be formed to monitor all water levels over the next few years and to help in starting artificial recharge projects. This Committee should after 2 years be able to formulate a management model which could be used to control and advise on abstraction-drawdown relationships for each farm.

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APPENDICES

APPENDIX A	–	BOREHOLE AND IRRIGATION SURVEY
APPENDIX B	–	CROP AND GROUNDWATER ABSTRACTION DATA
APPENDIX C	–	IRRIGATION AND HYDROGEOLOGICAL DATA
APPENDIX D	–	GROUNDWATER LEVELS ABOVE SEA LEVEL
APPENDIX E	–	EVAPORATION AND RAINFALL DATA
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APPENDIX G	–	GRAPHS OF WATER LEVELS (1976-86)
APPENDIX H	–	DEPTHS OF WEATHERING
APPENDIX I	–	ARTIFICIAL RECHARGE ON THE FARMS POTSDAM AND GELUKSFONTEIN (STUDY PROPOSAL)

APPENDIX A

BOREHOLE AND IRRIGATION SURVEY

WATER USE

I	:	Irrigation
D	:	Domestic
S	:	Stock
M	:	Municipal

TYPE OF PUMP

W-P	:	Wind pump
Subm	:	Submersible
Mono	:	Mono

APPENDIX B

CROP AND GROUNDWATER ABSTRACTION DATA

APPENDIX C

IRRIGATION AND HYDROGEOLOGICAL DATA

APPENDIX D

GROUND-WATER LEVELS ABOVE SEA LEVEL

APPENDIX E

EVAPORATION AND RAINFALL DATA

RAINFALL STATION 721/618 (WALDBURG)

YEARLY RAINFALL (OCTOBER - SEPTEMBER)

Year	Rainfall (mm)	Year	Rainfall (mm)	Year	Rainfall (mm)
1919-1920	346,2	1947-1948	555,9	1975-1976	448
1920-1921	301,7	1948-1949	403,6	1976-1977	395
1921	309,1	1949	412,0	1977	470
1922	277,1	1950	516,7	1978	231
1923	342,7	1951	418,6	1979	504
1924	443,7	1952	456,0	1980	702
1925	327,7	1953	399,8	1981	211
1926	179,7	1954	550,4	1982	61
1927	237,1	1955	428,3	1983	234
1928	224,2	1956	398,6	1984	393
1929	257,4	1957	179,9	1985	316
1930	278,3	1958	388,5		
1931	308,1	1969	332,1		
1932	273,1	1960	425,7		
1933	209,1	1961	300,0		
1934	250,3	1962	349,5		
1935	316,4	1963	222,0		
1936	521,6	1964	120,2		
1937	251,6	1965	221,7		
1938	533,0	1966	435,5		
1939	595,7	1967	270,4		
1940	557,3	1968	423,6		
1941	322,5	1969	292,4		
1942	333,7	1970	310,3		
1943	335,0	1971	462,5		
1944	186,6	1972	475,3		
1945	-	1973	388,8		
1946	-	1974	539,0		

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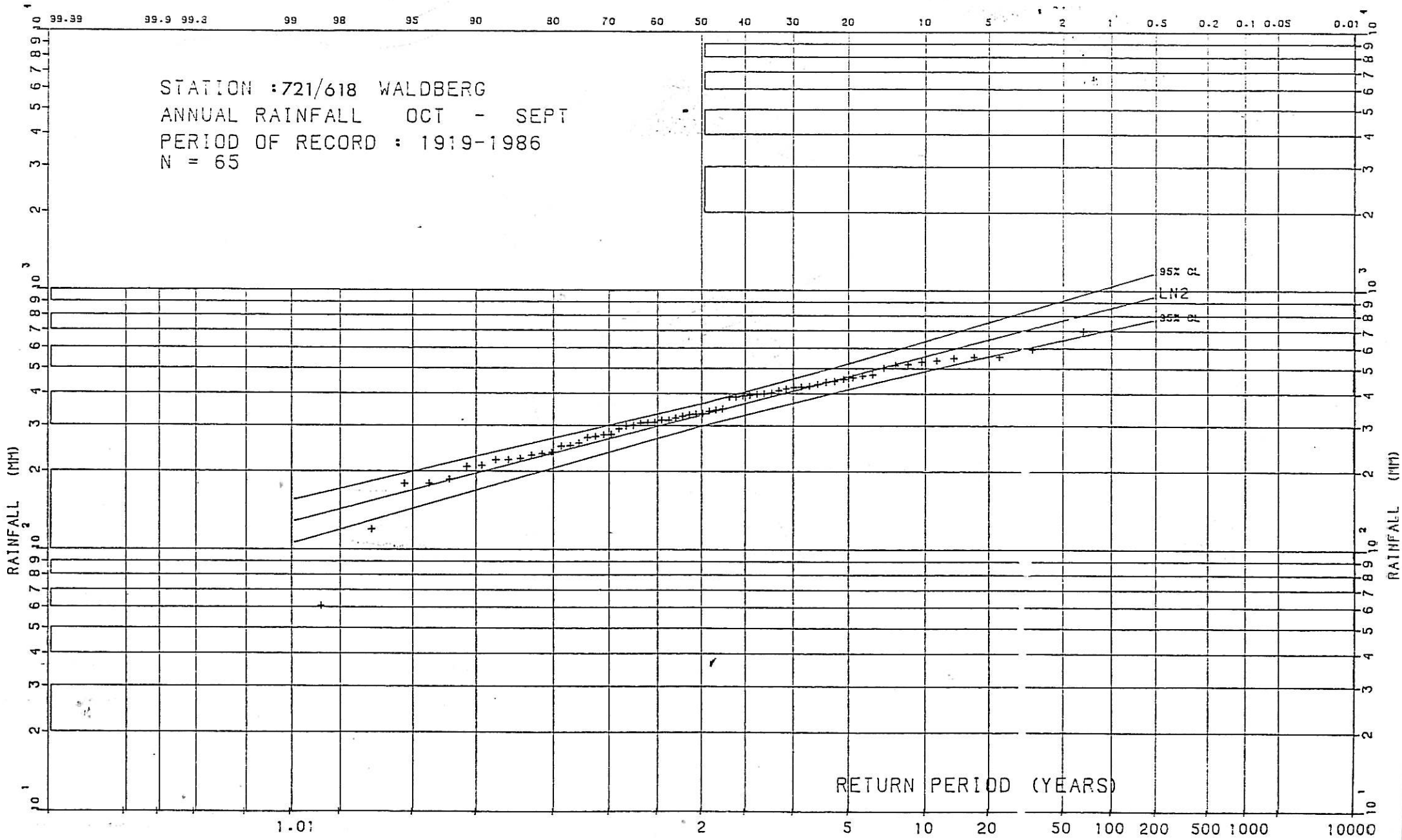
RAINFALL STATION 721/618 (WALDBURG)

(all values in mm)

YEAR	J	F	M	A	M	J	J	A	S	O	N	D	MAP*
1919							0	0	0	0,8	57,1	27,3	346
1920	62,4	152,2	45,5	0,3	0	0	0,3	0,3	0	68,0	50,8	8,9	301
1921	37,9	57,0	54,4	13,0	11,4	0	0,3	0	0	46,1	98,7	47,0	309
1922	23,9	-	72,9	0	3,3	4,0	0	13,2	0	17,8	24,8	43,8	277
1923	140,4	32,4	17,3	0,3	0,3	0	1,1	0	0	0	25,2	123,0	342
1924	79,7	23,7	63,9	0	27,2	0	0	2,8	7,2	16,6	119,7	96,1	443
1925	40,0	31,8	115,9	12,2	-	0,3	1,1	0	45,9	22,4	-	19,0	327
1926	26,2	77,5	36,1	13,4	40,5	0	47,0	0	0	0	49,1	24,9	179
1927	33,6	22,9	21,1	20,1	6,4	0	21,3	0	3,8	83,1	14,0	21,4	237
1928	41,3	47,5	20,2	5,8	0	0	0	0	0	0	92,0	6,6	224
1929	38,5	39,9	38,1	9,1	0	0	0	0	10,7	19,1	27,4	28,7	257
1930	51,3	52,1	25,2	42,9	0	5,6	-	-	0	0	0	53,8	278
1931	33,8	-	55,8	68,6	0	0	66,3	-	13,5	29,0	34,1	-	308
1932	64,8	34,3	63,2	37,8	31,4	0	0	0	0	39,2	-	72,6	273
1933	144,8	0	16,5	0	0	0	0	0	0	5,6	115,8	33,5	209
1934	36,3	7,6	10,5	0	0	0	0	0	7,1	31,8	45,0	41,1	250
1935	52,9	15,5	35,6	9,9	10,4	0	0	0	1,3	0	6,4	45,2	316
1936	126,4	47,7	78,9	4,1	4,1	1,3	1,0	0	10,4	8,4	66,9	117,3	521
1937	146,1	117,6	49,8	5,1	0	0	0	0	16,1	7,9	35,6	105,9	251
1938	22,1	42,4	21,6	0	0	0	0	0	41,2	107,7	0	108,2	533
1939	145,8	52,7	57,7	0	2,5	0	17,2	0	85,2	0	204,3	36,3	595
1940	32,0	97,8	67,7	36,8	0	35,6	0	0	3,8	18,5	126,2	180,5	557
1941	13,5	63,3	75,9	75,6	0	0	0	0	0	6,1	39,4	34,8	322
1942	25,4	11,5	164,2	0	41,1	0	0	0	0	20,8	38,1	19,6	333
1943	79,0	16,8	69,5	54,0	12,7	0	23,2	0	0	10,2	57,1	56,3	335
1944	67,4	106,9	22,4	7,1	0	7,6	0	0	-	50,3	-	25,4	186
1945	30,8	62,5	6,4	7,6	0	0	3,6	-	19,8	-	0	-	-
1946	-	-	-	-	-	-	-	-	-	-	-	-	-
1947	-	41,4	19,8	6,8	0	5,3	0	0	12,9	15,5	81,3	168,4	555
1948	66,9	86,5	85,8	18,8	0	0	0	0	13,9	55,1	37,9	45,2	403
1949	143,2	46,8	2,5	57,2	0	1,8	0	0	0	6,1	72,4	97,8	412
1950	88,4	14,2	0	74,7	58,4	0	0	0	0,8	7,4	42,9	120,6	516
1951	18,0	4,4	129,4	110,8	82,4	0	0	40,1	1,5	100,3	48,3	93,9	418
1952	13,4	46,8	25,4	27,9	0	21,0	0	0	4,8	19,9	51,2	82,6	456
1953	-	208,5	29,0	60,0	0	0	10,1	0	0	1,5	96,3	63,0	399
1954	140,0	62,5	0	34,0	2,5	0	0	0	0	0	69,1	75,5	550
1955	66,5	272,5	54,0	5,5	0	0	0	7,3	0	81,5	73,5	85,5	428
1956	6,0	120,0	11,5	25,0	15,5	9,8	0	0	4,5	8,5	32,5	96,5	398
1957	40,5	127,0	9,5	58,5	0	12,0	9,5	0	0	55,0	18,0	91,0	179
1958	-	15,5	0	0	0,2	0	0,2	0	36,0	41,0	21,7	190,0	388
1959	2,0	83,8	12,0	2,0	0	0	0	4,0	3,5	13,1	40,5	62,5	332
1960	16,5	64,0	86,5	32,5	0	9,0	0	0	0	14,5	49,0	102,7	425
1961	67,0	135,5	23,0	34,0	0	0	0	12,0	0	3,0	59,5	38,5	300
1962	31,0	24,0	53,5	90,5	0	0	0	0	-	3,5	91,0	78,0	349
1963	33,5	0	32,0	55,0	11,0	45,5	6,5	0	0	18,5	1,5	42,0	222
1964	78,5	70,0	0	11,5	0	0	0	0	0	25,7	32,5	45,5	120
1965	7,5	9,0	0	0	0	0	0	0	0	0	108,7	33,5	221
1966	35,0	44,5	0	0	0	0	0	0	0	5,0	48,5	30,0	435
1967	212,5	55,0	44,5	40,0	0	0	0	0	0	12,5	83,5	13,4	270
1968	29,0	31,5	28,5	41,0	19,0	12,0	-	0	0	0	0	122,0	423
1969	36,8	12,0	215,5	30,0	0	0	0	0	7,3	45,8	72,6	83,7	292
1970	0	44,5	0	0	0	11,0	6,0	0	0	3,0	34,5	127,0	310
1971	29,8	0	43,0	27,0	46,0	0	0	0	0	79,0	16,0	73,0	462
1972	162,5	50,2	47,1	22,7	12,5	0	0	0	11,0	61,6	59,6	117,2	475
1973	47,5	61,4	74,5	42,5	0	0	0	0	52,0	81,1	57,5	103,7	388
1974	65,0	15,5	14,0	0	0	0	21,0	0	50,2	0	171,1	63,8	539
1975	143,7	62,7	12,0	34,5	0	0	0	0	0	0	27,5	173,7	448
1976	11,0	110,0	113,6	13,0	0	0	0	0	0	10,5	79,5	34,5	395
1977	102,0	79,5	72,1	9,0	8,0	0	0	0	78,0	10,0	0	149,5	470
1978	202,9	0	29,7	0	0	0	0	0	0	0	62,6	31,0	231
1979	43,0	19,5	68,0	7,5	0	0	0	42,7	0	25,5	84,5	91,5	504
1980	125,5	135,0	0	0	0	0	0	0	34,5	27,0	93,5	40,5	702
1981	345,0	65,5	47,0	49,5	0	0	0	0	6,0	10,0	61,5	38,0	211
1982	83,0	0	0	12,5	0	0	0	0	0	19,0	42,5	0	61
1983	0	0	0	55,0	0	11,0	0	0	0	0	41,0	61,0	234
1984	38,0	8,0	86,0	0	0	2,0	18,5	0	10,5	53,5	58,0	9,5	393
1985	97,5	125,5	39,0	0	52,0	0	0	28,0	6,0	53,0	27,0	107,0	316
1986	0	95,0	-	10,10	0								
Average	66,0	57,2	42,0	16,3	7,6	2,9	3,7	2,4	9,1	23,8	54,2	68,6	353,8

MAP*: MEAN ANNUAL PRECIPITATION (OCTOBER-SEPTEMBER)



ANNUAL RAINFALL 1919 - 1985

REFERENCE NO. A7E07
VERWYSINGSNR.

************ COMBRO ************

LATITUDE	23 22 00	BREEDTEGRAAD
LONGITUDE	29 14 00	LENGTEGRAAD
HEIGHT ABOVE MEAN SEA LEVEL IN M	1036	HOOGTE BO GEMIDDELDE SEEVLAK IN M
DATA PROCESSED FOR PERIOD	68/12/18 - 80/01/14	DATA VERWERK VIR DIE PERIODE

GROSS EVAPORATION - SYMONS TANK = S = BRUTO VERDAMPING - SYMONS BAK
GROSS EVAPORATION - 'A' PAN = A = BRUTO VERDAMPING - 'A' PAN

PRECIPITATION = P = NEERSLAG

INCLUDES PERIOD(S) OF NO RECORD = * = BEVAT TYDPERK(E) VAN GEEN REKORD

SCREENED PAN(S) -DATA ADJUSTED / PAN(NE) AFGESKERM -DATA AANGEPAS

FIGURES IN MM / SYFERS IN MM

YEAR JAAR		TOTAL TOTAAL	OCT. OKT.	NOV. NOV.	DEC. DES.	JAN. JAN.	FEB. FEB.	MAR. MRT.	APR. APR.	MAY MEI	JUN. JUN.	JUL. JUL.	AUG. AUG.	SEP. SEP.
1968/69	S	* 1115				201	180	106	117	113	94	*	136	168
	P	* 323				43	29	215	20	9	0	*	0	6
1969/70	S	2102	166	193	220	278	197	200	168	136	92	109	153	190
	P	254	49	15	56	10	67	18	1	0	25	6	0	6
1970/71	S	1961	211	200	218	197	179	209	134	103	93	107	139	173
	P	445	30	53	72	125	13	54	27	61	0	0	0	10
1971/72	S	1752	214	163	204	180	166	122	129	105	95	97	113	164
	P	539	68	177	29	157	55	30	15	7	0	0	0	2
1972/73	S	2002	192	194	258	256	189	183	123	112	89	99	132	176
	P	370	68	70	34	18	33	25	56	0	0	0	0	66
1973/74	S	1683	173	150	164	171	160	175	110	108	97	96	130	150
	P	492	77	79	95	94	29	2	33	9	0	17	0	59
1974/75	S	1739	205	180	172	193	139	157	114	103	84	103	127	164
	P	489	0	126	64	76	60	85	55	15	7	0	3	0
1975/76	S	1699	198	199	192	177	146	128	107	91	87	93	122	159
	P	562	14	26	212	43	87	136	32	12	0	0	0	0
1976/77	S	1849	190	181	233	264	152	133	119	124	96	100	120	138
	P	441	37	65	49	55	56	81	12	4	0	0	0	83
1977/78	S	1741	209	208	155	163	158	160	114	113	87	94	125	157
	P	* 574	15	11	150	215	99	64	15	8	0	0	0	*
1978/79	S	1882	179	180	224	220	187	175	142	120	101	97	110	148
	P	* 302	*	80	8	*	82	63	7	9	5	4	43	3
1979/80	S	* 537	180	161	196									
	P	* 140	28	68	44									
AV/GEM.	S	1832	192	183	203	209	168	159	125	112	92	99	128	162
	P	461	39	70	74	83	55	70	25	12	3	3	4	23
MINIMUM	S	1683	166	150	155	163	139	106	107	91	84	93	110	138
ANN/JRL	P	254	0	11	8	10	13	2	1	0	0	0	0	0
MAX/MAKS.	S	2102	214	208	258	278	197	209	168	136	101	109	153	190
	P	562	77	177	212	215	99	215	56	61	25	17	43	83

ANNUAL MINIMUM AND MAXIMUM ARE CALCULATED FOR COMPLETE YEARS ONLY.

JAARLIKS MINIMUM EN MAKSIMUM WORD SLEGS VIR VOLLE JARE BEREKEN.

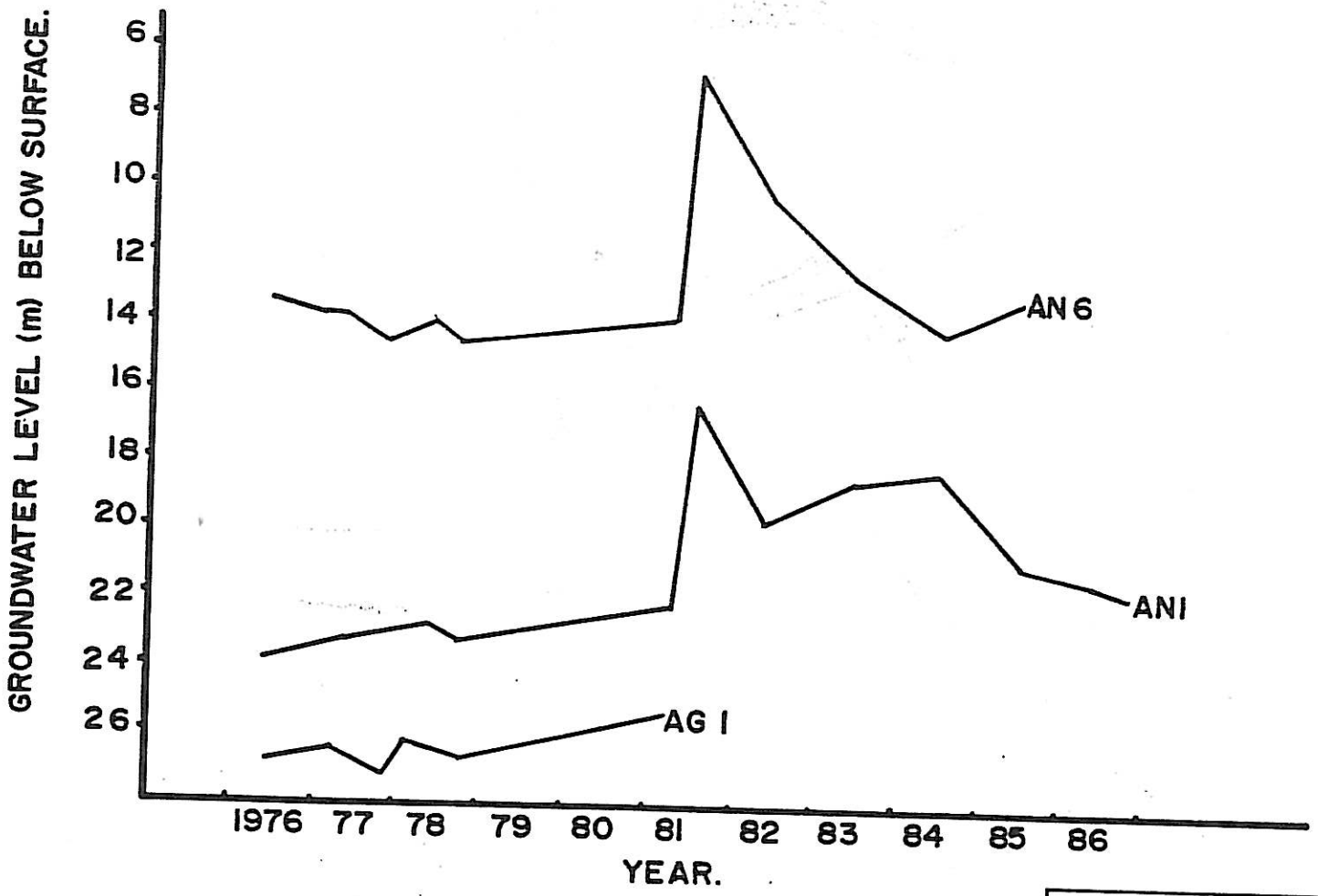
APPENDIX F

GROUNDWATER ELECTRICAL CONDUCTIVITY DATA

APPENDIX G

GRAPHS OF WATER LEVELS
(1976 - 1986)

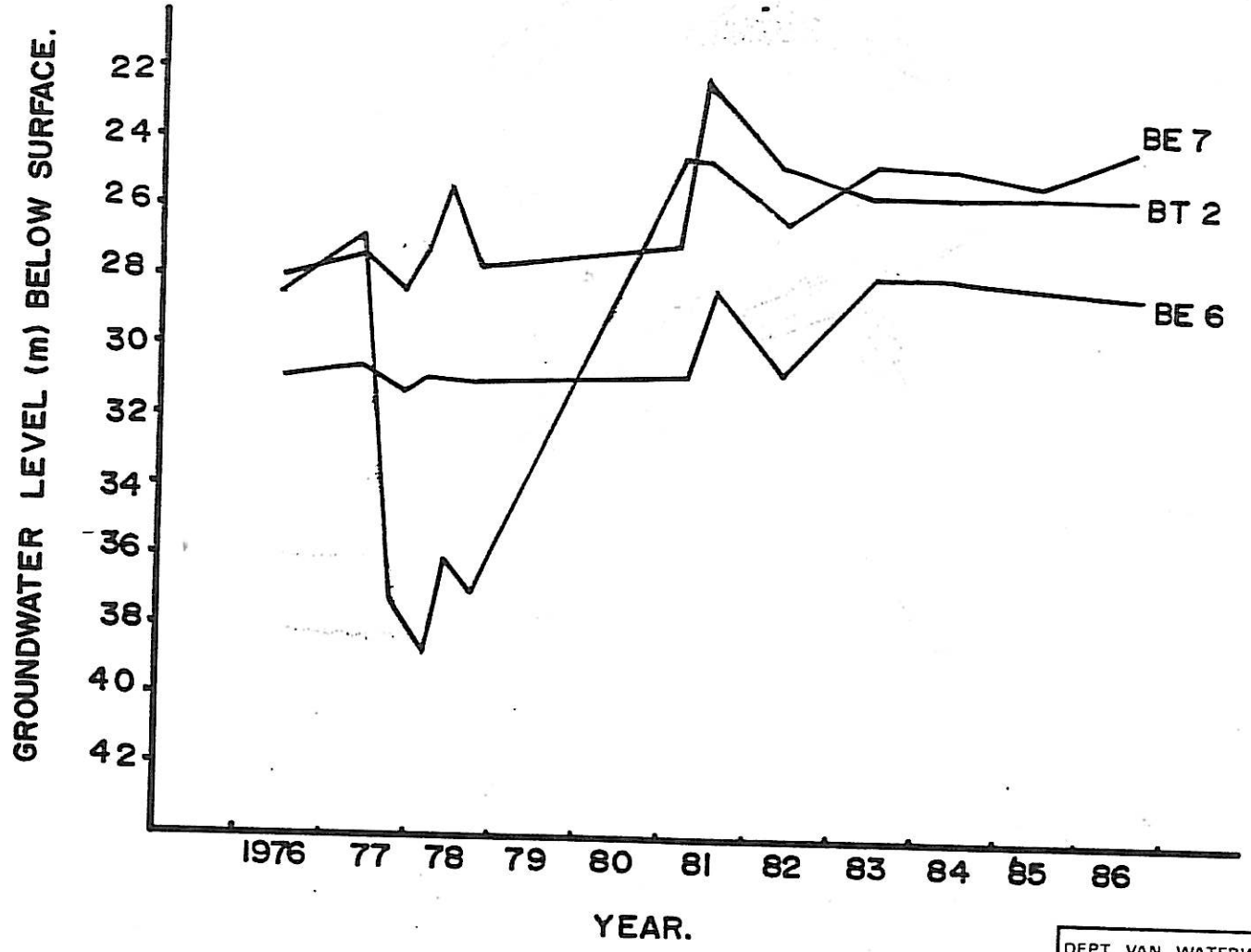
GROUNDWATER LEVELS : ALTENBURG AND ANEX ALION.



DEPT. VAN WATERWESE DIREKTORAAT GEOHIDROLOGIE		DEPT. OF WATER AFFAIRS DIRECTORATE GEOHYDROLOGY	
TITEL TITLE			
GETEKEN DRAWN	DAT.	NAGESIEN: CHECKED	DAT.
NAGETREK TRACED	DAT.	VERSLAG No REPORT No	GHP No.

Ozalid 86/378

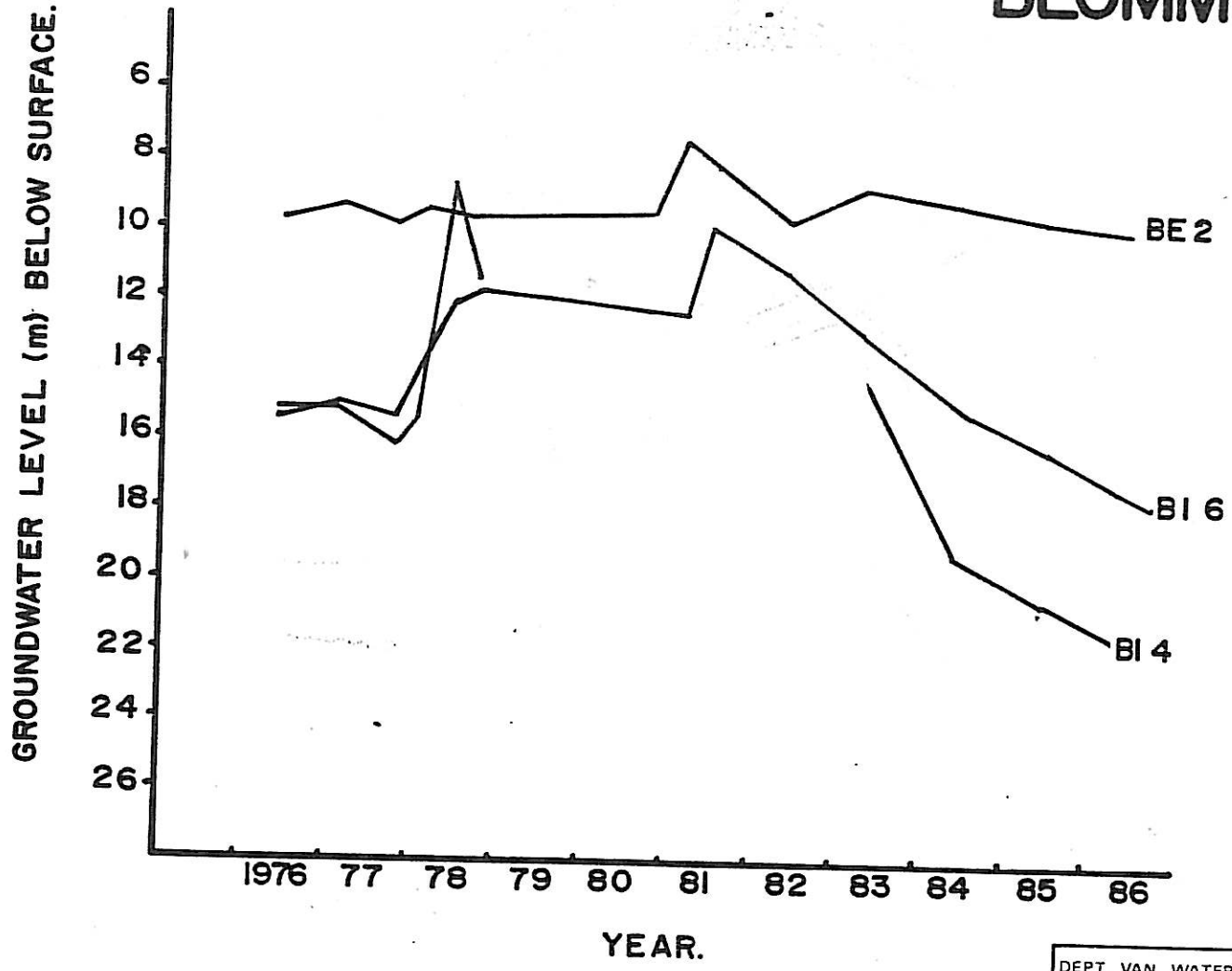
GROUNDWATER LEVEL: BAVIAANSPOORT AND BELLVUE.



DEPT. VAN WATERWESE DIREKTORAAT GEOHIDROLOGIE		DEPT. OF WATER AFFAIRS DIRECTORATE GEOHYDROLOGY	
TITEL TITLE			
GETEKEN DRAWN	DAT.	NAGESIEN. CHECKED	DAT.
NAGETREK TRACED	DAT.	VERSLAG No REPORT No	GHP No.

Ozalid 86/378

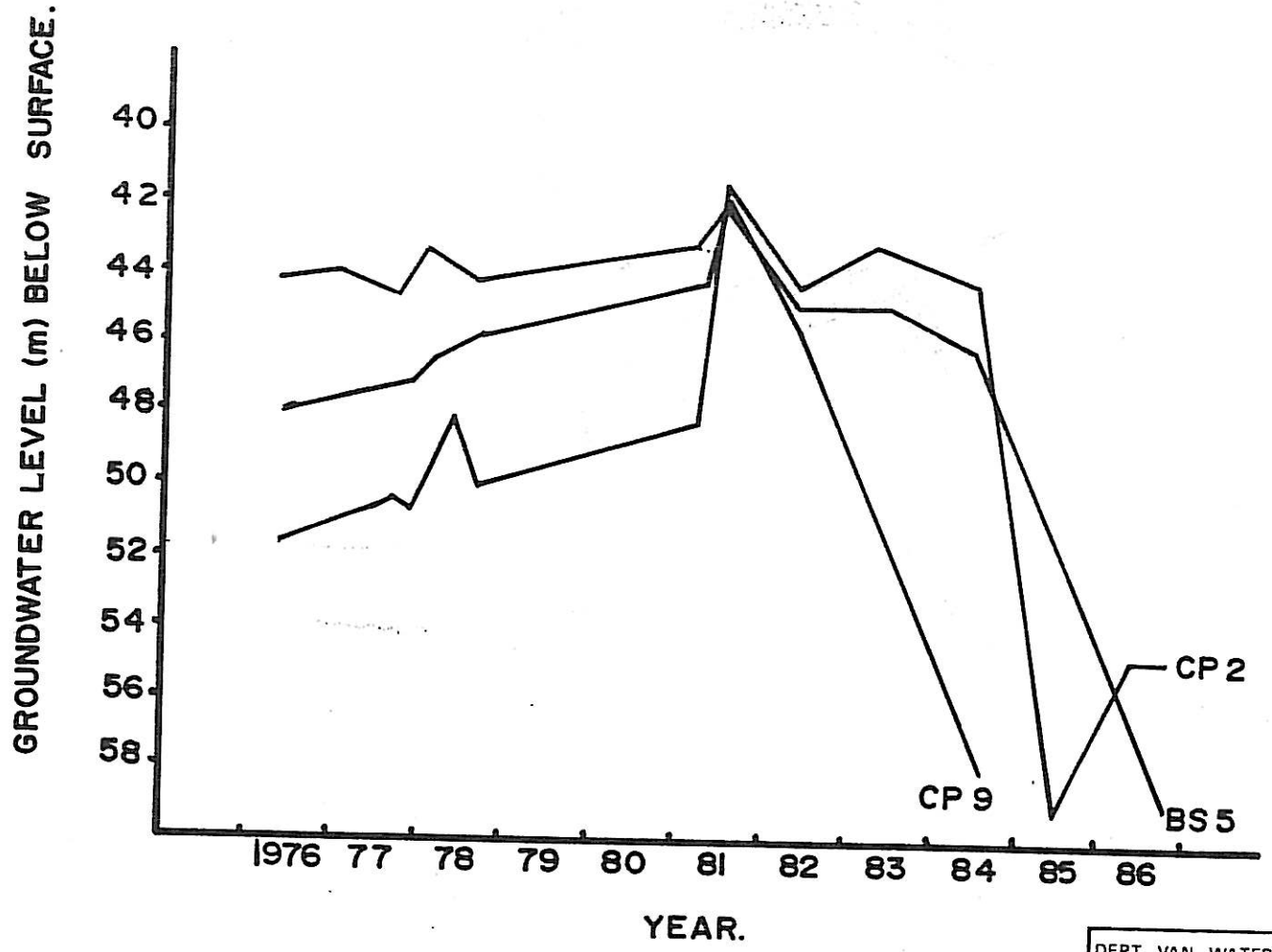
GROUNDWATER LEVELS: BELLVUE AND BLOMMETJIESVLEI



DEPT. VAN WATERWESE DIREKTORAAT GEOHIDROLOGIE		DEPT. OF WATER AFFAIRS DIRECTORATE GEOHYDROLOGY	
TITEL TITLE			
GETEKEN DRAWN	DAT.	NAGESIEN. CHECKED	DAT.
NAGETREK TRACED	DAT.	VERSLAG No REPORT No	GHP No.

Ozalid 86/378

GROUNDWATER LEVELS: BORNST AND CLAUDIUS HOOP.



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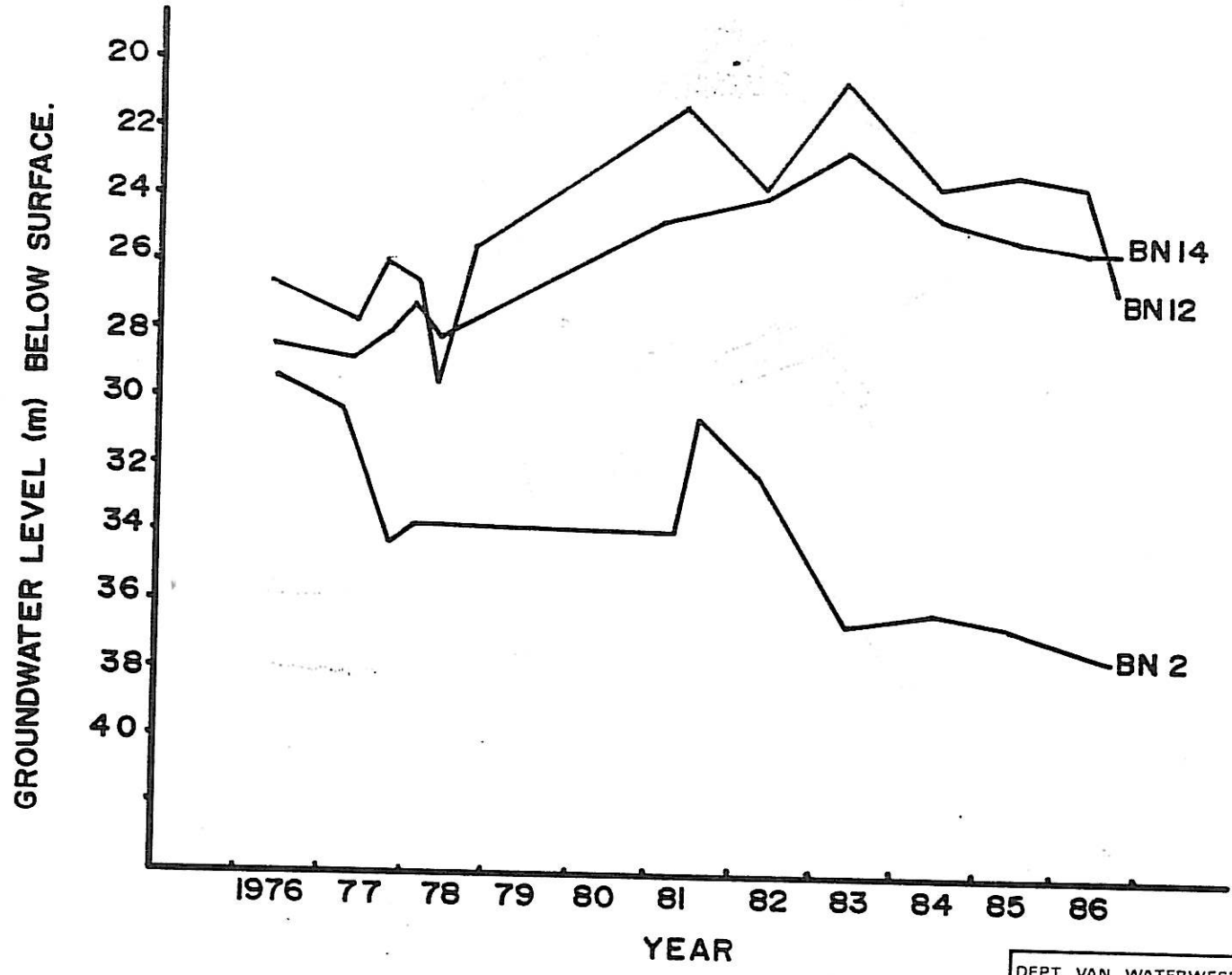
TITEL TITLE			
GETEKEN. DRAWN	DAT.	NAGESIEN CHECKED	DAT.
NAGETREK TRACED	DAT.	VERSLAG No REPORT No	GHP No.

Ozalid 86/378

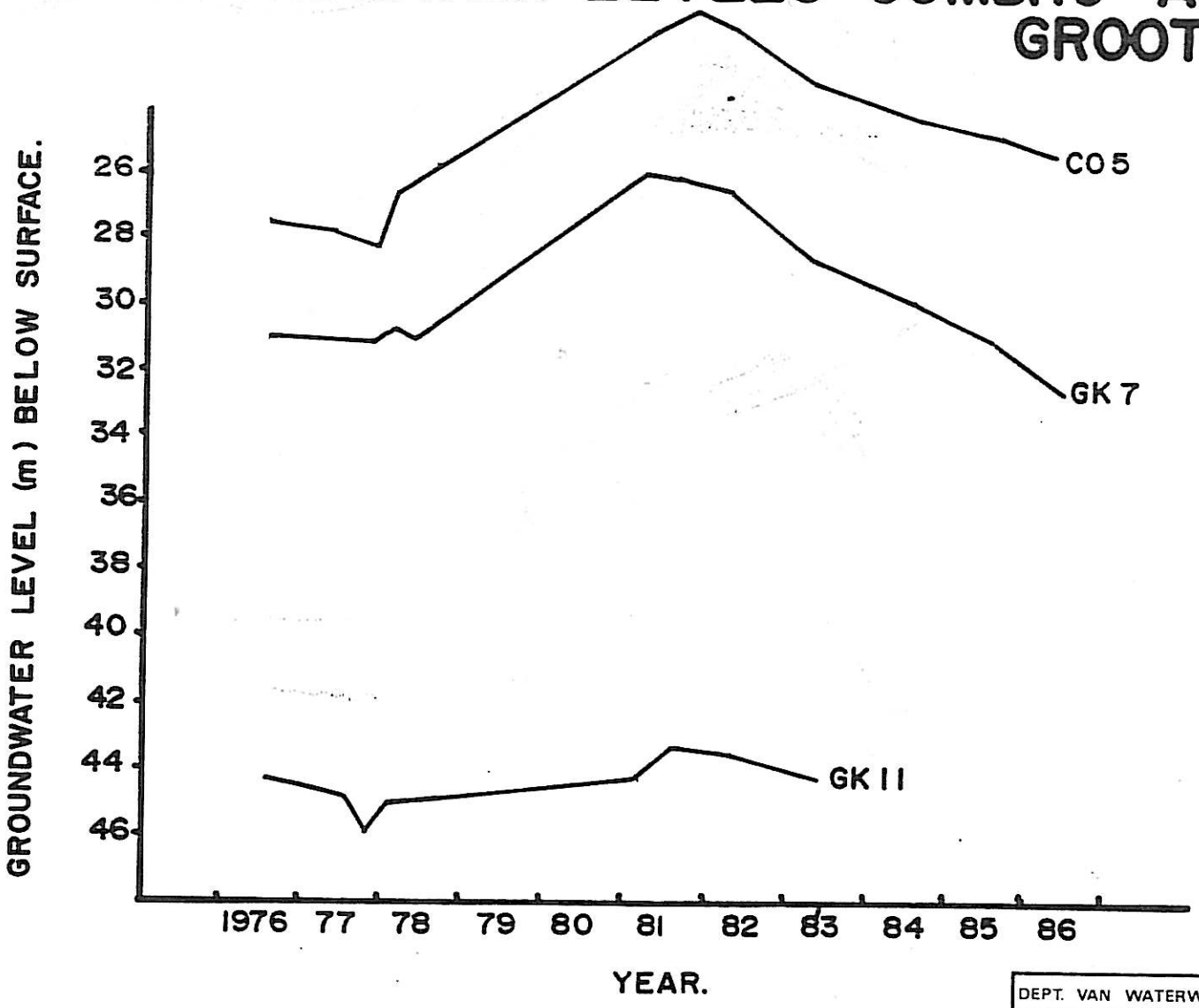
GROUNDWATER LEVEL : BOOMZIEN.



DEPT. VAN WATERWESE DIREKTORAAT GEOHIDROLOGIE		DEPT. OF WATER AFFAIRS DIRECTORATE GEOHYDROLOGY	
TITEL TITLE			
GETEKEN: DRAWN	DAT.	NAGESIEN: CHECKED	DAT.
NAGETREK TRACED	DAT.	VERSLAG No REPORT No	GHP No.

Ozalid 86/378

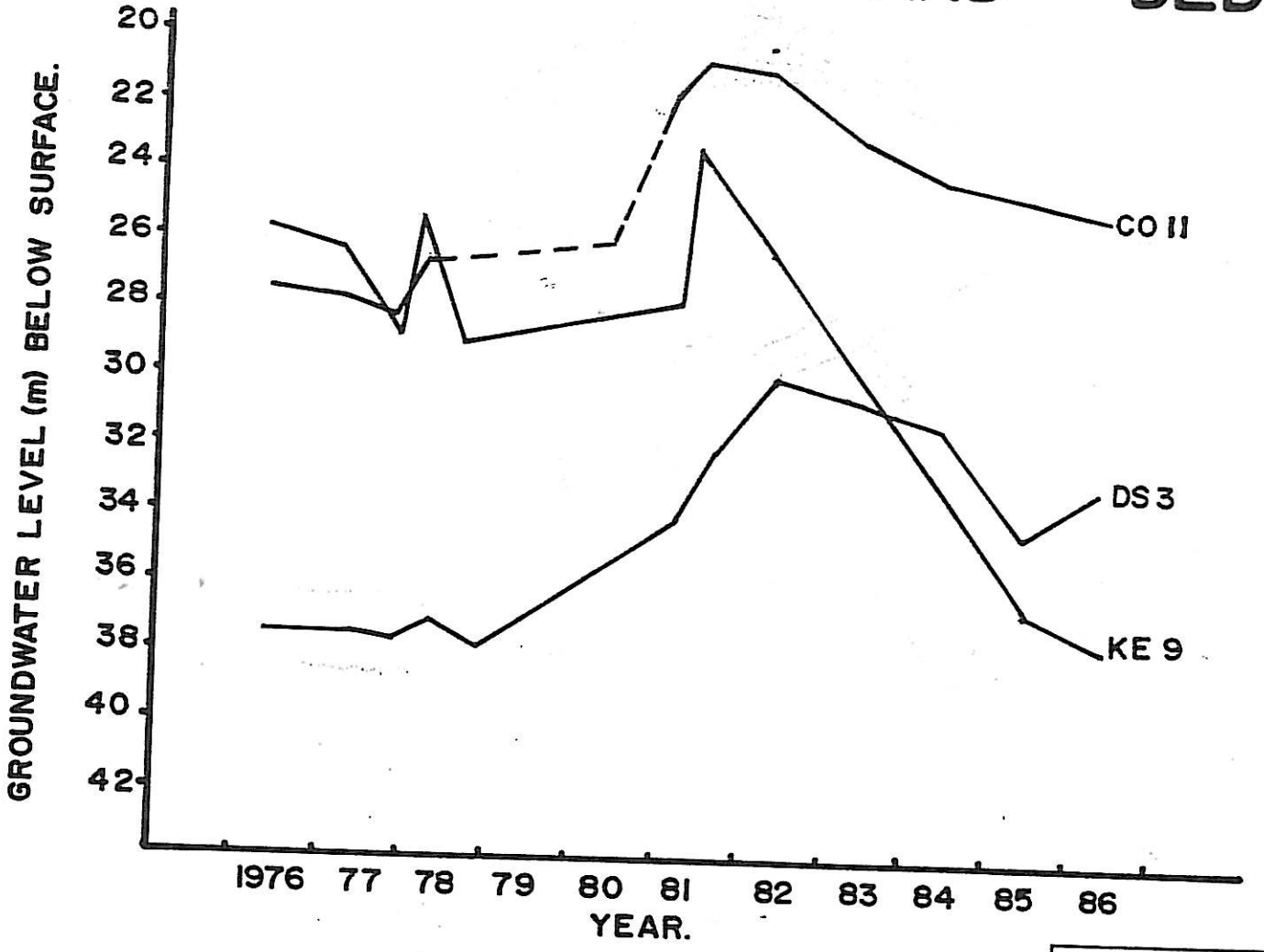
GROUNDWATER LEVELS: COMBRO AND GROOTHOEK.



DEPT. VAN WATERWESE DIREKTORAAT GEOHIDROLOGIE		DEPT. OF WATER AFFAIRS DIRECTORATE GEOHYDROLOGY	
TITEL TITLE			
GETEKEN DRAWN	DAT.	NAGESIEN CHECKED	DAT.
NAGETREK TRACED	DAT.	VERSLAG No REPORT No	GHP No.

Ozalid 86/378

GROUNDWATER LEVELS: COMBRO, KLEIN COLLIE AND DEDIMUS.



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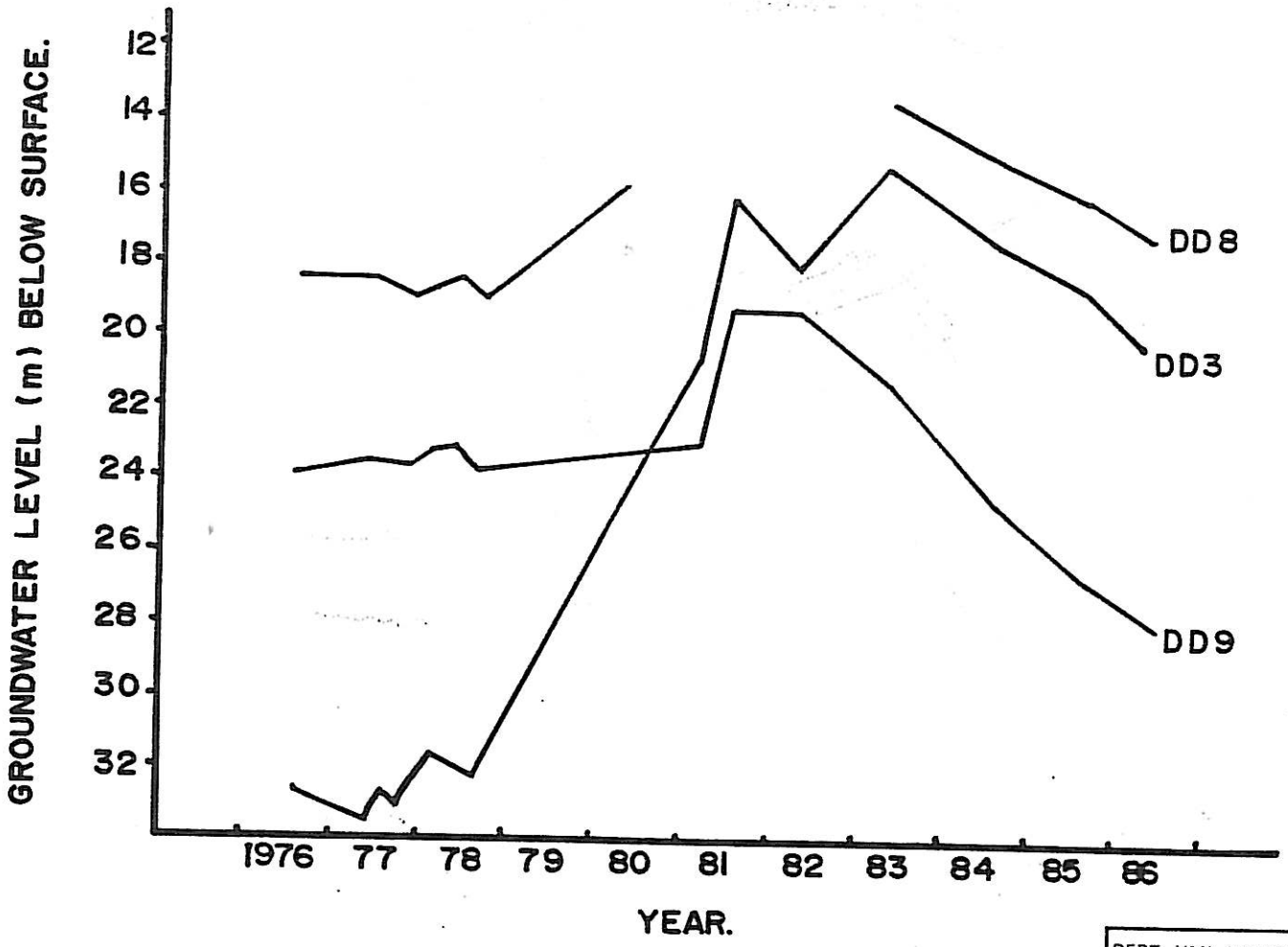
TITEL TITLE			
GETEKEN DRAWN	DAT.	NAGESIEN CHECKED	DAT.
NAGETREK TRACED	DAT.	VERSLAG No REPORT No	GHP No.

Ozalid 86/378

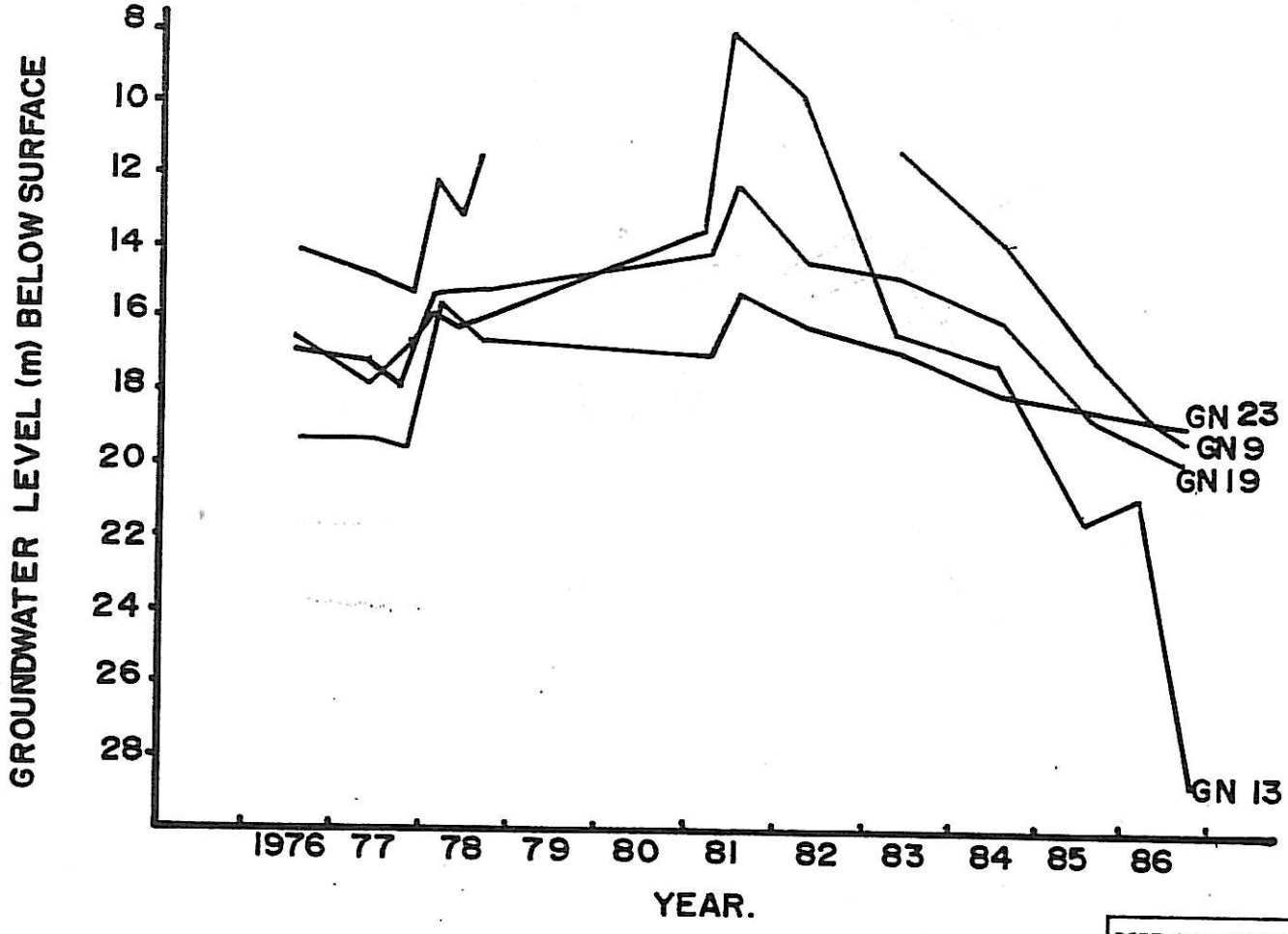
GROUNDWATER LEVEL: DUITSCHLAND



DEPT. VAN WATERWESE DIREKTORAAT GEOHIDROLOGIE		DEPT. OF WATER AFFAIRS DIRECTORATE GEOHYDROLOGY	
TITEL TITLE			
GETEKEN DRAWN	DAT.	NAGESIEN CHECKED	DAT.
NAGETREK TRACED	DAT.	VERSLAG No REPORT No	GHP No.

Ozalid 86/378

GROUNDWATER LEVELS : GELUKSFONTEIN.



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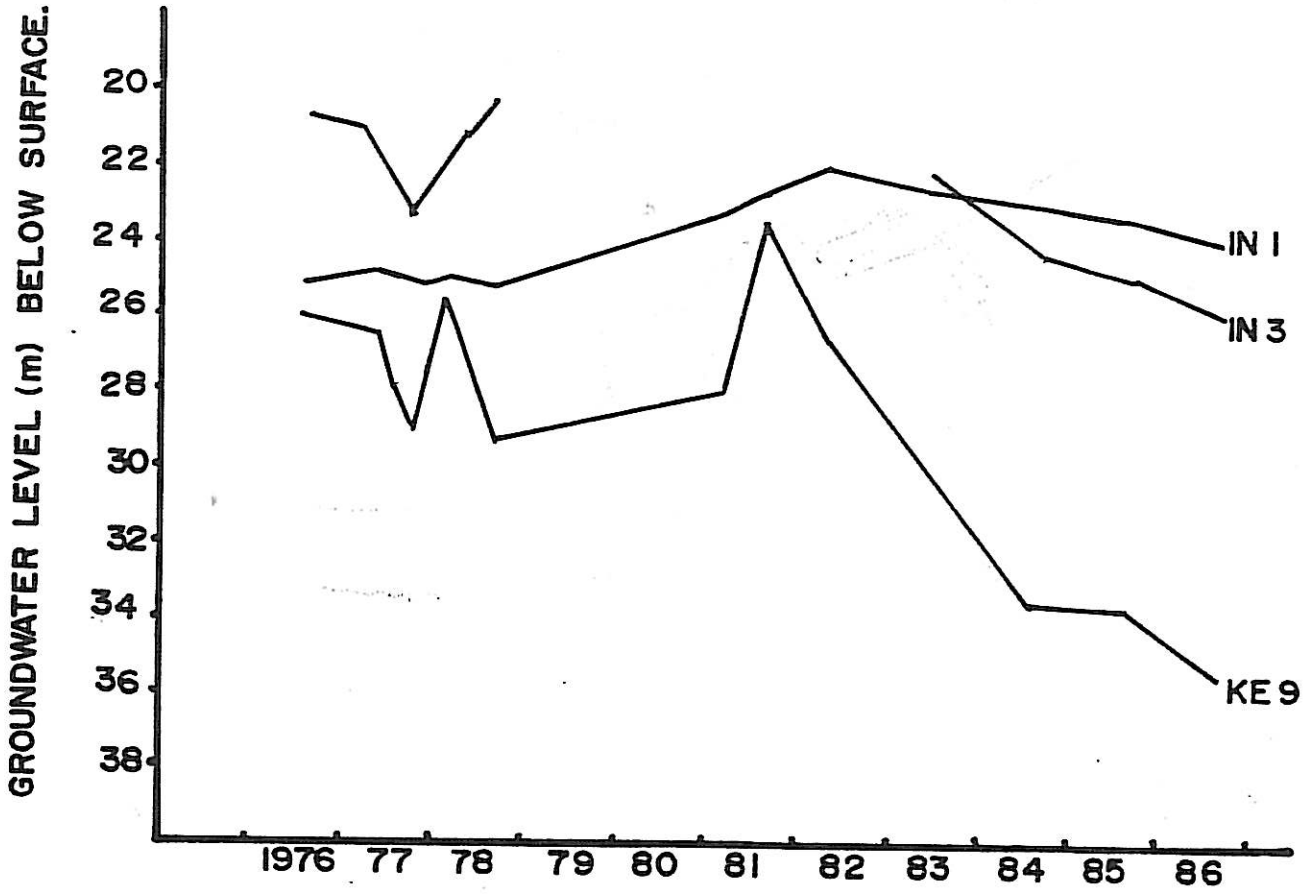
TITEL TITLE			
GETEKEN DRAWN	DAT.	NAGESIEN CHECKED	DAT.
NAGETREK TRACED	DAT.	VERSLAG No REPORT No	GHP No.

Ozalid 86/378

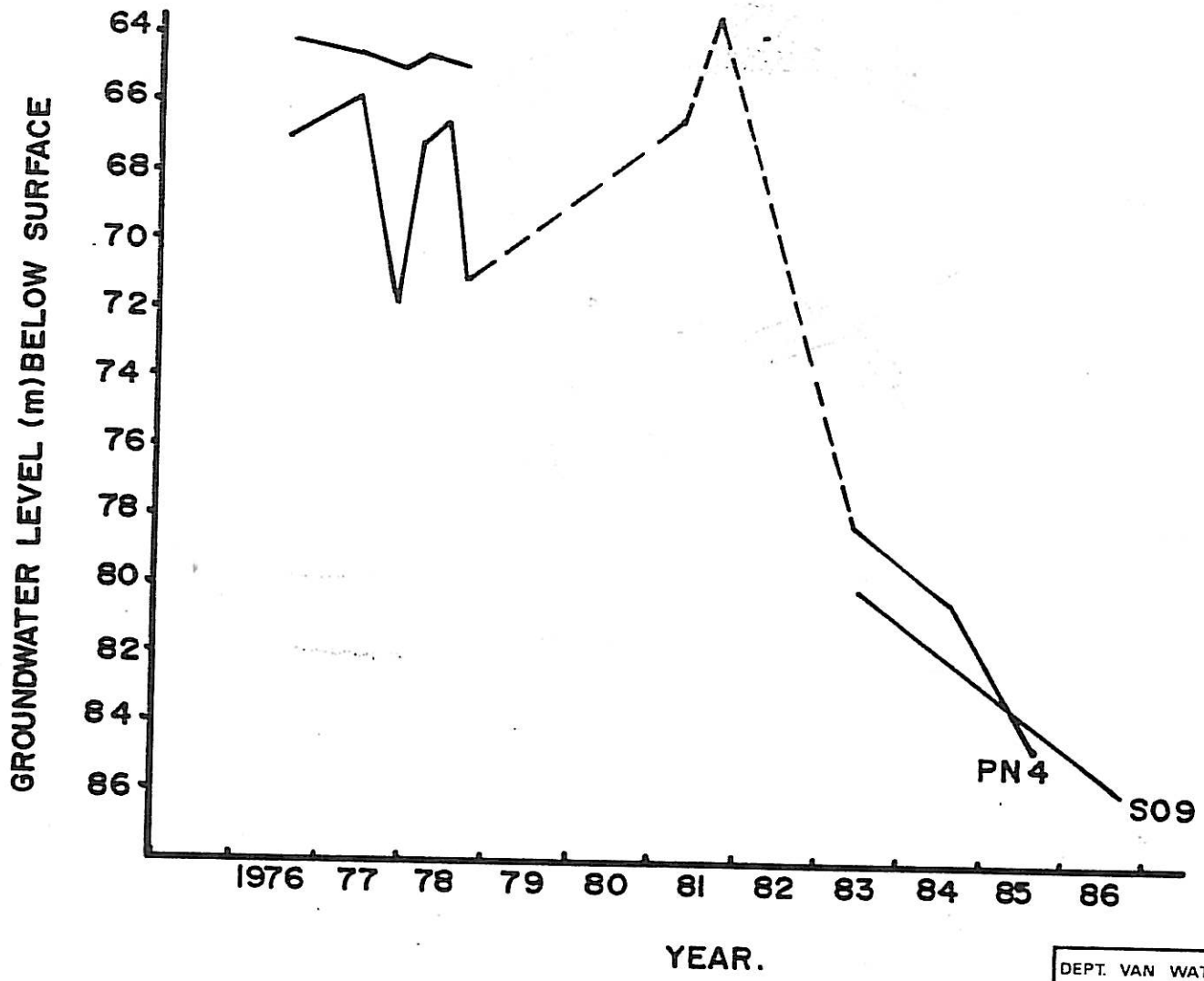
GROUNDWATER LEVELS: INDERHIKEN AND KLEIN COLLIE.



DEPT. VAN WATERWESE DIREKTORAAT GEOHIDROLOGIE		DEPT. OF WATER AFFAIRS DIRECTORATE GEOHYDROLOGY	
TITEL TITLE			
GETEKEN DRAWN	DAT.	NAGESIEN: CHECKED	DAT.
NAGETREK TRACED	DAT.	VERSLAG No: REPORT No:	GHP No.

Ozalid 86/378

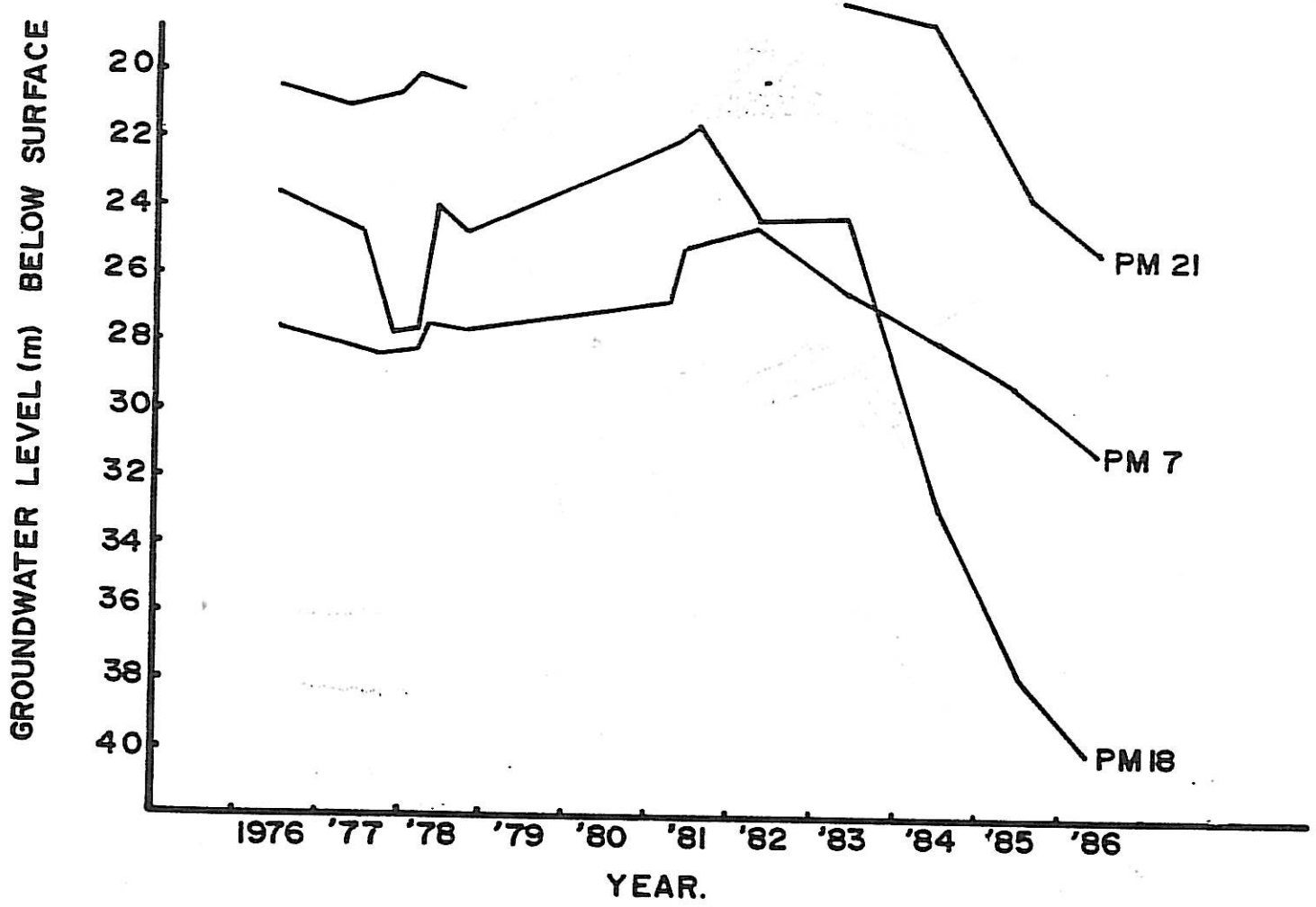
GROUNDWATER LEVELS: PATRYSPAN AND SOHO



DEPT. VAN WATERWESE DIREKTORAAT GEOHIDROLOGIE		DEPT. OF WATER AFFAIRS DIRECTORATE GEOHYDROLOGY	
TITEL TITLE			
GETEKEN DRAWN	DAT.	NAGESIEN CHECKED	DAT.
NAGETREK TRACED	DAT.	VERSLAG No REPORT No	GHP No.

Ozalid 86/378

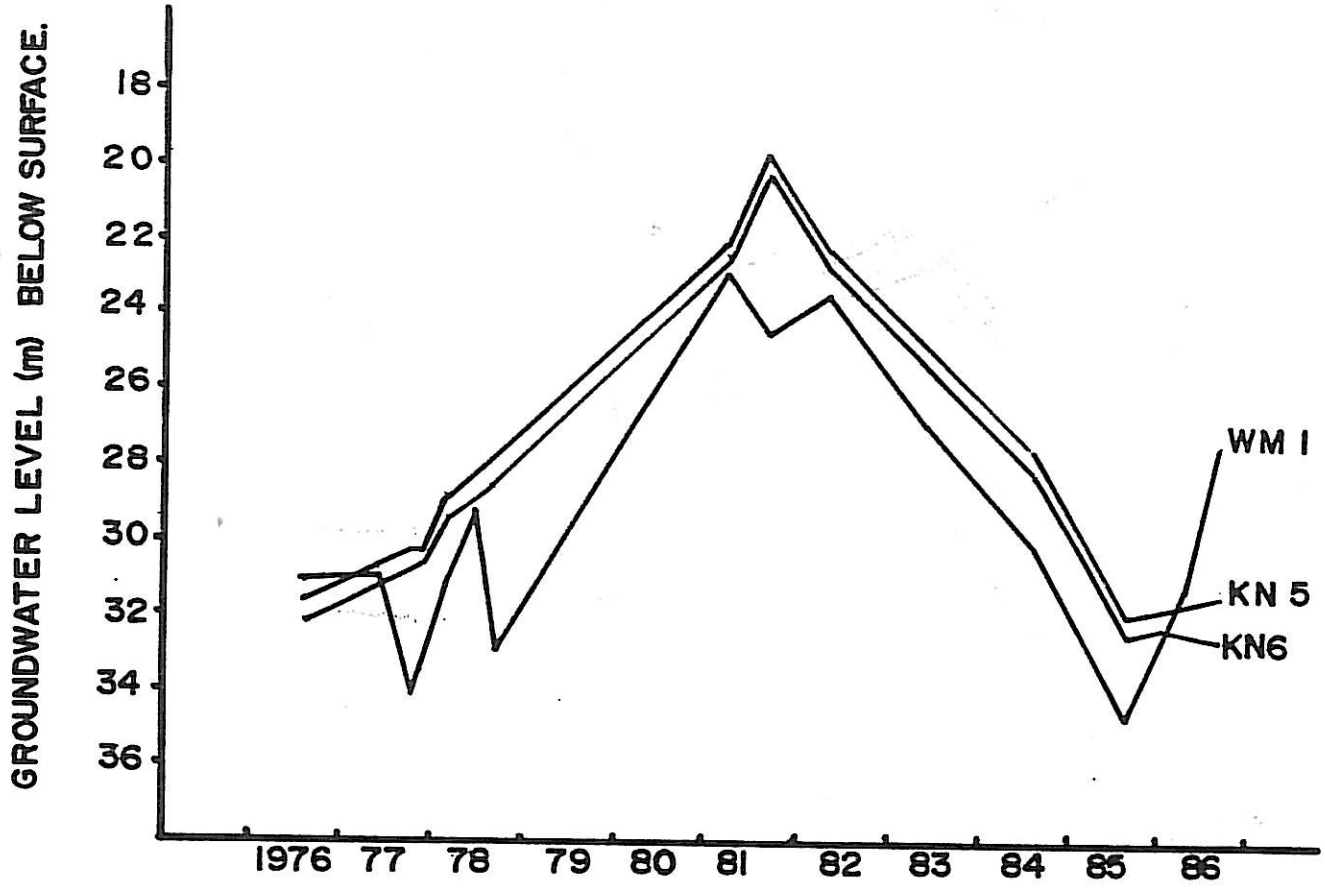
GROUNDWATER LEVELS: POTSDAM.



DEPT. VAN WATERWESE DIREKTORAAT GEOHIDROLOGIE		DEPT. OF WATER AFFAIRS DIRECTORATE GEOHYDROLOGY	
TITEL TITLE			
GETEKEN DRAWN	DAT.	NAGESIEN CHECKED	DAT.
NAGETREK TRACED	DAT.	VERSLAG No REPORT No	GHP No.

Ozalid 86/378

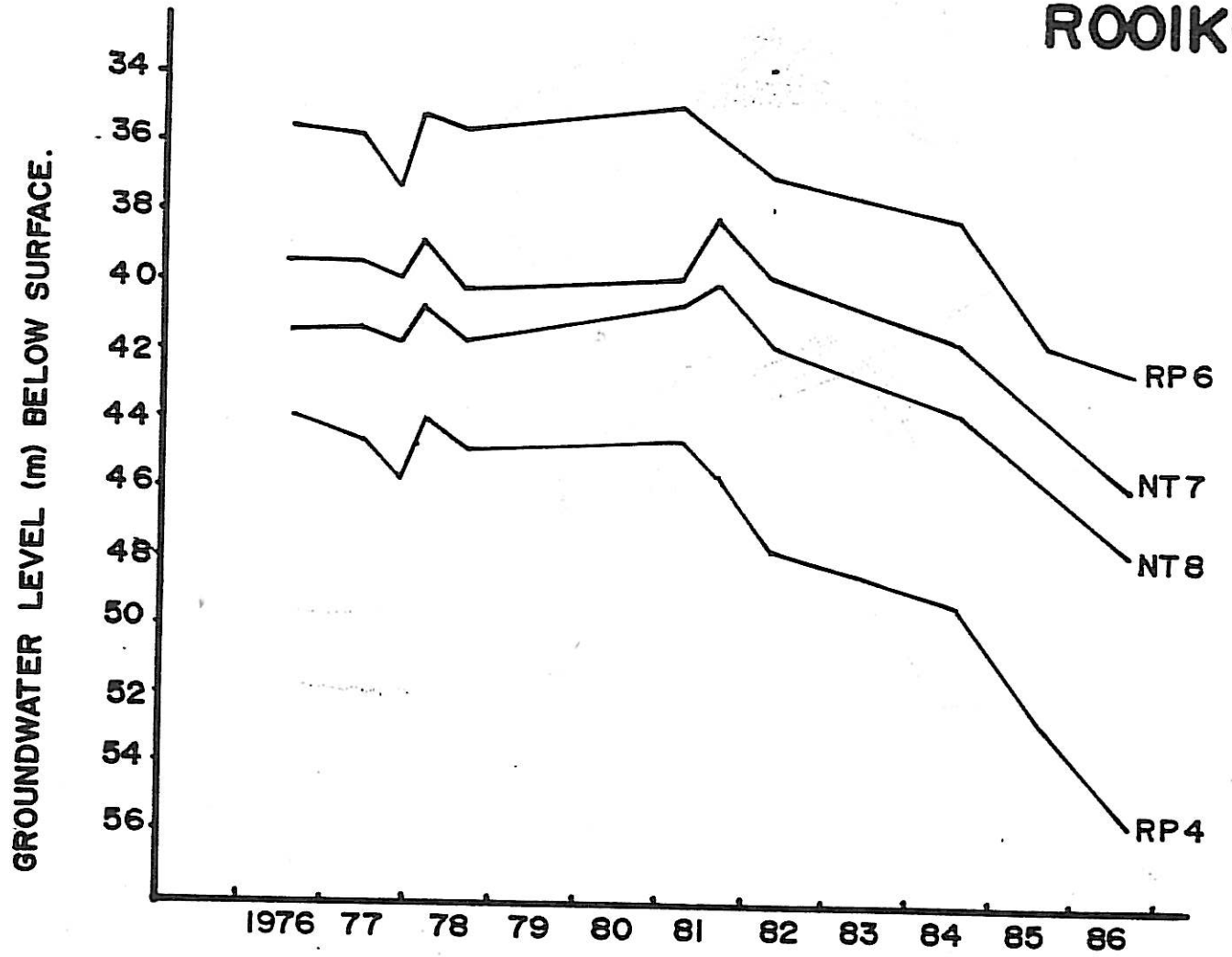
GROUNDWATER LEVEL: KRAAIFONTEIN AND WESTHEIM.



DEPT. VAN WATERWESE DIREKTORAAT GEOHIDROLOGIE		DEPT. OF WATER AFFAIRS DIRECTORATE GEOHYDROLOGY	
TITEL TITLE			
GETEKEN DRAWN	DAT.	NAGESIEN CHECKED	DAT.
NAGETREK TRACED	DAT.	VERSLAG No REPORT No	GHP No.

Ozalid 86/378

GROUNDWATER LEVELS: NIMMERSAULT AND ROOIKOP



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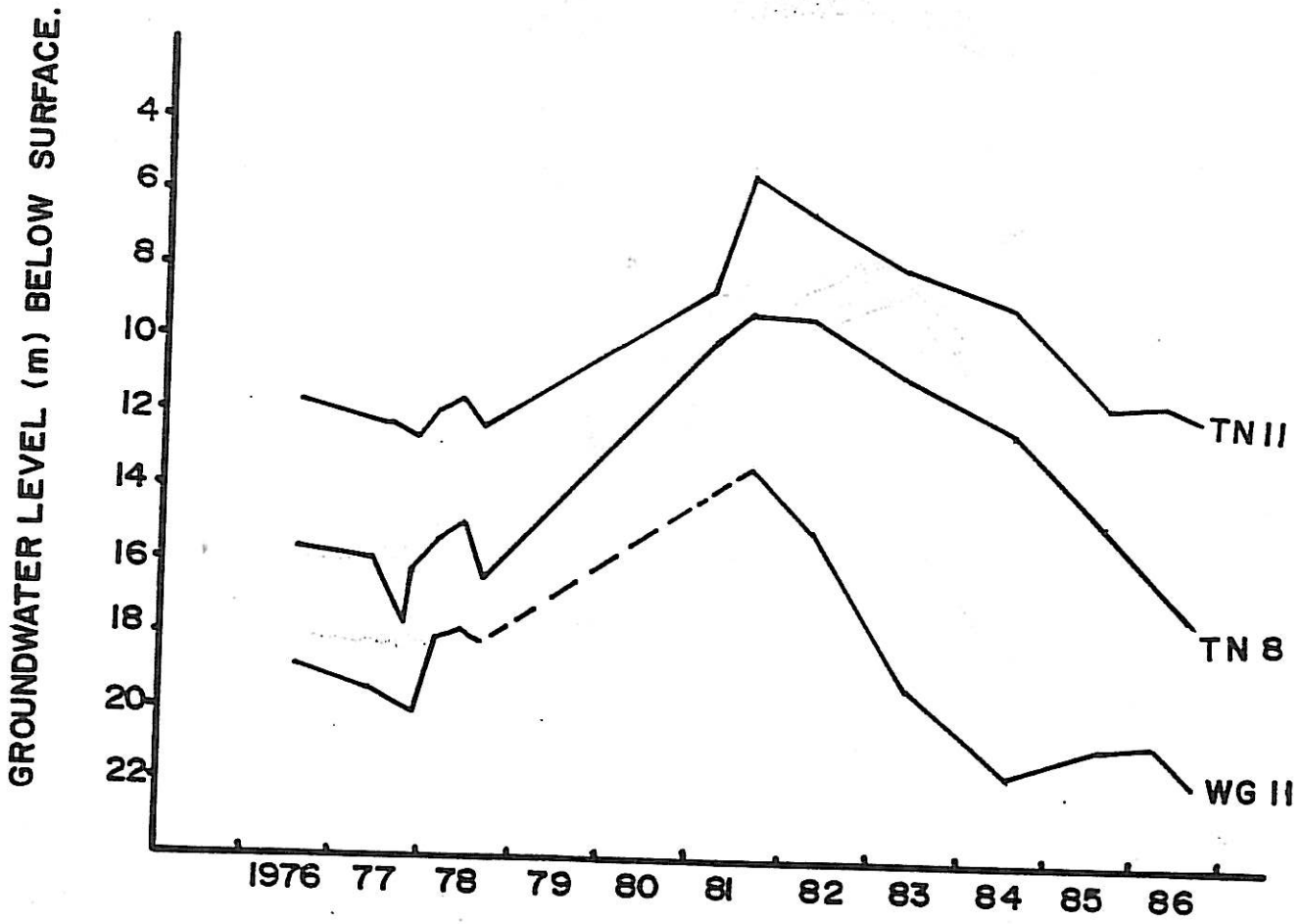
TITEL TITLE			
GETEKEN DRAWN	DAT.	NAGESIEN CHECKED	DAT.
NAGETREK TRACED	DAT.	VERSLAG No REPORT No	GHP No.

Ozalid 86/378

GROUNDWATER LEVELS: TWEEFONTEIN AND WALDBURG.



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TITEL TITLE			
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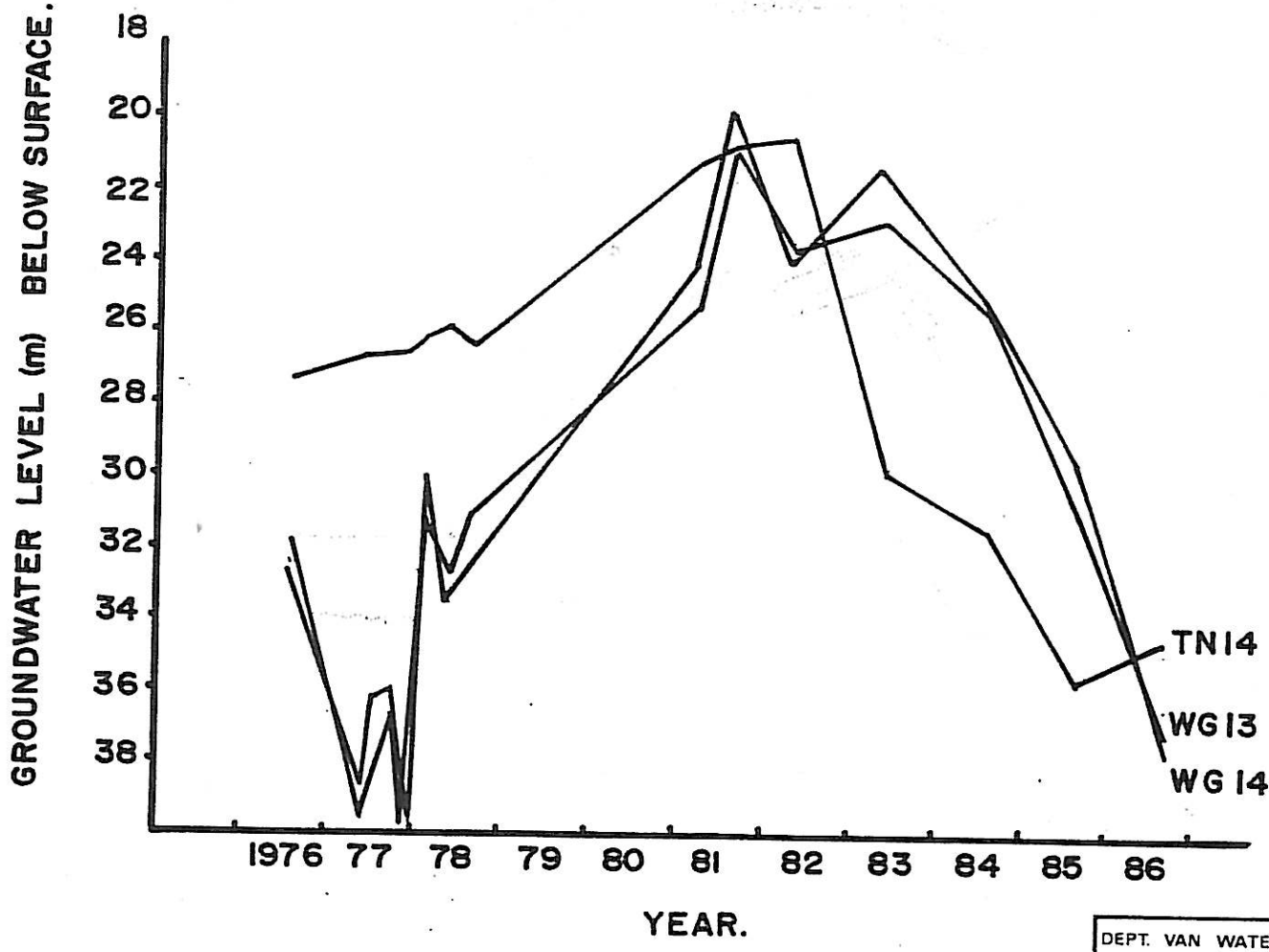
NAGETREK TRACED	DAT.	VERSLAG No REPORT No	GHP No.

Ozalid 86/378

GROUNDWATER LEVELS: TWEEFONTEIN AND WALDBURG.



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TITEL TITLE			
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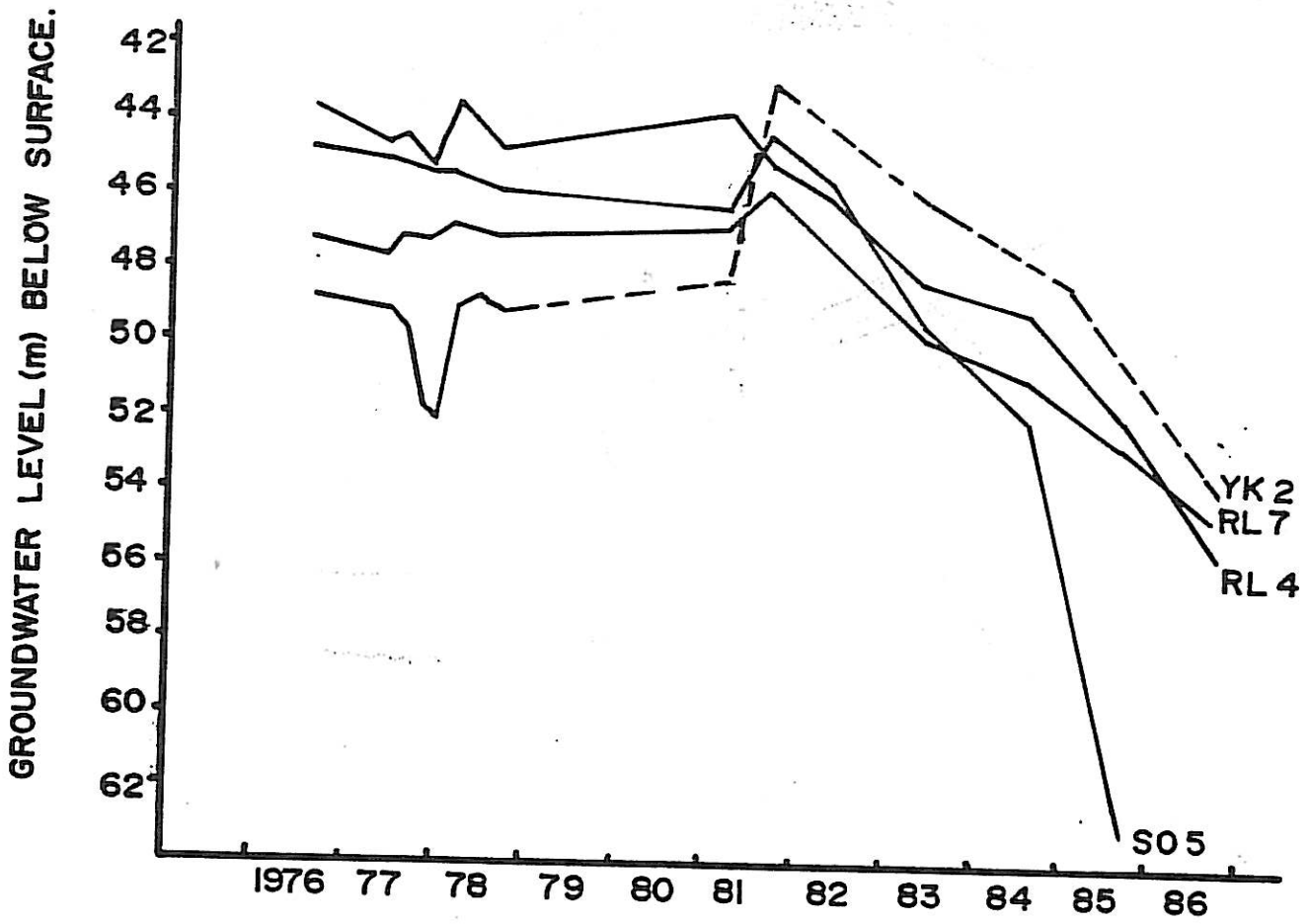
NAGETREK TRACED	DAT.	VERSLAG No REPORT No	GHP No.

Ozalid 86/378

GROUNDWATER LEVELS: REDHILL, SOHO AND YORK.



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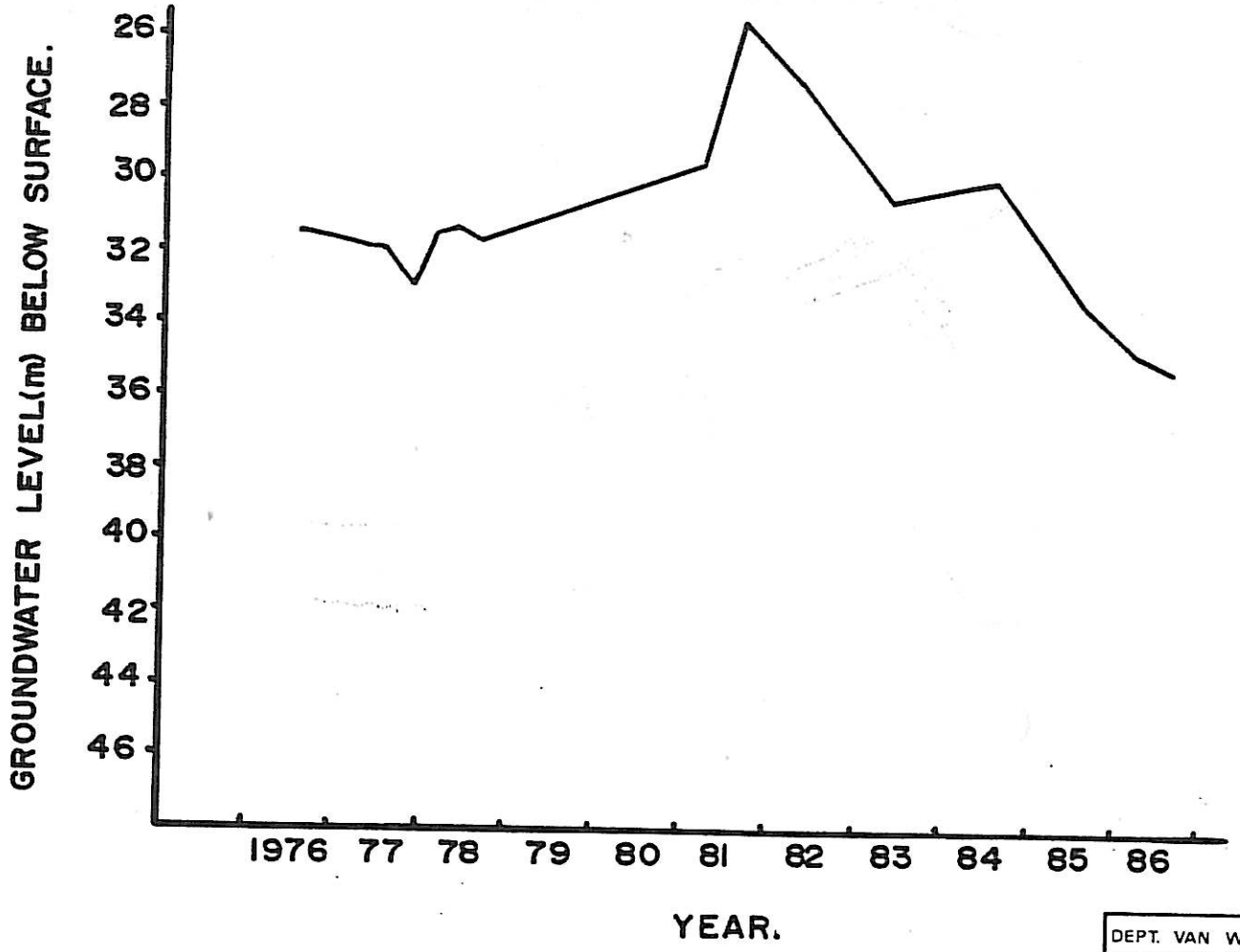
TITEL TITLE			
GETEKEN DRAWN	DAT.	NAGESIEN CHECKED	DAT.
NAGETREK TRACED	DAT.	VERSLAG No REPORT No	GHP No.

Ozalid 86/378

GROUNDWATER LEVELS: AVERAGE CONDITIONS.



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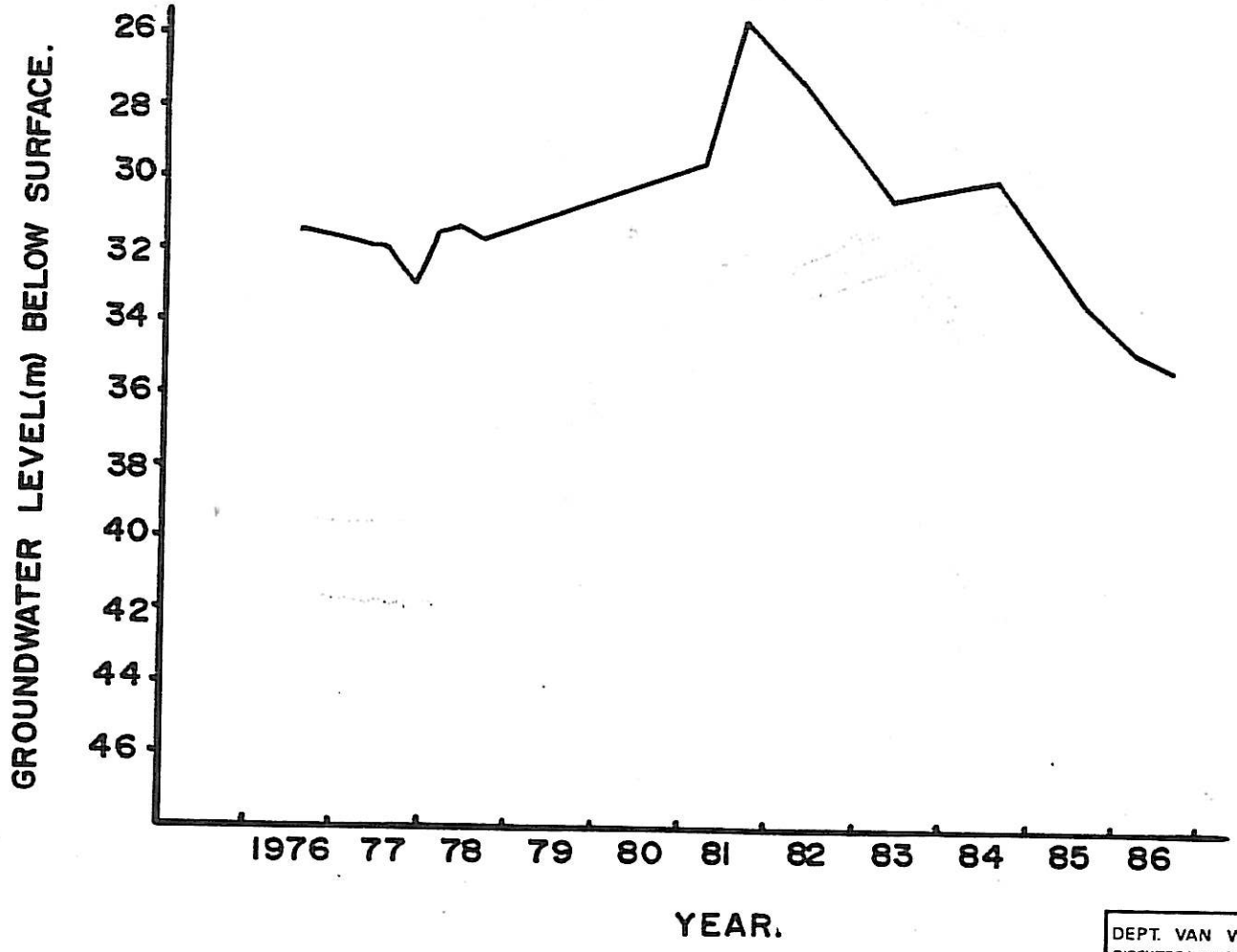
TITEL TITLE			
GETEKEN DRAWN	DAT.	NAGESIEN CHECKED	DAT.
NAGETREK TRACED	DAT.	VERSLAG No REPORT No	GHP No.

Ozalid 86/378

GROUNDWATER LEVELS: AVERAGE CONDITIONS.



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TITEL TITLE			
GETEKEN DRAWN	DAT.	NAGESIEN: CHECKED:	DAT.
NAGETREK TRACED	DAT.	VERSLAG No REPORT No	GHP No.

Ozalid 86/378

APPENDIX H

DEPTHS OF WEATHERING

APPENDIX I

DENDRON - ARTIFICIAL RECHARGE ON THE FARMS POTSDAM AND GELUKSFONTEIN

DENDRON - ARTIFICIAL RECHARGE ON THE FARMS POTSDAM AND GELUKSFONTEIN

(STUDY PROPOSAL)

J.L. JOLLY

NOVEMBER 1986

DIRECTORATE: GEOHYDROLOGY
DEPARTMENT OF WATER AFFAIRS

AIMS OF THE STUDY

(1) To ascertain the effect of the artificial recharge scheme on the groundwater system.

(2) To quantify the amounts of recharge involved, and

(3) To measure changes in groundwater levels caused by artificial recharge.

In order to satisfy these aims specific methods of study must be undertaken.

STUDY METHODS

(1) The dams must be surveyed so that the volume of water contained in the dams is known at all times. The depth of water in the dams must be measured on a twice weekly basis.

(2) Evaporation and rainfall data must be obtained from the existing pans and gauges on the farm Potsdam (Owner J. Roos 0152232 - 2622)

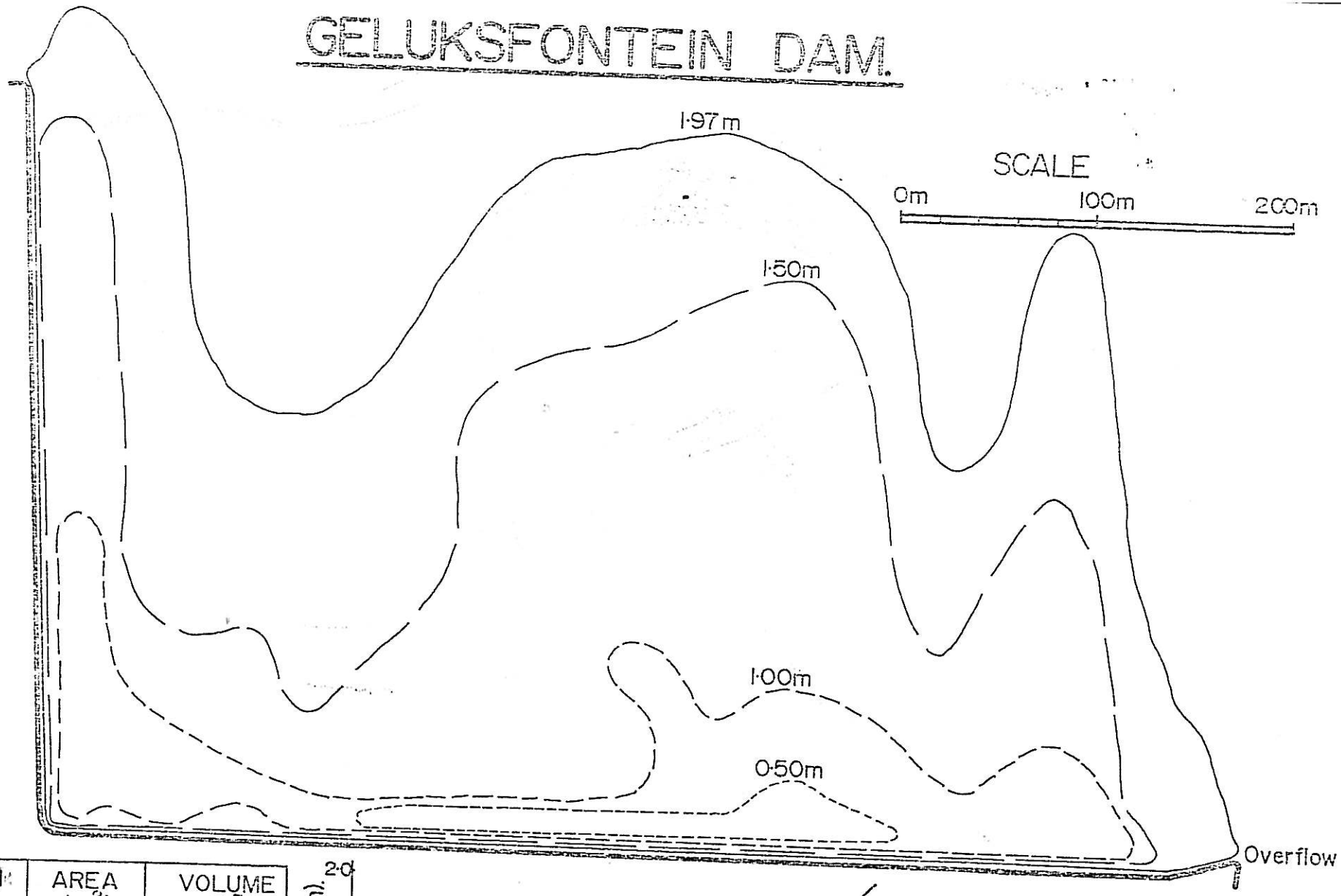
(3) At least three automatic water level recorders must be placed on open boreholes, while all the other open boreholes must have their waterlevels measured on a fortnightly basis.

(4) The study will last for one rainfall season (October 1986 - March 1987) and the results will be written up as a supplement to the borehole survey report on the Dendron Area.

COMPLETED WORK

During the week 20 - 24 October three water level recorders were installed while the two dams were surveyed and the gauges plates installed. The recorders were installed in two holes on Geluksfontein (39 + 40) and in hole 19 on Potsdam while the details of the dams areas, depths and volumes are contained in Figures 1 and 2.

GELUKSFONTEIN DAM.



DEPTH (m)	AREA (m^2)	VOLUME (m^3)
0—0·50	4214	1 053
0—1·00	27219	8 911
0—1·50	108 231	42 774
0—1·97	175 612	109 477

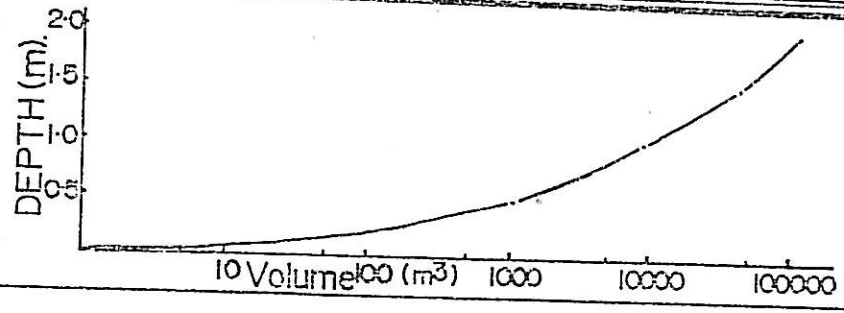


FIGURE 1

DEPT. OF WATER AFFAIRS
DIRECTORATE GEOHYDROLOGY

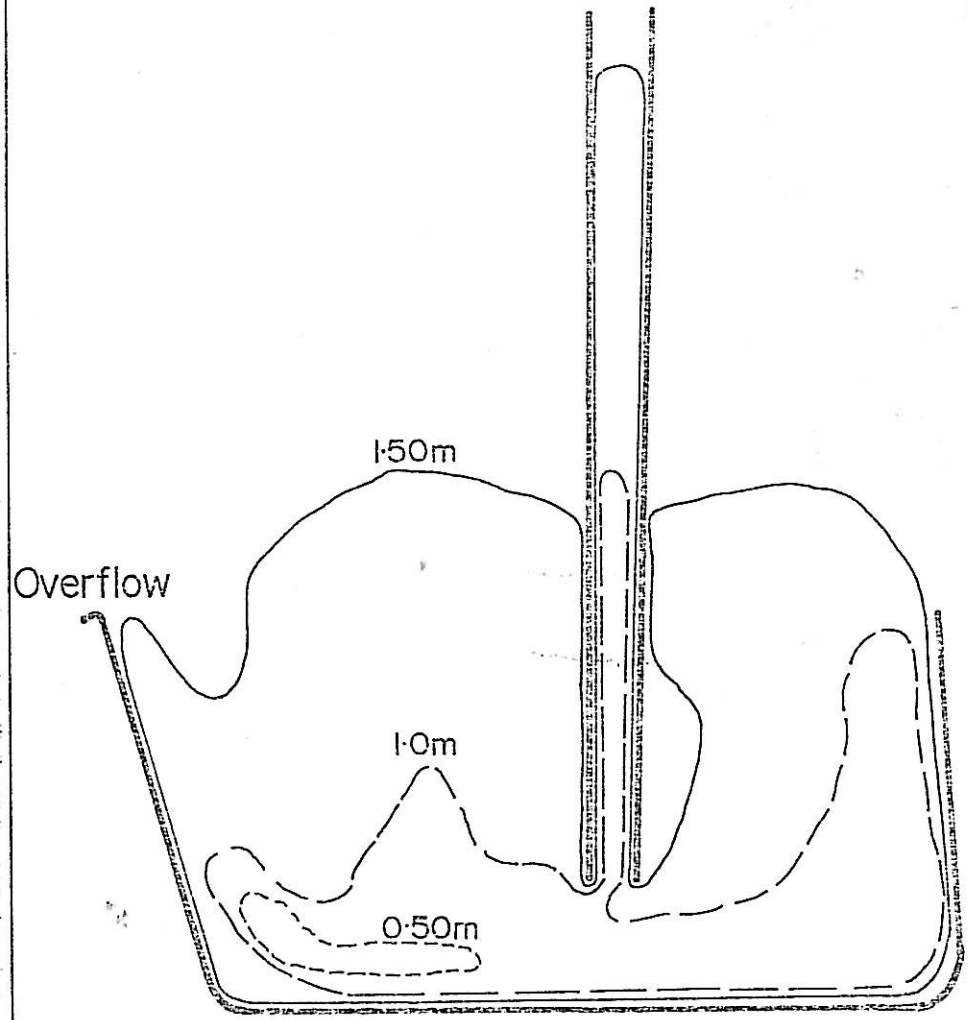
TITEL / TITLE: GELUKSFONTEIN DAM-CONTOURS ABOVE DEEPEST POINT IN DAM.

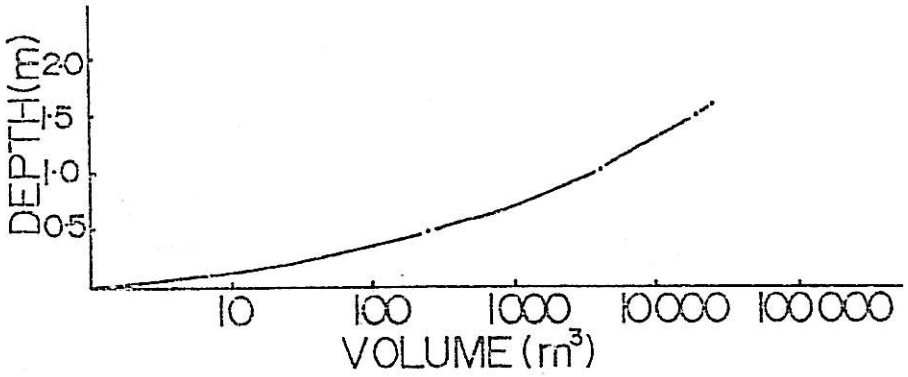
GETEKEN / DRAWN	DAT.	NAGESIEN / CHECKED	DAT.
NAGETREK / TRACED	DAT.	VERSLAG No / REPORT No.	GHP No.

Datum 84/1799

POTSDAM DAM

DEPTH(m)	AREA(m^2)	VOLUME(m^3)
0 – 0·50	960	240
0 – 1·00	14760	4170
0 – 1·50	46640	19520
0 – 1·62	50880	25371





SCALE 100m 0m 100m 200m

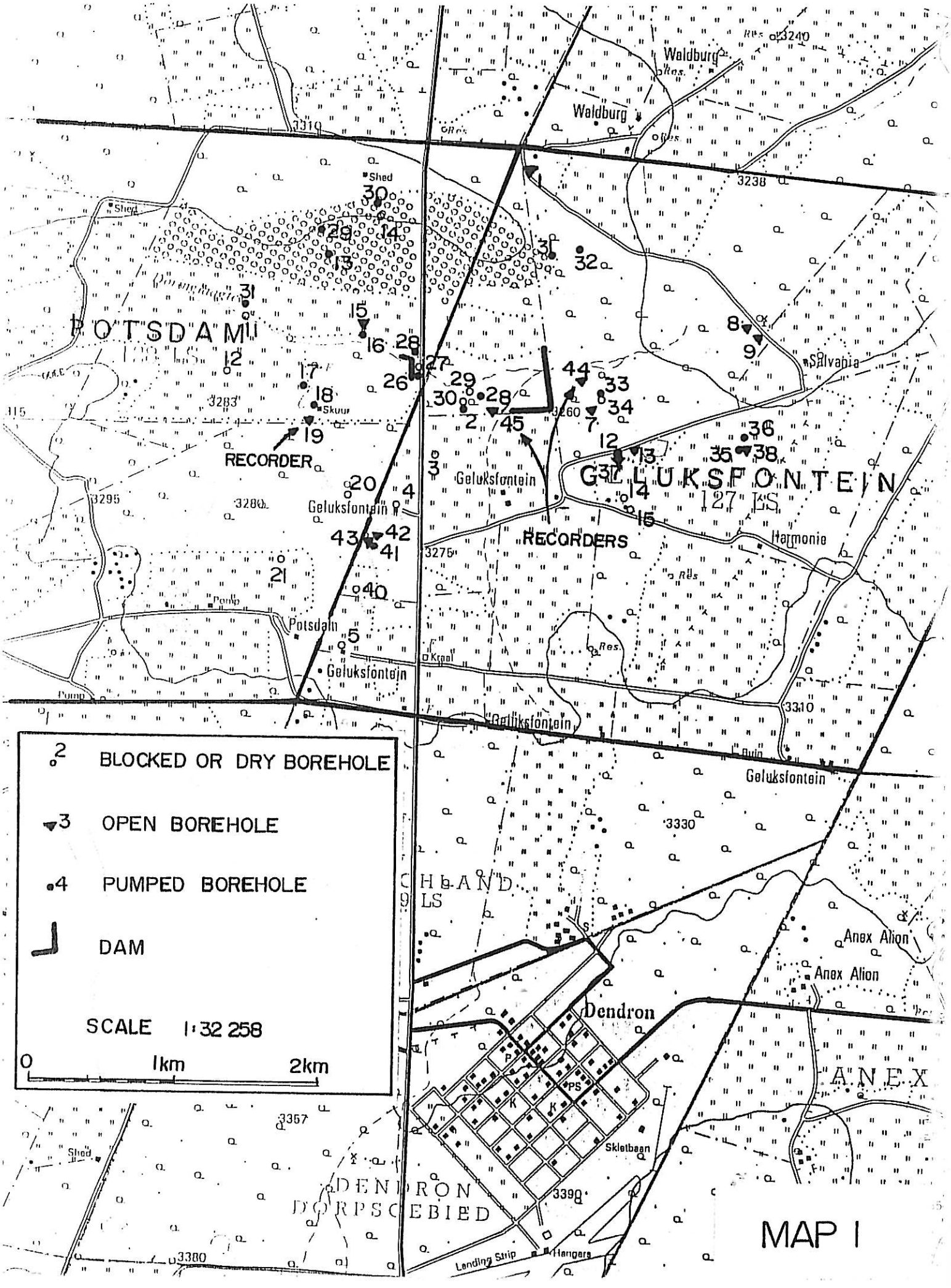
FIGURE 2

DEPT. OF WATER AFFAIRS
DIRECTORATE GEOHYDROLOGY

TITEL TITLE: POTSDAM DAM—CONTOURS ABOVE DEEPEST POINT IN THE DAM

GETEKEN: DRAWN:	DAT:	NAGESIEN CHECKED	DAT:
NAGETREK: TRACED:	DAT:	VERSLAG NO: REPORT No.	GHP No:

DENDRON–ARTIFICIAL RECHARGE PROJECT



MAP 1

INTRODUCTION

During July and August of 1986 a borehole survey was undertaken in the Dendron area. During this period a number of farmers who were troubled by decreasing borehole yields and a deepening water table expressed an interest in artificial recharge of the groundwater system. Since no scientific work has been undertaken with respect to artificial recharge in this area the Directorate was unable to provide any advice as to the possible success of artificial recharge schemes. It was therefore decided that an existing recharge scheme should be monitored to assess its potential.

STUDY AREA

The study area consists of the farms Potsdam and Geluksfontein, situated 5 km north of Dendron in the Northern Transvaal. (See Map 1) The two farms are owned by Mr Johan Becker (015 2232-130) who in June 1984 built two earth dams with the idea of containing the runoff from the Dooringlaagte non-perenial stream. Under normal yearly rainfall, (400 mm) this stream flows for about 4 - 5 days/year, a considerable amount of rainfall being lost as runoff. The recharge from these dams appears to be successful, but has never been quantified.

The study area is underlain by granites and gneisses of the Archaean Complex, which, in the vicinity of the two dams, are apparently weathered to 150 - 200 m. Within a 2 km radius of the dams 45 boreholes exist. Of these 13 are unequipped and open, 18 are being pumped while the rest are blocked or dry. The details of the pumped holes are as follows:

Borehole number		Yield (ℓ/sec)	Abstraction rate (ℓ/sec - hours/week)			Cond. (mS/m)	Depth
Potsdam	13	38	12,6	-	60	120	73,4
	16	40	15,7	-	60	120	67,3
	17	44	15,7	-	60	140	198,4
	18	44	15,7	-	60	120	76,4
	26	40	10,1	-	60	140	62,6
	28	40		-	60	140	
	29	38	18,8	-	60	110	85,6
	30	8	1,6	-	60	120	55,0
	31	40	15,2	-	60	110	70,3
Geluksfontein							
	2	15	10,0	-	60	150	48,4
	12	-	1,7	-	30	220	-
	28	15	10,1	-	60	180	55,0
	31	35	18,8	-	72	150	76,4
	32	35	18,8	-	72	150	122,3
	33	8	7,6	-	72	185	48,9
	35	3	2,7	-	20	240	35,8
	36	-	1,1	-	20	240	-
	41	-	1,3	-	40	210	-

Cadastral farm	Borehole no. (1974 Survey)	Depth of borehole (m)	Depth to base of heavily decomposed and weathered granite (m)	Depth of base of transition zone (m)
Anex Alion	57A	36,0	32,6	> 36,0
Bellevue	98	37,2	33,5	< 37,2
	101	32,9	> 32,9	?
Bloempiesvlei	76A	73,2	37,2	60,0
	213A	47,2	± 15	> 47,2
Boomzien	32	39,6	> 39,6	?
	32A	45,7	33,5	> 45,7
	33A	29,0	> 29,0	?
	35	43,6	Decomposed dolerite to 35 m	
	37	27,4	> 27,4	?
	70	30,5	± 74	No transition zone
	186	50,3	39,6	No transition zone
	186A	89,3	< 24,0	51,8
	187	38,1	± 12	> 38,1
	190	64,0	45,7	58,0
	192	36,6	± 12	33,5
	219	27,4	21,3	No transition zone
Combro	217	29,3	> 29,3	?
	220	43,9	42,1	< 43,9
	220A	46,6	< 24,0	> 46,6
	220B	48,2	± 15	41,2
	221	52,1	?	45,7
	222C	45,7	?	42,6
	226A	61,0	± 15	< 61,0
	228	34,4	± 21	> 34,4
	231	49,4	?	> 49,4
Dedimus	59	60,8	?	55,7
	151B	53,0	34,0	No transition zone
	153	135,3	?	> 67,7
	159	59,6	49,7	?
Duitsland	6	50,3	> 50,3	?
	45	38,1	± 18	± 27
	48A	62,2	Sporadic	> 54,9
	53B	91,1	± 12	45,7
	133A	?	< 18	?

Cadastral farm	Borehole no. (1974 Survey)	Depth of borehole (m)	Depth to base of heavily decomposed and weathered granite (m)	Depth of base of transition zone (m)
Geluksfontein	3A	?	< 12	?
	3B	?	?	± 39
	19	30,8	> 30,8	?
	20	36,6	27,4	No transition zone
	104	63,7	< 6	36,0
	106	?	± 18	31,1
	108	78,3	18,0	32,0
	109	61,9	21,0	48,5
	122	28,3	< 15	> 28,3
	123A	29,0	Nil	> 29,0
	124	56,4	± 18	42,7
	125	51,0	< 6	< 51,0
Groothoek	72	61,0	± 36	46,0
	206A	79,3	± 30	> 79,3
Inderhiken	177	56,4	> 56,4	?
Kraaifontein	65	51,9	± 24	> 51,9
	67	42,7	> 42,7	?
	73A	56,4	± 30	> 56,4
	162	61,0	± 18	< 46 ?
	162A	?	± 30	49,0
	165	75,6	± 18	± 50
	175	80,8	?	60,4 ?
Kwaggasbult	167	87,2	< 48,8 ?	< 87,2
Potsdam	197	21,6	?	> 21,6
Tweefontein	135A	44,8	< 12,0	16,0
	137	54,9	± 12	39,6
	137A	39,6	± 21	> 39,6
	139	61,0	± 12	35,0 ?
	141	50,9	± 24	43,6
	144A	64,9	< 24	64,9
	145	69,8	?	64,0
	146	110,3	< 18	No transition zone
	146A	57,9	± 42	< 57,9
	148	49,7	33,5	No transition zone
	149	40,2	< 12,0	No transition zone
	215	31,7	> 31,7	?

DORINGLAATE CATCHMENT: GROUNDWATER CONDUCTIVITY

BOREHOLE NUMBER		CONDUCTIVITY (mS/m)
Altenburg	8	250
Altenburg	11	220
Anex Alion	2	95
Anex Alion	7	120
Anex Alion	8	130
Anex Alion	14	105
Anex Alion	15	100
Anex Alion	20	180
Anex Alion	22	125
Appelfontein	2	180
Appelfontein	8	120
Appelfontein	10	130
Appelfontein	11	110
Appelfontein	15	100
Appelfontein	18	100
Baviaanspoort	6	100
Baviaanspoort	10	75
Bellvue	1	95
Bellvue	2	125
Bellvue	5	120
Bellvue	6	120
Bellvue	7	110
Bellvue	14	135
Bellvue	16	210
Bellvue	17	175
Bellvue	18	105
Bloemetjiesvlei	6	190
Bloemetjiesvlei	8	150
Bloemetjiesvlei	11	190
Bloemetjiesvlei	13	125
Bloemetjiesvlei	14	110
Bloemetjiesvlei	15	110
Bloemetjiesvlei	16	110
Bloemetjiesvlei	18	180
Bloemetjiesvlei	19	180
Bloemetjiesvlei	22	180
Boomzien	11	140
Boomzien	13	150
Boomzien	17	120
Boomzien	23	120
Boomzien	25	140
Boomzien	29	190
Boomzien	30	190
Boomzien	31	110
Boomzien	33	125
Boomzien	35	145
Boomzien	37	130
Bornst	1	105
Bornst	3	105
Bornst	6	105
Bornst	11	95
Bornst	16	120
Bornst	26	175
Bornst	28	85
Bornst	29	103
Bornst	30	103
Bornst	32	105
Bornst	33	105
Bornst	34	105
Bornst	36	130
Burg	4	100
Burg	12	120
Claudius Hoop	13	135
Claudius Hoop	14	100
Claudius Hoop	17	120
Claudius Hoop	19	115
Claudius Hoop	20	120
Claudius Hoop	21	110
Claudius Hoop	22	120
Claudius Hoop	23	120
Claudius Hoop	25	100
Claudius Hoop	29	110
Claudius Hoop	32	110
Claudius Hoop	33	110
Combro	2	110
Combro	5	120
Combro	6	130
Combro	10	140
Dedimus	4	95
Dedimus	5	95
Dedimus	8	120
Dedimus	15	95
Dedimus	16	95
Dedimus	23	270
Dedimus	24	210

BOREHOLE NUMBER		CONDUCTIVITY (mS/m)
Duitschland	5	240
Duitschland	7	170
Duitschland	11	140
Duitschland	13	170
Duitschland	14	140
Geluksfontein	11	250
Geluksfontein	12	220
Geluksfontein	16	150
Geluksfontein	18	120
Geluksfontein	20	185
Geluksfontein	28	180
Geluksfontein	31	150
Geluksfontein	32	150
Geluksfontein	33	185
Geluksfontein	34	185
Geluksfontein	35	240
Geluksfontein	36	240
Geluksfontein	39	150
Geluksfontein	41	210
Geluksfontein	2	150
Geluksfontein	4	230
Groothoek	10	135
Groothoek	12	125
Inderhiken	2	170
Inderhiken	3	100
Inderhiken	6	200
Inderhiken	11	85
Inderhiken	12	100
Inderhiken	14	100
Inderhiken	16	105
Klein Collie	9	300
Klein Collie	10	200
Klein Collie	12	210
Klein Collie	19	170
Klein Collie	20	160
Klein Collie	15	210
Klein Collie	21	220
Klein Collie	23	200
Klein Collie	27	140
Klein Collie	29	140
Klein Collie	33	290
Klein Collie	34	290
Koniggratz	1	130
Koniggratz	2	120
Kraaifontein	8	150
Kraaifontein	10	150
Kraaifontein	11	140
Kraaifontein	17	120

BOREHOLE NUMBER		CONDUCTIVITY (mS/m)
Kraaifontein	19	140
Kraaifontein	20	140
Kraaifontein	21	120
Kwaggasbult	1	85
Kwaggasbult	2	100
Kwaggasbult	5	120
Kwaggasbult	8	110
Kwaggasbult	9	110
Kwaggasbult	11	100
Kwaggasbult	12	110
Lekkerlacht	8	75
Lekkerlacht	11	75
Meanderthal	7	80
Meanderthal	8	80
Meanderthal	20	85
Meanderthal	22	80
Meanderthal	26	80
Meanderthal	28	90
Meanderthal	29	75
Meanderthal	30	80
Meanderthal	36	95
Meanderthal	37	115
Meanderthal	38	100
Ne Plus Ultra	3	110
Ne Plus Ultra	5	90
Ne Plus Ultra	6	98
Ne Plus Ultra	7	120
Ne Plus Ultra	9	110
Ne Plus Ultra	10	110
Ne Plus Ultra	11	130
Ne Plus Ultra	13	115
Ne Plus Ultra	15	110
Ne Plus Ultra	16	103
Ne Plus Ultra	17	140
New Hanover	1	190
New Hanover	2	190
New Hanover	5	260
New Hanover	6	140
New Hanover	7	140
New Hanover	11	180
New Hanover	12	240
New Hanover	13	175
Nimmersault	2	110
Nimmersault	3	110
Nimmersault	4	120
Nimmersault	6	95
Nimmersault	7	105
Nimmersault	8	90

BOREHOLE NUMBER		CONDUCTIVITY (mS/m)
Nimmersault	9	110
Nimmersault	11	190
Nimmersault	12	95
Nimmersault	14	110
Nimmersault	15	110
Patryspan	7	90
Patryspan	12	90
Patryspan	15	85
Patryspan	17	90
Persie	1	100
Persie	2	100
Potsdam	6	105
Potsdam	13	120
Potsdam	16	120
Potsdam	17	140
Potsdam	18	120
Potsdam	22	150
Potsdam	25	175
Potsdam	26	140
Potsdam	28	140
Potsdam	29	110
Potsdam	30	120
Potsdam	31	110
Potsdam	36	105
Potsdam	37	120
Potsdam	39	118
Potsdam	40	120
Potsdam	41	170
Redhill	2	110
Redhill	15	110
Redhill	16	110
Rooikop	1	110
Rooikop	10	110
Rooikop	11	110
Rooikop	15	175
Rooikop	1	87
Rooikop	22	100
Rooikop	27	110
Soho	4	70
Soho	7	90
Soho	8	100
Stettin	3	150
Tweefontein	7	115
Tweefontein	8	120
Tweefontein	9	210
Tweefontein	12	120
Tweefontein	18	300
Tweefontein	21	130
Tweefontein	22	140
Tweefontein	25	120

BOREHOLE NUMBER		CONDUCTIVITY (mS/m)
Waldburg	3	200
Waldburg	4	150
Waldburg	14	240
Waldburg	16	230
Waldburg	20	200
Waldburg	23	200
Waldburg	27	200
Waldburg	29	130
Westheim	4	140
Westheim	5	140
Wurthsdorp	5	145
Wurthsdorp	8	120
York	3	110
York	5	150
York	8	100
York	9	85
York	12	110
York	13	105
York	14	105
York	15	105
Zandput	2	120
Zandput	6	75
Zandput	5	100
Zandput	7	100
Zandput	11	110

NUMBER OF BOREHOLES: 258

AVERAGE CONDUCTIVITY: 135mS/m

JLJ/JB/0810J/0160A

DORINGLAAGTE CATCHMENT - GROUND WATER LEVELS ABOVE SEA LEVEL

Borhole number		Elevation above sea level**		Water level depth (meters below surface)	Ground-water level (meters above sea level)
		Feet	Meters		
Altenburg	10*	3 020	923,54	23,33	900,21
Altenburg	11*	3 030	926,60	26,68	899,92
Anex Alion	1	3 375	1 032,11	21,62	1 010,49
Anex Alion	10	3 400	1 039,75	46,21	993,54
Anex Alion	12	3 375	1 032,11	28,04	1 004,07
Anex Alion	17	3 410	1 042,81	39,35	1 003,46
Anex Alion	19	3 400	1 039,75	40,21	999,54
Anex Alion	24	3 350	1 024,46	23,34	1 001,12
Anex Alion	25	3 375	1 032,11	31,55	1 000,56
Appelfontein	5	3 600	1 100,91	1100,00	1 000,91
Appelfontein	13	3 560	1 088,68	31,61	1 057,07
Appelfontein	14	3 560	1 088,68	31,86	1 056,82
Appelfontein	17	3 560	1 088,68	58,91	1 029,77
Appelfontein	19	3 565	1 090,21	54,44	1 035,77
Baviaanspoort	2	3 240	990,82	25,69	965,13
Baviaanspoort	8	3 250	993,88	62,32	931,56
Baviaanspoort	9*	3 225	986,24	72,55	913,69
Bellvue	3*	3 300	1 009,17	10,52	998,65
Bellvue	4	3 305	1 010,70	9,68	1 001,02
Bellvue	15*	3 230	987,76	64,44	923,32
Bellvue	19	3 300	1 009,17	23,28	985,89
Bloempiesvlei	1	3 140	960,24	58,65	901,59
Bloempiesvlei	5	3 130	957,19	19,98	937,21
Bloempiesvlei	6*	3 135	958,71	17,74	940,97
Bloempiesvlei	11*	3 135	958,71	18,12	940,59
Bloempiesvlei	17	3 190	975,53	36,90	938,63
Bloempiesvlei	25	3 150	963,30	25,80	937,50
Bloempiesvlei	27	3 190	975,53	35,36	940,17
Boomzien	2	3 355	1 025,99	37,56	988,43
Boomzien	6	3 355	1 025,99	42,25	983,74
Boomzien	9	3 390	1 036,69	31,24	1 005,45
Boomzien	12	3 390	1 036,69	26,35	1 010,34
Boomzien	14	3 395	1 038,23	23,34	1 014,89
Boomzien	15	3 395	1 038,23	26,20	1 012,03
Boomzien	16	3 400	1 039,75	27,55	1 012,20
Boomzien	24	3 350	1 024,46	57,18	967,28
Boomzien	27	3 355	1 025,99	44,36	981,63
Boomzien	28*	3 390	1 036,69	30,52	1 006,17
Boomzien	32	3 355	1 025,99	16,00	1 009,99
Boomzien	36	3 325	1 025,99	32,51	993,48
Bornst	5*	3 220	984,71	58,74	925,97
Bornst	13	3 150	963,30	61,24	902,06
Bornst	15	3 155	964,83	57,31	907,52
Bornst	23	3 090	944,95	54,69	890,35
Bornst	24	3 140	960,24	44,47	915,77
Bornst	35	3 145	961,77	64,06	897,71
Burg	6	3 250	993,88	48,32	945,56
Burg	8	3 260	996,94	34,14	962,80
Burg	9	3 260	996,94	34,09	962,85
Burg	10	3 270	1 000,00	34,05	965,95
Burg	12*	3 290	1 006,11	35,59	970,52
Burg	13	3 290	1 006,11	32,33	973,78
Burg	14	3 270	1 000,00	34,05	965,95
Claudius Hoop	2	3 240	990,82	54,80	936,02
Claudius Hoop	5	3 240	990,82	76,40	914,42
Claudius Hoop	6	3 240	990,82	76,40	914,42
Claudius Hoop	7*	3 160	966,36	71,91	894,45
Claudius Hoop	10	3 165	967,89	63,93	903,96
Claudius Hoop	16	3 240	990,82	69,71	921,11
Claudius Hoop	27*	3 185	974,01	64,36	909,65
Claudius Hoop	28*	3 185	974,01	63,10	910,91
Claudius Hoop	34	3 160	966,36	69,31	897,05

* EQUIPPED BOREHOLES

** ELEVATION OBTAINED FROM A 1:50 000 TOPOGRAPHICAL MAP, WITH A SOFT CONTOUR INTERVAL

JLJ/JB/0810J/0160A

DORINGLAAGTE CATCHMENT - GROUND-WATER LEVELS ABOVE SEA LEVEL

Borhole number		Elevation above sea level**		Water level depth (meters below surface)	Ground-water level (meters above sea level)
		Feet	Meters		
Combro	7*	3 450	1 055,04	28,52	1 026,52
Combro	15	3 360	1 027,52	24,85	1 002,67
Combro	17	3 435	1 050,46	22,48	1 027,98
Combro	20	3 400	1 039,75	28,74	1 011,01
Dedimus	2	3 445	1 053,52	32,35	1 021,17
Dedimus	11	3 460	1 058,10	39,85	1 018,25
Dedimus	12	3 450	1 055,04	42,11	1 012,93
Dedimus	17	3 415	1 044,34	37,74	1 006,60
Dedimus	18	3 410	1 042,81	36,91	1 005,90
Dedimus	19	3 420	1 045,87	31,92	1 013,95
Dedimus	20	3 420	1 045,87	30,66	1 015,21
Dedimus	21	3 425	1 047,40	31,01	1 016,39
Dedimus	22	3 460	1 058,10	32,88	1 025,22
Dedimus	25	3 455	1 056,57	27,38	1 029,19
Dedimus	26	3 460	1 058,10	28,12	1 029,98
Dedimus	27	3 470	1 061,16	30,65	1 030,51
Duitschland	3	3 330	1 018,35	20,31	998,04
Duitschland	4	3 330	1 018,35	21,30	997,05
Duitschland	6	3 340	1 021,41	43,56	977,85
Duitschland	9	3 390	1 036,69	28,00	1 008,69
Duitschland	14*	3 400	1 039,75	38,81	1 000,94
Duitschland	15*	3 395	1 038,23	30,61	1 007,62
Duitschland	16	3 330	1 018,35	21,64	996,71
Duitschland	18	3 355	1 025,99	15,24	1 010,75
Geluksfontein	1	3 280	1 003,06	37,00	966,06
Geluksfontein	2*	3 265	998,47	37,50	960,97
Geluksfontein	7	3 260	996,94	29,35	967,59
Geluksfontein	8	3 240	990,82	18,75	972,07
Geluksfontein	9	3 240	990,82	19,11	971,71
Geluksfontein	13	3 260	996,94	28,74	968,20
Geluksfontein	19	3 290	1 006,11	18,66	987,45
Geluksfontein	23	3 250	993,88	18,76	975,12
Geluksfontein	25	3 310	1 012,23	9,58	1 002,65
Geluksfontein	37	3 260	996,94	29,07	967,87
Geluksfontein	38	3 255	995,41	21,00	974,41
Geluksfontein	39*	3 300	1 009,17	21,16	988,01
Geluksfontein	40	3 280	1 003,06	23,43	979,63
Geluksfontein	42	3 275	1 001,52	22,78	978,74
Geluksfontein	43	3 275	1 001,52	22,78	978,74
Geluksfontein	44	3 255	995,41	32,20	963,21
Geluksfontein	45	3 260	996,94	37,40	959,54
Groothoek	3	3 300	1 009,17	100,90	908,27
Groothoek	4*	3 300	1 009,17	85,63	923,54
Groothoek	10*	3 250	993,88	58,04	935,84
Groothoek	11	3 250	993,88	59,66	934,22
Groothoek	12*	3 250	993,88	51,45	942,43
Groothoek	13*	3 300	1 009,17	±100,90	908,27
Groothoek	14	3 300	1 009,17	+100,00	-909,17
Groothoek	15	3 300	1 009,17	+100,00	-909,17
Inderhiken	1	3 430	1 048,93	23,92	1 025,01
Inderhiken	13	3 480	1 064,22	30,84	1 033,38
Inderhiken	15	3 490	1 067,28	35,05	1 032,23
Inderhiken	17	3 550	1 085,62	70,41	1 015,21
Klein Collie	4	3 220	984,71	30,18	954,53
Klein Collie	5	3 200	978,59	28,12	950,47
Klein Collie	16*	3 160	966,36	35,94	930,42
Klein Collie	17	3 160	966,36	36,60	929,76
Klein Collie	22*	3 220	984,71	62,67	886,04
Klein Collie	24	3 220	984,71	41,25	943,46
Kraaifontein	2	3 550	1 085,63	66,59	1 019,04
Kraaifontein	5	3 500	1 070,33	31,49	1 038,84

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DORINGLAAGTE CATCHMENT - GROUND-WATER LEVELS ABOVE SEA LEVEL

Borhole number		Elevation above sea level**		Water level depth (meters below surface)	Ground-water level (meters above sea level)
		Feet	Meters		
Kraaifontein	6	3 500	1 070,33	32,62	1 037,71
Kraaifontein	7	3 530	1 079,52	64,65	1 014,87
Kraaifontein	18	3 550	1 085,63	+100,00	-985,63
Kraaifontein	22	3 520	1 076,45	63,97	1 012,48
Kraaifontein	23	3 520	1 076,45	+100,00	-976,45
Kraaifontein	24	3 555	1 087,15	69,12	1 018,03
Kraaifontein	25*	3 550	1 085,63	65,15	1 020,48
Kwaggabult	13	3 550	1 085,63	72,16	1 013,47
Lekkerlacht	3	3 670	1 107,03	+100,00	-1 007,03
Lekkerlacht	9	3 610	1 103,97	83,50	1 020,47
Meanderthal	6	3 520	1 076,45	60,93	1 015,52
Meanderthal	9	3 550	1 085,63	56,80	1 028,83
Meanderthal	13	3 590	1 077,86	81,61	1 016,25
Meanderthal	17	3 605	1 102,45	51,16	1 051,29
Meanderthal	21	3 625	1 108,56	87,17	1 021,39
Meanderthal	24	3 640	1 113,15	61,55	1 051,60
Meanderthal	31	3 590	1 097,86	80,95	1 016,91
Meanderthal	32	3 605	1 102,46	64,76	1 037,70
Meanderthal	33	3 525	1 077,98	34,12	1 043,86
Meanderthal	34	3 540	1 082,56	76,55	1 006,01
Meanderthal	35	3 590	1 097,86	73,24	1 024,62
Ne Plus Ultra	8	3 110	951,07	54,90	896,17
Ne Plus Ultra	12	3 030	926,60	35,24	891,36
New Hanover	1*	3 125	955,66	16,20	939,46
New Hanover	2*	3 125	955,66	15,90	939,76
New Hanover	5	3 150	963,30	36,00	927,30
New Hanover	7*	3 110	951,07	36,52	914,55
New Hanover	8	3 150	963,30	36,61	926,69
Nimmersault	13	3 070	938,83	46,14	92,69
Patryspan	14	3 640	1 113,15	63,85	1 067,01
Patryspan	16	3 605	1 102,45	71,68	1 030,77
Patryspan	18	3 590	1 097,86	79,07	1 018,79
Patryspan	19	3 590	1 097,86	79,41	1 018,45
Potsdam	8	3 320	1 015,29	34,08	951,21
Potsdam	13*	3 295	1 007,66	43,50	964,16
Potsdam	15*	3 285	1 004,58	41,07	963,51
Potsdam	19	3 275	1 001,53	41,91	949,62
Potsdam	26*	3 260	996,94	36,08	960,86
Potsdam	34	3 285	1 004,58	44,71	959,87
Potsdam	35	3 315	1 013,76	55,15	958,61
Potsdam	38	3 320	1 015,29	30,43	984,86
Potsdam	42	3 320	1 015,29	32,22	983,07
Redhill	1	3 150	963,30	44,41	918,89
Redhill	3	3 160	966,36	55,21	911,15
Redhill	4	3 160	966,36	55,54	910,82
Redhill	7	3 200	978,59	54,57	924,04
Redhill	8	3 200	978,59	54,84	923,75
Redhill	9	3 180	972,47	59,04	913,43
Redhill	12	3 205	980,12	61,28	918,84
Redhill	13	3 210	981,65	62,09	919,56
Redhill	14*	3 200	978,59	61,10	917,49
Redhill	17	3 160	966,36	46,82	919,54
Rooikop	5	3 165	967,89	51,53	916,36
Rooikop	6*	3 160	966,36	42,55	923,81
Rooikop	7	3 150	963,30	46,34	916,96
Rooikop	12	3 160	966,36	46,34	920,02
Rooikop	14	3 160	966,36	52,40	913,96
Rooikop	16	3 160	966,36	51,31	915,05
Rooikop	17	3 165	967,89	51,85	916,04
Rooikop	18	3 150	963,30	64,60	898,70
Rooikop	22	3 150	963,30	57,57	905,73

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DORINGLAAGTE CATCHMENT - GROUND WATER LEVELS ABOVE SEA LEVEL

Borhole number		Elevation above sea level**		Water level depth (meters below surface)	Ground water level (meters above sea level)
		Feet	Meters		
Rooikop	23	3 150	963,30	46,96	916,34
Rooikop	24	3 140	960,24	47,34	912,90
Rooikop	25	3 140	960,24	47,45	912,79
Rooikop	26	3 140	960,24	48,38	911,86
Soho	3	3 720	1 137,61	41,01	1 096,6
Soho	10	3 640	1 113,15	86,38	1 026,77
Soho	12	3 635	1 111,62	100,00	1 011,62
Tweefontein	8*	3 385	1 035,16	17,36	1 017,80
Tweefontein	14	3 500	1 070,34	34,54	1 035,80
Tweefontein	17	3 375	1 032,11	23,87	1 008,24
Tweefontein	20	3 410	1 042,81	21,22	1 021,59
Tweefontein	23	3 510	1 073,39	68,65	1 004,74
Tweefontein	26	3 470	1 061,16	27,86	1 033,30
Tweefontein	27	3 470	1 061,16	31,74	1 029,42
Waldburg	7	3 190	975,54	22,53	953,01
Waldburg	8	3 195	977,06	30,56	946,50
Waldburg	11	3 170	969,42	21,98	947,44
Waldburg	21	3 120	969,42	30,42	939,00
Waldburg	22	3 170	969,42	30,15	939,27
Waldburg	24	3 170	969,42	30,15	939,27
Waldburg	25	3 185	974,00	31,50	942,50
Waldburg	30	3 240	990,82	45,84	944,98
Westheim	1	3 655	1 117,73	27,61	1 090,12
Westheim	2	3 655	1 117,73	28,74	1 089,00
York	2	3 120	954,13	54,10	900,03
York	4	3 120	954,13	38,32	915,81
York	6	3 115	952,59	22,32	930,27
York	7	3 105	949,54	53,10	996,44
York	10	3 120	954,13	53,46	900,67
York	16	3 090	944,95	44,17	900,78
York	17	3 090	944,95	45,50	899,45
York	18	3 140	960,24	51,10	909,14
York	19	3 150	963,30	43,45	919,85
York	20	3 110	951,07	46,99	904,08
			Range: 944,95 1 137,61	Average: 43,87 m	Range: 881,63 1 057,07

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Boreholes

Farm Name	Number of boreholes	Boreholes used* I	D	S	Number of boreholes open	Crop types	Theoretical irrigation quantity (mm/season)	Hectates under irrigation (ha)	Theoretical yearly irrg.amount ($x10^3m^3$)	Total ($x10^3m^3$)	Yearly borehole abstraction ($x10^3m^3$)	Conductivity (range and average) (mS/m)	Water-level range m	Average water level m
Altenburg	6	2	0	1	2	Maize	855	25	214	337	197	220-250 235	23-27	25
						Potatoes	617	20	123					
Annex Alion	27	8	4	1	7	Tomatoes	676	20	135	550	867	95-180 122	21-47	32
						Maize	855	20	171					
						Pumpkins	484	20	97					
						Potatoes	617	16	99					
						Lucerne	1 600 mm/yr	3	48					
Appelfontein	19	9	0	1	5	Maize	855	40	342	809	988	100-130 110	31-110	57
						Pumpkins	484	20	97					
						Potatoes	617	60	370					
Baviaanspoort	11	0	2	2	3	Domestic stock				-	29	75-100 87	25-72	53
Bellvue	19	6	2	2	3	Maize	855	18	153	356	327	95-210 133	9-65	26
						Potatoes	617	18	111					
						Sweet Pots	617	15	92					
Bloemtjiesvlei	33	10	2	1	12	Maize	855	70	598	1 354	1 095	110-190 151	17-59	27
						Cotton	821	20	164					
						Tomatoes	676	10	68					
						Oats	737	25	184					
						Wheat	737	20	147					
						Pumpkins	484	20	97					
						Potatoes	617	155	96					
Boomzien	38	11	5	0	11	Cotton	821	25	205	389	308	110-190 124	16-58	33
						Wheat	737	25	184					
Bornst	36	14	2	0	5	Maize	855	70	598	1 418	906	85-175 102	44-65	56
						Potatoes	617	70	431					

* I: Irrigation
D: Domestic
S: Stock

Farm Name	Number of boreholes	Boreholes used* I	D	S	Number of boreholes open	Crop types	Theoretical irrigation quantity (mm/season)	Hectates under irrigation (ha)	Theoretical yearly irrg.amount ($\times 10^3 m^3$)	Total ($\times 10^3 m^3$)	Yearly borehole abstraction ($\times 10^3 m^3$)	Conductivity (range and average) (mS/m)	Water-level range m	Average water level m
Burg	14	0	1	1	6	Stock		-		-	4	100-150 123	32-49	36
Claudius Hoop	34	17	2	1	6	Cotton	821	125	1 026	1 452	1 376	100-135 114	54-77	67
						Tomatoes	676	10	67					
						Maize	855	35	299					
						Potatoes	617	34	209					
						Pumpkins	484	30	145					
Combro	21	4	2	0	4	Cotton	821	15	123	306	378	110-140 125	22-29	26
						Vegetables	676	10	67					
						Tomatoes	676	10	68					
						Pumpkins	484	10	48					
Dedimus	27	0	2	6	12	Stock Domestic				-	35	95-270 140	27-43	33
Duitsland (Plus Dendron Municipality)	18	3	3	0	5	Dendron municipality				-	285)	140-240 172	15-44	27
						Maize	855	20	171	491	)			
						Grazing	1600 mm/yr	10	320		313)			
Geluksfontein	43	13	7	0	13	Grazing	1600 mm/yr	10	160	2 175	633	120-250 182	9-37	23
						Tomatoes	676	26	175					
						Potatoes	617	30	185					
						Pumkins	484	30	145					
						Maize	855	86	735					
Groothoek	15	4	0	0	4	Maize	855	20	171	665	300	125-135 130	39-110	90
						Potatoes	617	80	494					
Inderhiken	17	6	1	1	4	Pumpkins	484	30	145	362	282	85-200 123	23-71	40
						Potatoes	617	30	185					
						Grazing	1600 mm/yr	2	32					

Farm Name	Number of boreholes	Boreholes used* I	D	S	Number of boreholes open	Crop types	Theoretical irrigation quantity (mm/season)	Hectates under irrigation (ha)	Theoretical yearly irrg.amount ($x10^3m^3$)	Total ($x10^3m^3$)	Yearly borehole abstraction ($x10^3m^3$)	Conductivity (range and average) (mS/m)	Water-level range m	Average water level m
Klein Collie	36	12	4	1	7	Sweet Potatoes	617	13	80	792	1 258	140-290 212	28-63	39
						Potatoes	617	13	80					
						Tomatoes	676	80	540					
						Pumpkins	484	10	48					
						Oats	734	6	44					
Koniggratz (Fatima Mission)	2	0	2	0	0	Domestic				-	262	120-130 125	-	-
Kraaifontein	25	8	0	0	8	Cotton	821	30	164	287	609	120-150 137	31-110	68
						Potatoes	617	20	123					
Kwaggasbult	12	9	0	0	1	Pumpkins	484	60	290	1 249	960	85-120 105	-	72
						Maize	855	40	342					
						Potatoes	617	100	617					
Lekkerlacht	11	2	0	0	2	Potatoes	617	33	203	203	157	75	83-110	97
Meanderthal	39	11	1	1	11	Maize	855	90	769	1 654	740	75-115 87	51-81	66
						Potatoes	617	120	740					
						Pumpkins	484	30	145					
Ne Plus Ultra	17	8	4	0	2	Maize	855	60	513	944	793	90-140 110	35-55	45
						Potatoes	617	70	431					
New Hanover	13	3	1	5	1	Maize	855	20	171	294	113	140-260 186	15-37	28
						Potatoes	617	20	123					
Nimmersault	15	9	1	2	1	Maize	855	60	513	883	746	90-190 113	-	46
						Potatoes	617	60	370					

Farm Name	Number of boreholes	Boreholes used* I	D	S	Number of boreholes open	Crop types	Theoretical irrigation quantity (mm/season)	Hectates under irrigation (ha)	Theoretical yearly irrg.amount ($x10^3m^3$)	Total ($x10^3m^3$)	Yearly borehole abstraction ($x10^3m^3$)	Conductivity (range and average) (mS/m)	Water-level range m	Average water level m
Patryspan	22	8	0	0	4	Pumpkins	484	20	97	515	799	85-90 89	63-80	73
						Maize	855	20	171					
						Potatoes	617	40	247					
Persie	2	0	2	0	0	Domestic				-	27	100	-	-
Potsdam	42	14	4	0	5	Maize	855	30	256	1 525	1 616	100-175 128	32-56	40
						Pumpkins	484	30	145					
						Potatoes	617	80	493					
						Cotton	821	50	410					
						Wheat	737	30	221					
Redhill	18	5	0	0	9	Maize	855	30	256	620	547	110	44-63	55
						Potatoes	617	30	185					
						Ground nuts	598	30	179					
Rooikop	27	8	1	1	11	Maize	855	70	598	1 029	926	100-175 116	42-64	47
						Potatoes	617	70	431					
Soho	13	3	0	1	3	Lucerne	1600 mm/yr	8	128		75	70-100 87	41-110	79
Stettin	3	0	1	1	0	Stock				-	6	150	-	-
						Domestic						123		
Tarantaalpan	1	0	1	0	0	Not used				-	0	-	-	-
Tweefontein	27	6	4	1	7	Maize	855	10	85	259	575	115-300 157	17-69	32
						Cotton	821	10	82					
						Potatoes	617	15	92					
Waldburg	32	8	4	0	8	Maize	855	10	85	2 000	1 227	130-240 193	21-45	30
						Potatoes	617	3	18					
						Wheat	737	100	737					
						Pumpkins	484	100	484					
						Vegetables	676	100	676					

Farm Name	Number of boreholes	Boreholes used* I	D	S	Number of boreholes open	Crop types	Theoretical irrigation quantity (mm/season)	Hectates under irrigation (ha)	Theoretical yearly irrg.amount ($x10^3m^3$)	Total ($x10^3m^3$)	Yearly borehole abstraction ($x10^3m^3$)	Conductivity (range and average) (mS/m)	Water-level range m	Average water level m
Westheim	5	0	2	0	2	Domestic		-		-	4	140	27-29	28
Wurthsdorp	10	1	1	0	0	Domestic				-	94	145-120 132	-	-
York	20	6	1	3	10	Maize	855	100	855	1 592	1 420	87-150 106	22-54	45
						Wheat	737	100	737					
Zandput	11	5	0	0	0	Maize	855	80	684	807	524	75-120 101	-	-
						Potatoes	617	20	123					
Total	781	233	69	33	194	-	-	3 579		25 317	21 753 (20 759 for irrigation only)	70-300 129	9-±110	47

Farm	Owner	Summer		Winter		Boreholes used	Yearly groundwater abstraction ($\times 10^3$ m^3)
		Crop	Area (ha)	Crop	Area (ha)		
Redhill	C. Blofield	Maize Groundnuts	30 30	Potatoes	30	14, 15, 16, 2, 6	547
Rooikop	G.C. Fick	Maize	70	Potatoes	70	1, 10, 11, 13, 15, 20, 22, 8, 6, 27	926
Soho	S.M. Vorster	Lucerne	4	Lucerne	4	7, 8, 9, 13, 4	75
Stettin	Lebowa	No irrigation - stock and domestic only				3	6
Tarantaalpan	M. Baikie	No groundwater use at all				-	-
Tweefontein	H.J. Visagie	Maize Cotton	10 10	Potatoes	15	4, 9, 12, 18, 21,	572
	H.N. Labeschagne	No irrigation - domestic only				5	1
	J.H. de Jager	No irrigation - domestic and stock only				7, 8, 24, 25	2
Waldburg	Pistorius	Wheat Vegetables	50 100	Wheat Pumpkins	50 100	14, 15, 16, 23, 32, 20, 26, 27	1 088
	J. Becker (Hires farm)	Maize	10	Potatoes	3	3, 4, 9, 10, 28, 29	139
Westheim	Lebowa	No irrigation - only stock and domestic				4, 5	4
Wurthsdorp	Lebowa	No irrigation - only stock and domestic				5, 8	94
York	F. Kloppers	Maize	40	Wheat	40	14, 15, 18, 1, 2, 5, 9	460
	Van Zyl	Maize	60	Wheat	60	3, 12, 13	960

Farm	Owner	Summer		Winter		Boreholes used	Yearly groundwater abstraction ($\times 10^3$ m^3)
		Crop	Area (ha)	Crop	Area (ha)		
Zandput	T. Youngbloed	Maize	80	Potatoes	20	2, 5, 6, 7, 11	524
Total 39 farms		Maize	1 024			335	21 753
		Potatoes	1 245				
		Cotton	275				
		Tomatoes	156				
		Wheat	275				
		Oats	31				
		Pumpkins	390				
		Vegetables	110				
		Groundnuts	30				
		Lucerne	11				
		Grazing	22				

Farm	Owner	Summer		Winter		Boreholes used	Yearly groundwater abstraction ($x10^3$ m^3)
		Crop	Area (ha)	Crop	Area (ha)		
Koniggratz	Lebowa	No irrigation - domestic and stock only				1, 2	262
Kraaifontein	W. Becker	Cotton	30	Potatoes	20	8, 10, 11	500
	C.v.d. Merwe	No irrigation - stock only (water pumped to Kwaggasbult for irrigation)				25	109
Kwaggasbult	C. v.d. Merwe	Maize Pumpkins	40 60	Potatoes	100	1, 2, 5, 7-12	960
Lekkerlacht	M. Baikie			Potatoes	33	7, 8, 11, 17, 19 20, 21	157
Meanderthal	M. Baikie	Maize	60	Potatoes	60	20, 22, 26, 27, 28, 29, 30, 7, 8	740
	C. v.d. Merwe	Maize Pumpkins	30 30	Potatoes	60	36, 37, 38, 39	268
Ne Plus Ultra	J. van Wyk	Maize	30	Potatoes	30	9, 10, 11	396
	W. v.d. Merwe	Maize Potatoes	30 10	Potatoes	30	3, 5, 6, 7, 13-17	397
New Hanover	H.C.J.v. Rensburg	Maize	20	Potatoes	20	5, 9, 11, 1, 2, 12, 13	112
	C.J.J.v. Rensburg	No irrigation - stock and domestic only				6, 7	1
Nimmersault	J. van Wyk	Maize	60	Potatoes	60	2, 3, 4, 6-12 14, 15	746
Patryspan	C. v.d. Merwe	Pumpkins Maize	20 20	Potatoes	40	3, 7, 12, 17 20-22	696
	M. Baikie	Water pumped to irrigate Lekkerlacht				15	103
Persie	Lebowa	No irrigation - stock and domestic only				1, 2	27
Potsdam	J. Becker	Maize Pumpkins	30 30	Potatoes Wheat	30 30	13, 15-18, 23, 26 28, 29, 31, 30	898
	J. Roos	Cotton	50	Potatoes	50	6, 32, 34, 36, 37 39, 40, 22, 25, 41	718

Farm	Owner	Summer		Winter		Boreholes used	Yearly groundwater abstraction ($\times 10^3$ m^3)
		Crop	Area (ha)	Crop	Area (ha)		
Combro	T. Roos (Hires land)	Cotton Tomatoes	15 5	Pumpkins Tomatoes	10 5	5, 6, 9, 10, 18	368
	Lebowa (Hires land)	Vegetables	5	Vegetables	5	2	10
Dedimus	Walgenbag	No irrigation - domestic and stock only				1, 4, 5, 15, 16	43
	F. Viljoen	No irrigation - domestic and stock only				8	3
	C.P.G. v. Tonder	No irrigation - domestic and stock only				23, 24	11
Duitschland	Dendron Municipality	No irrigation - domestic only				11, 13, 14	285
	J.M. Grobbelaar	Maize	20	Grazing	10	2, 5, 7	313
Geluksfontein	G.J. Briers	Maize	23	Grazing Maize	10 13	12, 14, 35, 36, 20	36
	N.J. Grobler	No irrigation - domestic and stock only				41	9
	O.J. Swan	Tomatoes Maize	13 20	Tomatoes	13	33, 34, 32, 31, 10, 11	274
	J.H. Potgieter	No irrigation - domestic and stock only				4	1
	J. Becker	Maize Pumpkins	30 30	Potatoes	30	2, 16, 18, 27, 28	309
	P.A. Botes	No irrigation - domestic and stock only				5	4
Groothoek	G. Holtshauzen	Maize Potatoes	20 40	Potatoes	40	4, 10, 12, 13	300
Inderhiken	B. Reudler	Grazing	1	Grazing	1	2, 6, 7, 3	14
	C. v.d. Merwe	Pumpkins	30	Potatoes	30	11, 12, 14, 16	268
Klein Collie	H.P. Venter	Sweet Potatoes	13	Potatoes	13	12, 15, 21-24	64
	J. Fuhri	Tomatoes Pumpkins	80 10	(Nine month season)		9, 10, 26, 18, 19, 20	1 164
	M.J. Botha	Oats	6			27, 29, 32-34	30

Farm	Owner	Summer		Winter		Boreholes used	Yearly groundwater abstraction ($\times 10^3$ m^3)
		Crop	Area (ha)	Crop	Area (ha)		
Altenburg	J. van Wyk	Maize	25	Potatoes	20	10, 8, 11	197
Anex Alion	M.J. Botha	Tomatoes	10	Tomatoes	10	21, 22, 11, 20	212
	M.C. Jordaan	Maize Pumpkins	20 20	Potatoes Lucerne	16 3	7, 8, 9, 14, 15, 16, 2, 13 18	655
Appelfontein	C.v.d. Merwe	Maize Pumpkins	40 20	Potatoes	60	1, 2, 4, 6, 8, 10, 11 15, 16, 18	720
Baviaanspoort	G.C. Fick	No irrigation - Domestic use + stock only				6, 10	29
Bellvue	M. Baikie	Maize	18	Potatoes	18	2, 5, 6, 18, 1	240
	M.J. Botha			Sweet potatoes	15	14, 15, 16, 17, 7	57
Bloemetjiesvlei	H. de Kock	Maize Cotton Tomatoes	20 20 10	Wheat Pumpkins	20 20	16, 15, 14, 13, (1+17 on standby), 3	388
	D. Fick	Potatoes Maize	80 50	Potatoes Oats	75 25	8, 18-22, 24, 26	706
	Badenhorst	No irrigation - stock and domestic only				6, 11	
Boomzien	W.L. Roos	Cotton	25	Wheat	25	11, 13, 17, 28, 29, 30 23, 25, 26, 19, 22	248
	Plot owners	No irrigation - Domestic and stock only				31, 33, 35, 37, 38	60
Bornst	G.C. Fick	Maize	40	Potatoes	40	1, 3, 9, 11, 16	446
	W. v.d. Merwe	Maize	20	Potatoes	20	16, 28, 29, 30	270
	L.A. Smit	Maize	10	Potatoes	10	5, 6, 32-34, 36	190
Burg	Badenhorst	No irrigation - only stock and domestic				4, 12	4
Claudius Hoop	C. Botha	Cotton Pumpkins	60 30			21-28, 17	426
	M.C. Vorster	Cotton Tomatoes Maize	40 10 10	Potatoes	20	27, 28, 29-33	810
	C.J. Blofield	Maize Cotton	25 25	Potatoes	14	4, 13-14	70

2329AA

CADASTRAL FARM NAME: APPELFONTEIN

Borehole no.	Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping periods and quantity abstracted (l/s - hrs/week)	Groundwater level		Borehole depth (m)	E.C.		Other information
							Date	Depth below collar (m)		(mS/m)	Date	
AF 1	C. v.d. Merwe	S	Turb.			1 - 10						
2	C. v.d. Merwe	I	Spiral		22,7	13,8 - 84			97,8	180	1/10	
3	C. v.d. Merwe	Not	None			Not used						Dry
4	C. v.d. Merwe	I	Spiral		22,7	13,8 - 84			97,8			
5	C. v.d. Merwe	Not	None			Not used	1/10	+ 100 m				
6	C. v.d. Merwe	I	Spiral		16,4	8,8 - 84			103,9			
7	C. v.d. Merwe	Not	None			Not used						
8	C. v.d. Merwe	I	None		20,2	11,3 - 84			165,1	120	1/10	
9	C. v.d. Merwe	Not	None	21,4		Not used (dry)			91,7			Yield dropped
10	C. v.d. Merwe	I	Spiral		25,2	13,8 - 84			91,7	130	1/10	
11	C. v.d. Merwe	I	Subm.		21,4	12,6 - 84			103,9	110	1/10	
12	C. v.d. Merwe	Not	None	21,4		Not used						
13	C. v.d. Merwe	Not	None			Not used	1/10	31,61				Dry-yield decreased
14	C. v.d. Merwe	Not	None			Not used	1/10	31,86				
15	C. v.d. Merwe	I	Spiral		17,6	10,1 - 84			131,5	100	1/10	
16	C. v.d. Merwe	I	Spiral		21,4	13,8 - 84			91,7			
17	C. v.d. Merwe	Not	None		6,3	Not used	1/10	58,91	79,5			
18	C. v.d. Merwe	I	Subm.		11,3	6,3 - 84			94,8	100	1/10	
19	C. v.d. Merwe	Not	None		7,6	Not used	1/10	54,44	85,6			

CADASTRAL FARM NAME: ANEX ALION

Borehole no.	Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping periods and quantity abstracted (l/s - hrs/week)	Groundwater level		Borehole depth (m)	E.C.		Other information
							Date	Depth below collar (m)		(mS/m)	Date	
AN 1	M.C. Jordaan	Not	None		1,26	Not used	22/8	21,62				
2	M.C. Jordaan	D	Turb.			6,23 - 20			55,9	95	22/8	
3	M.J. Botha	Not in existence										
4	M.J. Botha	Not	Turb.	20,13		Not used			30,6			
5	M.J. Botha	Not	Broken W-P	18,8		Not used			30,6			
6	M.C. Jordaan	Not	None		7,5	Not used			30,6			
7	M.C. Jordaan	I	Turb.		+38,0	22,3 - 72			51,9	120	22/8	
8	M.C. Jordaan	I, D	Turb.			12,8 - 72			87,2	130	22/8	
9	M.C. Jordaan	I	Turb.			11,3 - 72 (2 m/yr)			79,5			
10	M.C. Jordaan	Not	None	6,87	1,26	Not used	22/8	46,21				
11	D.C. Grobler	D	Subm.									
12	D.C. Grobler	Not	None				25/8	28,04				
13	M.C. Jordaan	S	Wind		1,12				58,1			
14	M.C. Jordaan	I	4" mono		15,2	15,2 - 36			100,9	105	22/8	
15	M.C. Jordaan	I	Turb.		+38,0	22,3 - 72			87,8	100	22/8	
16	M.C. Jordaan	D	Mono			11,3 - 9			92,7			
17	M.C. Jordaan	Not	None		3,8	Not used	25/8	39,35	168,2			
18	M.C. Jordaan	D	Mono			2,6 - 20			140,6			
19	M.C. Jordaan	Not	None			Not used	25/8	40,21				
20	D.C. Grobler	I, D	Subm.			3,2 - 40				180	25/8	
21	M.J. Botha	I, D	Subm.		12,6	12,6 - 36			48,9			
22	M.J. Botha	I	Turb.	15,18		6,2 - 36			91,7	125	26/8	
23	M.J. Botha	Not	None	0,64		Not used			137,6			
24	M.J. Botha	Not	None	3,03	0,48	Not used	26/6	23,34	42,8			
25	M.J. Botha	Not	None	12,6		Not used	26/6	31,55	85,6			

CADASTRAL FARM NAME: ALTENBURG

Borehole no.	Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping rate and abstraction period (l/s - hrs/week)	Groundwater level		Borehole depth (m)	E.C.		Other information
							Date	Depth below collar (m)		(mS/m)	Date	
AG 1	Farm vacated											
2												
3		Gates locked - no access to farm										
4												
5	J.J.H. van Wyk	Unknown borehole										
6	"	"										
7	"	"										
8	"	I	Subm	20	20	12-60			79,5	250	7/8	
9	"	Unknown borehole										
10	"	I	Pump out	20	20	12-60	7/8	23.33	61	-		
11	"	S	3" mono	-	-		7/8	26.68	-	220	7/8	

CADASTRAL FARM NAME: BAVIAANSPOORT

Borehole no.	Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping periods and quantity abstracted (l/s - hrs/week)	Groundwater level		Borehole depth (m)	E.C.		Other information
							Date	Depth below collar (m)		(mS/m)	Date	
BT 1	G. Fick	Not	Broken W-P		0,8	Not used			42,8			)Pumps broken
2	G. Fick	Not	Broken stroke		1,6	Not used	12/8	25,69	42,8			))
3	G. Fick	Not	None		7,5	Fallen in			61,2			Fallen in
4	G. Fick	Not	W-P		1,3	Not used			61,2			Pump broken
5	G. Fick	Not	Broken W-P		1,3	Not used			67,3			Pump broken
6	G. Fick	D	3" Mono		7,6	7,6 - 20			82,6	100	12/8	
7	G. Fick	Not	Broken W-P		5,1	Not used			67,3			Pump broken
8	G. Fick	Not	None		7,6	Not used	12/8	62,32	107,0			Water stinks
9	G. Fick	Not	None		7,6	Not used	12/8	72,55	107,0			
10	G. Fick	S	3" Turb.		7,6	7,6 - 2			107,0	75	12/8	
11	G. Fick	S	W-P		1,3	Dry?			55,0			Dry?

CADASTRAL FARM NAME: BELLVUE

Borehole no.	Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping periods and quantity abstracted (l/s - hrs/week)	Groundwater level		Borehole depth (m)	E.C.		Other information
							Date	Depth below collar (m)		(mS/m)	Date	
BE 1	M. Baikie	S	W-P		<1,26				15,3	95	23/9	
2	M. Baikie	S, I	Turb.		12,64	12,64 - 60			48,9	125	23/9	
3	M. Baikie	Not	None		1,26	Not used	23/9	10,52				
4	M. Baikie	Not	Broken W-P		1,0	Not used	23/9	9,68 m	<30,6			Benthole
5	M. Baikie	I	Spiral			7,58 - 60			73,4	120	23/9	
6	M. Baikie	I	Turb.			12,64 - 60			79,5	120	23/9	
7	M.J. Botha (Rustig)	S	W-P							110	13/8	
8	M.J. Botha	Unknown borehole										
9	M. Baikie	No longer exists										
10	M.J. Botha	Not	None			Not used						Fallen in
11	M.J. Botha	Not	None			Not used						Dry
12	M.J. Botha	Borehole ploughed over										
13	M.J. Botha	Not	None			Not used						Dry
14	M.J. Botha	I	Mono		7,9	7,5 - 20			70,4	135	13/8	
15	M.J. Botha	I	Pump out				1/8	64,44				Pump being repaired
16	M.J. Botha	I, D	4" mono			18,8 - 20			79,5	210	13/8	
17	M.J. Botha	I	Turb.			5 - 20			82,0	175	13/8	
18	M.J. Baikie	D, S	Spiral			3,79 - 30			45,8	105	23/9	
19	M.J. Baikie	Not	None		0,6	Not used	23/9	23,28				

CADASTRAL FARM NAME: BLOEMETJIESVLEI

Borehole no.	Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping periods and quantity abstracted (l/s - hrs/week)	Groundwater level		Borehole depth (m)	E.C.		Other information
							Date	Depth below collar (m)		(mS/m)	Date	
BI 1	H. de Kock	Not	None		15,16	Not used	4/8	58,65	61,16			
2	H. de Kock	Not	None		22,75	Not used						Fallen in
3	H. de Kock	D	Mono		2,53	2,53 - 12			30,58			
4	D. Fick	Not	None			Not used						Fallen in
5	D. Fick	Not	None		1,26	Not used	18/9	19,98	30,58			
6	Badenhorst	D, S	Mono		0,8	0,8 - 10	31/7	17,74	30,6	190	31/7	
7	D. Fick	Not	None		1,26	Not used			68,8			Fallen in
8	D. Fick	I	Subm.			22,75 - 80			68,5	180	18/9	
9	H. de Kock	Not	None			Not used						Dry
10	H. de Kock	Not	None			Not used						Dry
11	Badenhorst	S	Wind		0,3		31/7	18,12	30,6	190	31/7	
12	Badenhorst	Not	None			Not used	31/7	17,43	42,8			
13	H. de Kock	I	Turb.		22,75	15,16 - 60			91,74	125	4/8	
14	H. de Kock	I	Subm.		22,75	15,16 - 60			91,74	110	4/8	
15	H. de Kock	I	Turb.		18,96	10,1 - 60			76,45	110	4/8	
16	H. de Kock	I	Turb.		22,75	15,16 - 60			61,12	110	4/8	
17	H. de Kock	Not	None		18,96	Not used	4/8	36,90	70,34			
18	D. Fick	D, I	Subm.		18,96	18,96 - 42			54,74	180	18/9	
19	D. Fick	I	Subm.			31,6 - 40			54,04	180	18/9	
20	D. Fick	D	Subm.			31,6 - 40			61,16			
21	D. Fick	I	Mono			6,32 - 40			±61 m			
22	D. Fick	I	Subm.			6,32 - 40			±61 m	180	18/9	
23	D. Fick	Not	None		12,64	Not used			61,16			Fallen in
24	D. Fick	I	Subm.			6,32 - 40			55,04			
25	D. Fick	Not	None		6,32	Not used	18/9	25,80	±61			Subm. to be installed
26	D. Fick	I	Subm.			22,75 - 40			68,8			
27	D. Fick	Not	None		12,64	Not used	18/9	35,36	68,8			
28	D. Fick	Not	None		10,1	Not used	18/9	26,2				
29	D. Fick	Not	None			Not used	18/9	23,66				
30	D. Fick	Not	None			Not used	18/9	19,4				
31	D. Fick	Not	None			Not used	18/9	25,93				
32	D. Fick	Not	None			Not used	18/9	26,32				
33	D. Fick	Not	None			Not used	18/9	33,34				

CADASTRAL FARM NAME: BOOMZIEN

Borehole no.	Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping periods and quantity abstracted (l/s - hrs/week)	Groundwater level		Borehole depth (m)	E.C.		Other information
							Date	Depth below collar (m)		(mS/m)	Date	
BN 1	W.L. Roos	Not	None	5,0	1,26	Not used	20/8	37,56	43			Yield decreased
2	W.L. Roos	Not	None	5,0	1,26	Not used						Dry
3	W.L. Roos	Not	None		1,26	Not used						Dry
4	W.L. Roos	Not	None		1,26	Not used						Fallen in (12 m)
5	W.L. Roos	Not	None			Not used						Fallen in
6	W.L. Roos	Not	None		3,8	Not used	20/8	42,25	91,7			
7	W.L. Roos	Not	None			Not used						Dry
8	W.L. Roos	Not	None			Not used						Dry
9	W.L. Roos	Not	None		< 1,26	Not used	20/8	31,24				
10	W.L. Roos	Not	None			Not used						Fallen in
11	W.L. Roos	I	3" turb.		3,19	3,19 - 60			61,2	140	20/8	
12	W.L. Roos	Not	None			Not used	20/8	26,35				
13	W.L. Roos	I	2 ½" mono		3,8	3,8 - 60				150	20/8	
14	W.L. Roos	Not	None			Not used	20/8	23,34				
15	W.L. Roos	Not	None			Not used	20/8	26,20				
16	W.L. Roos	Not	None			Not used	20/8	27,55				
17	W.L. Roos	I	4" mono	11,34		6,32 - 60			52	120	20/8	
18	W.L. Roos	Unknown - not marked on map										
19	A.J. Moulder	D	WP		0,3	Not used			61,2			
20	B. Reudler	Not	None			Not used						
21	B. Reudler	Not	None			Not used						Dry/Fallen in
22	A.J. Moulder	D	Mono		1,26	1,26 - 2			30			Dry/Fallen in
23	W.L. Roos	I	4" mono	18,85	6,31	6,32 - 60 (8 months)			91,7	120	20/8	
24	W.L. Roos	Not	None	12,6	1,26	Not used	20/8	57,18				
25	W.L. Roos	I	4" mono	8,8	3,8	3,8 - 60			61,2	140	20/8	Pumping nearby
26	W.L. Roos	I	2" subm.	7,5	3,8	3,8 - 60			91,7			
27	W.L. Roos	Not	None		5,1	Not used		44,36				
28	W.L. Roos	I	2½" subm.			2,6 - 60	20/8	30,52	36,7			
29	W.L. Roos	I	3" mono	7,5	3,6	3,6 - 60				190	20/8	
30	W.L. Roos	I	3" mono		2,6	2,6 - 60				190	20/8	
31	H.J.F. Rowles	D	2" mono		3,6	3,6 - 60			61,2	110	20/8	
32	H.J.F. Rowles	Not	None		3,6	Not used	20/8	16,00	45,8			
33	G.D. Wiehahn	D	Subm.		1,3	0,8 - 30			55,0	125	20/8	
34	G.D. Wiehahn	Not	None	18,8	1,88	Not used			36,7			
35	De Beer	I	3" mono		6,2	3,8 - 72			55,0	145	20/8	
36	De Beer	Not	None		0,3		20/8	32,51	152,9			10m from pumped hole
37	J.T. Vogel	D	Subm.		6,2	6,2 - 10			39,7	130	20/8	
38	J.P. Greyling	I, D	Mono	31,6								Owner in Jhb.

CADASTRAL FARM NAME: BORNST

Borehole no.	Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping periods and quantity abstracted (l/s - hrs/week)	Groundwater level Date	Groundwater level Depth below collar (m)	Borehole depth (m)	E.C. (mS/m)	E.C. Date	Other information
BS 1	G.C. Fick	I	4" turb.		19,0	15,18 - 70			67,3	105	11/8	
2	G.C. Fick	Not	None		10,0	Not used			42,8			Fallen in
3	G.C. Fick	I	4" subm.		25,2	15,18 - 70			152,9	105	11/8	
4	L.A. Smith	Not	None			Not used						Farmer didn't know about it
5	L.A. Smith	I	Turb.		6,32	6,32 - 72	17/9	58,74	122,0			Fallen in at 55 m
6	L.A. Smith	I	Subm.			6,32 - 72			103,9	100	17/9	
7	G.C. Fick	Not	None		15,18	Not used			64,2			Bulldozed flat
8	G.C. Fick	No knowledge				Not used						Bulldozed flat
9	G.C. Fick	I	4" turb.		18,9	15,18 - 70			73,4			
10	G.C. Fick	Not	None		18,9	Not used			73,4			Fallen in
11	G.C. Fick	I	4" turb.		18,9	15,18 - 70			55,0	95	11/8	
12	G.C. Fick	Not	None		12,6	Not used			73,4			Dry?
13	G.C. Fick	Not	None		12,6	Not used	12/8	61,25	107,0			
14	G.C. Fick	Not	None		5,1	Not used			64,2			Dry
15	W.C. v.d. Merwe	Not	None		6,2	Not used	13/8	57,31	95,0			
16	W.C. v.d. Merwe	I	Turb.	12,5	8,75	5,5 - 48			105,0	120	13/8	
17	W.C. v.d. Merwe	Not	None		8,8	Not used)						)Yields drop from
18	W.C. v.d. Merwe	Not	None			Not used)						)5,5 l/s to minimal
19	W.C. v.d. Merwe	Not	None			Not used) Fallen in or						)after a few
20	W.C. v.d. Merwe	Not	None			Not used) block up						)month's pumping
21	W.C. v.d. Merwe	Not	None			Not used)						)
22	W.C. v.d. Merwe	Not	None			Not used)						
23	W.C. v.d. Merwe	Not	None		14,1	Not used	13/8	54,69				
24	G.C. Fick	Not	None		2,6	Not used	12/8	44,47	76,4			
25	G.C. Fick	I	4" turb.		7,6	7,6 - 70						
26	G.C. Fick	D	Subm.		7,6	7,6 - 20			116,2	175	12/8	
27	W.C. v.d. Merwe	Not	None			Not used						Blocked by rocks
28	W.C. v.d. Merwe	I	Turb.	25	25	9,5 - 48	Pump being repaire		110,0	85	13/8	Fallen in at 58 m
29	W.C. v.d. Merwe	I	Turb.	20	20	8 - 48			100,0	103	13/8	
30	W.C. v.d. Merwe	I	Turb.	15	15	7 - 48			90,0	103	13/8	
31	W.C. v.d. Merwe	Not	None			Dry hole			95,0			Dry
32	L.A. Smit	I	Turb.			8,2 - 72			85,6	105	17/9	
33	L.A. Smit	I	Subm.		+15,16	8,8 - 72			137,6	105	17/9	
34	L.A. Smit	I	Subm.			15,16 - 72			103,9	105	17/9	
35	L.A. Smit	Not	None		15,16	Not used	17/9	64,06	97,8			Subm to be installed
36	L.A. Smit	D	Subm.		6,3	6,3 - 15				130	17/9	

CADASTRAL FARM NAME: CLAUDIUS HOOP

Borehole no.	Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping periods and quantity abstracted (l/s - hrs/week)	Groundwater level Date	Groundwater level Depth below collar (m)	Borehole depth (m)	E.C. (mS/m)	E.C. Date	Other information
CP 1	C. Botha	Unknown borehole										
2	C. Botha	Not	None	37,8		Not used	5/8	54,80	73,4			
3	C.J. Blofield	Not	None	15,2		Dry			52			Dry
4	C.J. Blofield	S	2" mono	2,3	1,3	1,3 - 9			55			
5	C.J. Blofield	Not	None			Not used	4/8	76,4				
6	C.J. Blofield	Not	None			Not used	4/8	76,4				
7	M.C. Vorster	I	Mono		20,1	12,6 - 72	5/8	71,91	88,7			Pump being repaired
8	M.C. Vorster	Not	None		0,3	Dry			91,7			Dry
9	M.C. Vorster	Not	None			Fallen in						Fallen in
10	C. Botha	Not	None			Not used	5/8	63,93	91,7			Yield too low
11	C. Botha	Bulldozed										Bulldozed
12	C. Botha	Not	None	2,3		Not used			79,5			
13	C.J. Blofield	I	3" mono	12,6	5,1	5,1 - 48		±76		135	4/8	
14	C.J. Blofield	I	4" mono	15,18	5,1	15,18 - 48			100	100	4/8	
15	C.J. Blofield	Not	None	15,18		Dry						Dry
16	C. Botha	Not	None			Not used	4/8	69,71				Yield too low
17	C. Botha	D	Turb.	25,2	12,6	12,6 - 6			67,3	120	5/8	
18	C. Botha	Not	None			Dry						Dry
19	C. Botha	I	4" mono	7,3	7,3	7,3 - 84			76,5	115	5/8	4 months only/year
20	C. Botha	I	4" mono		4,3	4,3 - 84			79,5	120	5/8	4 months only/year
21	C. Botha	I	4" mono		9,6	9,6 - 84			91,7	110	5/8	4 months only/year
22	C. Botha	I	4" mono		4,9	4,9 - 84			79,5	120	5/8	4 months only/year
23	C. Botha	I	4" mono		19,3	19,3 - 84			79,5	120	5/8	4 months only/year
24	C. Botha	I	4" mono		13,9	13,9 - 84			84,0			4 months only/year
25	C. Botha	I	4" mono		18,3	18,3 - 84			85,0	100	5/8	4 months only/year
26	C. Botha	I	4" mono		10,3	10,3 - 84			82,0			4 months only/year
27	M.C. Vorster	I	3" mono		10,0	7,6 - 72	5/8	64,36	91,7			4 months only/year
28	M.C. Vorster	I	Subm.		10,0	7,6 - 72	5/8	63,10	91,7			
29	M.C. Vorster	I	Subm.		10,0	7,6 - 72			91,7	110	5/8	
30	M.C. Vorster	D	2" mono		12,6	5,2 - 72			91,7			
31	M.C. Vorster	I	4" turb.		22,7	12,6 - 72			75,3			
32	M.C. Vorster	I	4" mono		25,8	15,18 - 72			91,7	110	5/8	
33	M.C. Vorster	I	4"		25,8	15,18 - 72			91,7	110	5/8	
34	M.C. Vorster	Not	None			Not used	5/8	69,31	91,7			

CADASTRAL FARM NAME: COMBRO

Borehole no.	Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping periods and quantity abstracted (l/s - hrs/week)	Groundwater level		Borehole depth (m)	E.C.		Other information
							Date	Depth below collar (m)		(mS/m)	Date	
CO 1	SADT (Hired by Lebowa farmers)	Not	None			Not used			± 46 m	110	18/9	Fallen in
2		I	Turb.			2 - 30						
3		Not	None			Not used						
4	SADT (Hired by T. Roos)	No longer exists										Fallen in
5		I	Spiral		6,32	5,0 - 48						
6	"	I	Spiral		+12,64	12,64 - 60			42,8	120	18/9	
7	"	Not	None			Not used				130	18/9	
8	"	Not	Turb.		< 1,26	Not used	18/9	28,52				
9	"	D	Spiral			3,79 - 60						
10	"	D	Spiral			25,28 - 60						
11	"	Not	Turb.			Not used				140	18/9	
12	"	Not	None			Not used						
13	Lebowa farms	Not	None			Not used						Fallen in
14	Lebowa farms	Not	None			Not used						Fallen in
15	Lebowa farms	Not	Spiral			Not used	18/9	24,85				Fallen in
16		Unknown										
17	T. Roos	Not	None			Not used	18/9	22,48				
18	T. Roos	I	Turb.		6,32	5,7 - 84						
19	T. Roos	Not	None			Not used						
20	Lebowa farms	Not	None			Not used	18/9	28,74				Fallen in
21	Lebowa farms	Not	Spiral			Not used						

CADASTRAL FARM NAME: DEDIMUS

Borehole no.	Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping periods and quantity abstracted (l/s - hrs/week)	Groundwater level Date	Groundwater level Depth below collar (m)	Borehole depth (m)	E.C. (mS/m)	E.C. Date	Other information
DS 1	Walgenbag	D	3" mono			3,2 - 40						
2	Walgenbag	Not	None			Not used	26/8	32,35				Farmer lives in
3	Walgenbag	No longer exists										
4	Walgenbag	S	Subm.							95	26/8	
5	Walgenbag	S	Subm.							95	26/8	
6	-	Not in existance										
7	F. Viljoen	Not	None			Not used						
8	F. Viljoen	S	3" mono			3,2 - 5						Dry - Fallen in
9	-	Not in existance								120	26/8	Farmer now in
10	-	Not in existance										
11	Walgenbag	Not	None			Not used	26/8	39,85				
12	Walgenbag	Not	None			Not used	26/8	42,11				
13	Walgenbag	Not	None			Not used						
14	Walgenbag	Not	None			Not used						Blocked @ 1 m
15	Walgenbag	S	Turb.									Dry
16	Walgenbag	S	4" turb.			2 - 10				95	26/8	
17	F. Viljoen	Not	Subm.			Not used	27/8	37,74		95	26/8	
18	F. Viljoen	Not	None			Not used	27/8	36,91				
19	F. Viljoen	Not	None			Not used	27/8	31,92				
20	F. Viljoen	Not	None			Not used	27/8	30,66				Government driller
21	F. Viljoen	Not	None			Not used	27/8	31,01				Government driller
22	C.P.G. van Tonder (d'Sonsin)	Not	None			Not used	27/8	32,88				
23	C.P.G. van Tonder	D	4" mono			3 - 10						Farmer lives in Pietersburg
24	"	S	3" mono							270	27/8	
25	"	Not	None							210		
26	"	Not	None			Not used	27/8	27,38				
27	"	Not	None			Not used	27/8	28,12				
						Not used	27/8	30,65				

CADASTRAL FARM NAME: DUITSCHLAND

Borehole no.	Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping periods and quantity abstracted (l/s - hrs/week)	Groundwater level		Borehole depth (m)	E.C.		Other information
							Date	Depth below collar (m)		(mS/m)	Date	
DD 1	J.M. Grobbelaar	Not	None	15,18		Not used			48,9			Fallen in
2	J.M. Grobbelaar	I	4" turb.	18,85		12,6 - 72			61,2			
3	J.M. Grobbelaar	Not	None	15,18		Not used	21/8	20,31	48,9			
4	J.M. Grobbelaar	Not	None	12,6		Not used	21/8	21,30	50			
5	J.M. Grobbelaar	I	Subm.	20,2		12,6 - 72			107	240	21/8	
6	J.M. Grobbelaar	Not	None		12,6	Not used	21/8	43,56				
7	J.M. Grobbelaar	I	Turb.		18,85	12,6 - 72			112,5	170	21/8	
8	Dendron Municip.	Unknown borehole										
9	Dendron Municip.	Not	None		1,6		21/8	28,00	36,7			Will be used shortly at caravan park
10	Dendron Municip.	Not	Mono	+12,6		Dry			40			Dried up
11	Dendron Municip.	M	Subm.	35,7		1,6 - 45			104,6	140	21/8	Pump to be moved to hole No. 9
12	Dendron Municip.	Not	Turb.	12,6		Dry			80,5			Dried up
13	Dendron Municip.	M	Turb.		6,39	6,31 - 60			104,6	170	21/8	Automatic float switch
14	Dendron Municip.	M	Subm.		44,1	18,9 - 60	21/8	38,81	50,7	140	21/8	Automatic float switch
15	Dendron Municip.	Not	Subm.			7,4 - 45	21/8	30,61	80			Pump in No. 14 to be moved to No. 15 (September 1986)
16	J.M. Grobbelaar	Not	None		7,4	Not used	21/8	21,64	48,9			
17	J.M. Grobbelaar	Not	None		10,0	Not used			61,2			
18	Dendron Municip.	Not	None				21/8	15,24				Fallen in

CADASTRAL FARM NAME: GROOTHOEK

Borehole no.	Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping periods and quantity abstracted (l/s - hrs/week)	Groundwater level		Borehole depth (m)	E.C.		Other information
							Date	Depth below collar (m)		(mS/m)	Date	
GK 1	G. Holtshausen	Not	None			Not used			76,5			
2	"	Not	None		3,16	Not used			91,7			
3	"	Not	None			Not used	19/9	± 100,9	107,0			Fallen in
4	"	I	Mono		30,34	15,16 - 90	19/9	85,63	137,6			
5	"	Not	None			Not used						Unknown Doesn't exist
6	"	Not	None			Not used						Unknown Doesn't exist
7	"	Not	None			Not used						Fallen in 1986
8	"	Not	Turb.		3,16	Not used	1984	39,75	91,7			
9	"	Not	None			Not used						
10	"	D, I	Turb.		7,5	4,4 - 48	19/9	58,04	91,7	135	19/9	
11	"	Not	None		10,11	Not used	19/9	59,66	137,6			
12	"	I	Spiral		15,16	10,11 - 72	19/9	51,45	65,7	125	19/9	
13	"	I	Spiral		7,5	4,4 - 72	19/9	± 100,9	168,2			
14	"	Not	None			Not used	19/9	± 100 m				
15	"	Not	None			Not used	19/9	± 100 m				

Borehole no.	Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping periods and quantity abstracted (l/s - hrs/week)	Groundwater level		Borehole depth (m)	E.C.		Other information
							Date	Depth below collar (m)		(mS/m)	Date	
GN 1	O.J. Swan	Not	None				18/8	37,00				
2	J. Becker	I	Turb.		15,18	10,0 - 60	18/8	± 37,5	48,4	150	18/8	
3	J. Becker	I	Turb.							180	18/8	
4	J.H. Potgieter	D	Mono			0,8 - 10				230	19/8	
5	P.A. Botes	D	Mono			0,8 - 48				185	19/8	
6	F. Potgieter	Not	None			Not used						
7	O.J. Swan	Not	None			Unused	18/8	29,35				Blocked
8	O.J. Swan	Not	Turb.			Not used	18/8	18,75				
9	O.J. Swan	Not	None			Not used	18/8	19,11				
10	O.J. Swan	D	Turb.		1,52	1,12 - 24						
11	O.J. Swan	D	Subm.		1,52	1,12 - 20			36,7	250	13/8	
12	G.J. Briers	I	Turb.			1,75 - 30				220	19/8	Yield decreases during 5 hours of pumping
13	G.J. Briers	Not	None									
14	G.J. Briers	I	3" turb.			2,6 - 40	19/8	28,74				
15	G.J. Briers	Not	None			Not used						
16	J. Becker	I	2" subm.		15,18	9,9 - 60						Blocked with rocks
17	J. Becker	Not	None			Not used			85,6	180	18/8	
18	J. Becker	I	Turb.		15,18	10,0 - 60			24,5			Dry
19	G.J. Briers	Not	None						67,3	120	18/8	
20	G.J. Briers	D	Turb.			1,44 - 20	19/8	18,66				
21	G.J. Briers	Not	None			Not used				185	19/8	
22	G.J. Briers	Not	None			Not used						Closed in
23	O.J. Swan	Not	None			Not used						Closed in
24	Van Rensburg	S	W-P				18/8	18,76				
25	J. Becker	Not	None		15,18	Not used				170	19/8	
26	J. Becker	Not	None				18/8	9,58				
27	J. Becker	D	3" turb.			7,9 - 60						Fallen in
28	J. Becker	I	Turb.		15,18	10,0 - 60			36,7			
29	J. Becker	Not	None		7,6	Not used			55,0	180	18/8	
30	J. Becker	Not	None			Not used			36,7			Fallen in - Dry?
31	O.J. Swan	I	Subm.		±35,0	18,8 - 72						Fallen in
32	O.J. Swan	I	Subm.		+35,0	18,8 - 72			76,4	180	18/8	
33	O.J. Swan	I	Turb.		7,6	7,6 - 72			122,3	180	18/8	
34	O.J. Swan	I	Turb.		7,6	7,6 - 72			48,9	185	18/8	
35	G.J. Briers	I	Turb.		3,2	2,7 - 20			35,8	240	19/8	
36	G.J. Briers	I	Turb.			1,1 - 20			35,8	240	19/8	
37	G.J. Briers	Not	None			Not used	19/8	29,07		240	19/8	
38	G.J. Briers	Not	None			Not used	19/8	21,00				
39	F. Potgieter	D	Subm.				19/8	21,16		150	19/8	
40	N.J. Grobler	Not	Mono			Not used	19/8	23,43				
41	N.J. Grobler	I	Subm.			1,3 - 40				210	19/8	
42	N.J. Grobler	Not	None			Not used	19/8	22,78				
43	N.J. Grobler	Not	None			Not used	19/8	22,78				
44	O.J. Swan	Water level recorder										
45	J. Becker	Water level recorder										

CADASTRAL FARM NAME: INDERHIKEN

Borehole no.	Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping periods and quantity abstracted (l/s - hrs/week)	Groundwater level		Borehole depth (m)	E.C.		Other information
							Date	Depth below collar (m)		(mS/m)	Date	
IN 1	B. Reudler	Not	Broken Stroke	3,79	1,89	Not used	24/9	23,92	45,8			
2	B. Reudler	I	Turb.			1,5 - 30			45,8	170	24/9	
3	B. Reudler	S	W-P		0,25				48,9	100	24/9	
4	B. Reudler	Not	None		0,2	Not used			61,2			WP to be installed
5	C. v.d. Merwe	Not	None			Not used						Dry
6	B. Reudler	D, I	Subm.	1,26	0,75	0,75 - 30			45,8	200	24/9	
7	B. Reudler	D,I,S	Subm.		0,25	0,25 - 30			45,8			
8	C. v.d. Merwe	Not	None			Not used						Dry
9	C. v.d. Merwe	Not	None			Not used						Dry
10	B. Reudler	Not	None		0,25	Not used			45,8			
11	C. v.d. Merwe	I	Mono		20,2	10,1 - 84			100,9	85	1/10	
12	C. v.d. Merwe	I	Mono		20,2	11,3 - 84			88,6	100	1/10	
13	C. v.d. Merwe	Not	None			Not used	1/10	30,84				
14	C. v.d. Merwe	I	Spiral		7,56	5,04 - 84			85,6	100	1/10	
15	C. v.d. Merwe	Not	None			Not used	1/10	35,05				
16	C. v.d. Merwe	D	Subm.		2,27	1,26 - 84			73,4	105	1/10	
17	C. v.d. Merwe	Not	None			Not used	1/10	70,41	107,0			

CADASTRAL FARM NAME: KLEIN COLLIE

Borehole no.	Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping periods and quantity abstracted (l/s - hrs/week)	Groundwater level Date	Groundwater level Depth below collar (m)	Borehole depth (m)	E.C. (mS/m)	E.C. Date	Other information
KE 1	M.J. Botha	Not in existance										
2	M.J. Botha	Not	None			Not used						Doesn't exist
3	M.J. Botha	Ploughed over										Fallen in
4	M.J. Botha	Not	Not			Not used	15/8	30,18				Ploughed over
5	M.J. Botha	Not	Not			Not used	15/8	28,12	48,9			
6	M.J. Botha	Not	Not			Not used						
7	J.J. Fuhri	Borehole unknown										Fallen in (4 m)
8	J.J. Fuhri	Borehole unknown										
9	J.J. Fuhri	I	Turb.		15,18	15,18 - 60		± 30 m	48,9	300	1/8	
10	J.J. Fuhri	I	Mono		25,2	25,2 - 60		± 30 m	48,9	200	1/8	
11	H.P.J. Venter					Not used						
12	H.P.J. Venter	I	4" mono	8,78	5,1	5,1 - 60			61,2	210	1/8	Dry
13	-	Borehole unknown										
14	-	Borehole unknown										
15	H.P.J. Venter	I	2" mono	8,78	2,6	2,6 - 60			61,2	210	1/8	
16	J.J. Fuhri	Not	None				1/8	35,94	48,9			
17	J.J. Fuhri	Not	None				1/8	36,60	-			
18	J.J. Fuhri	I	4" mono		22,6	22,6 - 60		± 30 m	± 48,9			
19	J.J. Fuhri	I	4" mono		25,2	25,2 - 60		± 30 m	± 46	170	1/8	
20	J.J. Fuhri	I	4" mono		12,6	12,6 - 60		± 30 m	± 46	160	1/8	
21	H.P.J. Venter	I	3" mono	±20,7	8,78	8,78 - 60			78,9	220	1/8	
22	H.P.J. Venter	S	Mono		5,1	5,1 - 5	1/8	62,67	97,6			
23	H.P.J. Venter	I	Turb.		8,78	8,78 - 36			114,6	200	1/8	
24	H.P.J. Venter	D	Subm.		2,6	2,6 - 5			91,7			
25	H.P.J. Venter	Not	None		3,8	Not used	1/8	41,25	-			
26	J.J. Fuhri	I	4" mono		18,8	18,8 - 60		± 30 m	48,9			
27	M.J. Botha	I	Turb.		18,8	18,8 - 84			76,5	140	13/8	
28	"	None	None			Not used						Dry
29	"	I	Turb.			17 - 84			76,5	140	13/8	
30	"	None	None			Not used						Dry
31	"	None	None			Not used						Dry
32	"	D	Mono			Not used						Dry
33	"	D	Mono			0,79 - 6			94,8	290	13/8	
34	"	D	Mono			0,79 - 12			91,7	290	13/8	
35	"	None	None				13/8	44,07	76,5			
36	"	None	None				13/8	53,96				

CADASTRAL FARM NAME: KRAAIFONTEIN

Borehole no.	Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping periods and quantity abstracted (l/s - hrs/week)	Groundwater level		Borehole depth (m)	E.C.		Other information
							Date	Depth below collar (m)		(mS/m)	Date	
KN 1	C. v.d. Merwe	No longer exists										
2	C. v.d. Merwe	Not	None			Not used	1/10	66,59				Dry
3	C. v.d. Merwe	Not	None			Not used						
4	C. v.d. Merwe	Not	Turb.			Not used						
5	C. v.d. Merwe	Not	None			Not used	1/10	31,49				
6	W. Becker	Not	None		5,1	Not used	25/9	32,62				
7	W. Becker	Not	Turb. head		12,64	Not used	25/9	64,65	120			
8	W. Becker	I	Turb.		18,96	12,64 - 72			120	150	25/9	
9	W. Becker	Not	None		5,1	Not used			55			Sealed
10	W. Becker	I	Subm.		15,16	6,9 - 72			120	150	25/9	
11	W. Becker	D, I	Mono		4,0	4 - 72				140	25/9	
12	C. v.d. Merwe	Not	W-P			Not used						Broken W-P
13	"	No longer exists										Ploughed over
14	"	No longer exists										Ploughed over
15	"	No longer exists										Ploughed over
16	W. Becker	Not	None	5,1		Not used			55			Dry
17	W. Becker	I	Subm.		10,11	5,05 - 72			120	140	25/9	
18	W. Becker	Not	Head of		6,32	Not used	25/9	+ 100 m	130			
19	W. Becker	I	Turb.		15,16	5,05 - 72			120	120	25/9	
20	W. Becker	I	Subm.		22,75	15,16 - 72			120	140	25/9	
21	W. Becker	I	Turb.		18,96	8,85 - 72			120	120	25/9	
22	W. Becker	Not	None		6,32	Not used	25/9	63,97				
23	W. Becker	Not	None			Not used	25/9	+ 100 m				
24	C. v.d. Merwe	Not	None			Not used	1/10	69,12				
25	C. v.d. Merwe	I	Turb.		20,2	11,3 - 84	1/10	65,15	91,7			Being repaired

CADASTRAL FARM NAME: KWAGGASBULT

Borehole no.	Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping periods and quantity abstracted (l/s - hrs/week)	Groundwater level		Borehole depth (m)	E.C.		Other information
							Date	Depth below collar (m)		(mS/m)	Date	
KT 1	C. v.d. Merwe	I	Spiral		22,68	13,8 - 84			100,9	85	1/10	
2	C. v.d. Merwe	I	Spiral		22,68	13,8 - 84			97,8	100	1/10	
3	C. v.d. Merwe	Not longer exists										
4	C. v.d. Merwe	Not	None			Not used						Dry
5	C. v.d. Merwe	I	Spiral		20,2	11,3 - 84			91,7	120	1/10	
6	C. v.d. Merwe	Not	None			Not used						Dry
7	C. v.d. Merwe	I	Spiral		5,0	2,5 - 84			85,6			
8	C. v.d. Merwe	I	Spiral		17,6	8,8 - 84			88,6	110	1/10	
9	C. v.d. Merwe	I	Subm.		15,1	8,8 - 84			91,7	110	1/10	
10	C. v.d. Merwe	I	Spiral		17,6	10,1 - 84			91,7			
11	C. v.d. Merwe	D, S	Subm.		10,1	5,04 - 84			51,9	100	1/10	
12	C. v.d. Merwe	D, S	Spiral		25,2	13,8 - 84			97,8	100	1/10	
13	C. v.d. Merwe	Not	None		2,5	Not used	1/10	72,16	76,4			

Borehole no.	Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping periods and quantity abstracted (l/s - hrs/week)	Groundwater level		Borehole depth (m)	E.C.		Other information
							Date	Depth below collar (m)		(mS/m)	Date	
ML 1	C. v.d. Merwe	No longer exists										
2	C. v.d. Merwe	No longer exists										
3	C. v.d. Merwe	No longer exists										
4	C. v.d. Merwe	No longer exists										
5	C. v.d. Merwe	Not	None			Not used						
6	M. Baikie	Not	None	15,16	3,79	Not used	30/9	60,93	61,2			Dry
7	M. Baikie	I	Turb.		12,64	12,64 - 60			84,15	80	30/9	Yield dropped
8	M. Baikie	I	Turb.		12,64	12,64 - 60			84,15	80	30/9	
9	M. Baikie	Not	None		1,26	Not used	30/9	56,80				
10	M. Baikie	No longer exists										
11	M. Baikie	No longer exists										
12	C. v.d. Merwe	No longer exists										
13	C. v.d. Merwe	Not	None			Not used	1/10	81,61				
14	M. Baikie	No longer exists										
15	M. Baikie	No longer exists										
16	M. Baikie	No longer exists										
17	M. Baikie	Not	None		8,85	Not used	30/9	51,16	73,4			
18	M. Baikie	No longer exists										
19	M. Baikie	No longer exists										
20	M. Baikie	D	Subm.		10,11	10,11 - 30						
21	M. Baikie	Not	None		15,17	Not used	30/9	87,17	94,8	85	30/9	
22	M. Baikie	I	Turb.		8,85	8,85 - 60			91,7	80	30/9	
23	M. Baikie	Not	None			Not used						
24	M. Baikie	Not	None			Not used	30/9	61,55				Fallen in
25	M. Baikie	No longer exists										
26	M. Baikie	I	Subm.			15,17 - 60			116,2	80	30/9	
27	M. Baikie	I	Subm.			15,17 - 60			76,4	80	30/9	
28	M. Baikie	I	Turb.			15,17 - 60			73,4	90	30/9	
29	M. Baikie	I	Spiral			10,11 - 60			76,4	75	30/9	
30	M. Baikie	I	Subm.	15,17	7,58	7,58 - 60			91,7	80	30/9	
31	M. Baikie	Not	None			Not used	30/9	80,95				
32	M. Baikie	Not	None	15,16	2,53	Not used	30/9	64,76	73,4			
33	C. v.d. Merwe	Not	None			Not used	1/10	34,12	116,2			
34	C. v.d. Merwe	Not	None		25,3	Not used	1/10	76,55	122,3			
35	C. v.d. Merwe	Not	None		5,0	Not used	1/10	73,24	91,7			
36	C. v.d. Merwe	S	Spiral		11,3	6,3 - 84			97,8	95	1/10	
37	C. v.d. Merwe	I	Spiral		25,3	13,86 - 84			113,1	115	1/10	
38	C. v.d. Merwe	I, D	Subm.		13,8	7,56 - 84			91,7	100	1/10	
39	C. v.d. Merwe	I	Subm.		13,8	7,56 - 84			91,7			

CADASTRAL FARM NAME: NE PLUS ULTRA

Borehole no.	Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping periods and quantity abstracted (l/s - hrs/week)	Groundwater level		Borehole depth (m)	E.C.		Other information
							Date	Depth below collar (m)		(mS/m)	Date	
NA 1	J.J.H. van Wyk		Unknown borehole									
2			Unknown borehole									
3	W. v.d. Merwe	I	Turb.	15	6	6 - 48			70	110	13/8	
4	J.J.H. van Wyk	I	Turb.	15	6	12 - 60						
5	W. v.d. Merwe	I	Turb.	22,5	22	8 - 48			65	90	13/8	
6	W. v.d. Merwe	D	Turb.	10	5	5 - 23			60	98	13/8	
7	W. v.d. Merwe	I	Mono	22,5	22,5	10 - 48			100	120	13/8	
8	W. v.d. Merwe	Not	None		3,2	Not used	13/8	54,90	85			
9	J.J.H. van Wyk	I	Turb.	20	20	12 - 60			64	110	13/8	
						4 months						
10	J.J.H. van Wyk	I	Turb.	20	20				61	110	13/8	
11	J.J.H. van Wyk	I	Turb.	20	20				67	130	13/8	
12	J.J.H. van Wyk	Not	None			Not used	7/8	35,24	67			
13	W. v.d. Merwe	I	Turb.	20	20	7 - 48			60	115	13/8	
14	W. v.d. Merwe	I	Turb.	20	20	4 - 48			80			
15	W. v.d. Merwe	I	Turb.	6,3	6,3	5 - 48			105	110	13/8	
16	W. v.d. Merwe	I	Turb.	25	25	10 - 48			100	103	13/8	
17	W. v.d. Merwe	I	Turb.	14	14	10 - 48			85	140	13/8	

CADASTRAL FARM NAME: NEW HANOVER

Borehole no.	Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping periods and quantity abstracted	Groundwater level		Borehole depth (m)	E.C.		Other information
							Date	Depth below collar (m)		(mS/m)	Date	
NR 1	H.C.J. van Rensburg	S	Wind	2,2	2,2		4/8	16,20	18,3	190	4/8	
2	H.C.J. van Rensburg	S	Stroke	2,2	2,2	0,8 - 5	4/8	15,90	18,3	190	4/8	
3	H.C.J. van Rensburg	Not				Not used						
4	H.C.J. van Rensburg	Fallen in										Fallen in
5	H.C.J. van Rensburg	I	4" turb.	15,18	15,18	18,18 - 25	4/8	36,00		260	4/8	
6	C.J.J. van Rensburg	D, S	Stroke	2,2	1,1				33	140	1/8	
7	C.J.J. van Rensburg	D, S	Wind	-	0,3		1/8	36,52	45,8	140	1/8	Drillen in 1918
8	H.C.J. van Rensburg	Not			10,0	Not used	1/8	36,61				)Same aquifer
9	H.C.J. van Rensburg	I	4" turb.	15,18	15,18	15,18 - 25			100	160	4/8	)
10	H.C.J. van Rensburg	Not				Dry						Dry
11	H.C.J. van Rensburg	I	4" turb.	8,8	8,8	8,8 - 25		± 25,6	125,4	180	4/8	
12	H.C.J. van Rensburg	S	Wind	2,2	2,2			± 14 m	24,4	240		
13	H.C.J. van Rensburg	D	Subm.	7,6	7,6	1,3 - 36		± 45 m	79,5	175	4/8	

CADASTRAL FARM NAME: NIMMERSAULT

Borehole no.	Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping periods and quantity abstracted (l/s - hrs/week)	Groundwater level		Borehole depth (m)	E.C.		Other information
							Date	Depth below collar (m)		(mS/m)	Date	
NT 1	J.J.H. van Wyk	Unknown borehole										
2	"	I	Turb.	20	20	12 - 60			45,8	110		Farmer knows nothing about the hole
3	"	I	Subm.	20	20	12 - 60			61,2	110		
4	"	I	Turb.	20	20	12 - 60			61,2	120		"
5	J.J.H. van Wyk	Unknown borehole										
6	J.J.H. van Wyk	S	Stroke	-	-	1 - 10			-	95		"
7	J.J.H. van Wyk	I	Turb.	20	20	12 - 10			60	105		
8	J.J.H. van Wyk	S	Wind	-	-	-			-	90		
9	J.J.H. van Wyk	D	Turb.	12	12	12 - 60			30	110		
10	J.J.H. van Wyk	I	Turb.	20	20	12 - 60			50	-		
11	J.J.H. van Wyk	I	Turb.	20	20	12 - 60			61	190		
12	J.J.H. van Wyk	I	Turb.	20	20	12 - 60			67	95		
13	J.J.H. van Wyk	Not	None	-	-	Not used	7/8	46,14	-	-		
14	J.J.H. van Wyk	I	Turb.	20	20	12 - 60			72	110		
15	J.J.H. van Wyk	I	Turb.	20	20	12 - 60			-	110		

CADASTRAL FARM NAME: PATRYSPAN

Borehole no.	Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping periods and quantity abstracted (l/s - hrs/week)	Groundwater level		Borehole depth (m)	E.C.		Other information
							Date	Depth below collar (m)		(mS/m)	Date	
PN 1	C. v.d. Merwe	Not	None			Not used						
2	C. v.d. Merwe	Not	None			Not used						Filled in
3	C. v.d. Merwe	I	Spiral		22,7	12,64 - 84			97,8			Dry
4	C. v.d. Merwe	No longer exists										
5	C. v.d. Merwe	No longer exists										
6	C. v.d. Merwe	No longer exists										
7	C. v.d. Merwe	I	Spiral		15,2	12,64 - 84			85,6	90	2/10	
8	C. v.d. Merwe	Not	None			Not used						Dry
9	C. v.d. Merwe	Not	None			Not used						Dry
10	C. v.d. Merwe	No longer exists										
11	C. v.d. Merwe	No longer exists										
12	C. v.d. Merwe	I	Subm.		3,7	3,7 - 84			76,4	90	2/10	
13	C. v.d. Merwe	No longer exists										
14	M. Baikie	Not	None		0,1	Not used	29/9	63,85	92,6			
15	M. Baikie	I	Turb.			15,12 - 60			78,3	85	29/9	
16	C. v.d. Merwe	Not	None		22,7	Not used	29/9	71,68	103,9			
17	C. v.d. Merwe	I	Subm.		22,7	12,64 - 84			91,7	90	2/10	
18	C. v.d. Merwe	Not	None			Not used	29/9	79,07				
19	C. v.d. Merwe	Not	None			Not used	29/9	79,41				
20	C. v.d. Merwe	I	Turb.			12,64 - 84			85,6			
21	C. v.d. Merwe	I	Spiral		17,6	8,82 - 84			100,9			
22	C. v.d. Merwe	I	Spiral		12,6	8,82 - 84			85,6			

CADASTRAL FARM NAME: POTSDAM

Borehole no.	Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping periods and quantity abstracted (l/s - hrs/week)	Groundwater level Date	Groundwater level Depth below collar (m)	Borehole depth (m)	E.C. (mS/m)	E.C. Date	Other information
PM 1	J.M. Roos	Not		18,85		Not used			50			Fallen in
2	J.M. Roos	Unknown borehole										Unknown borehole
3	J.M. Roos	Ploughed over										Ploughed over
4	J.M. Roos	Ploughed over										Ploughed over
5	J.M. Roos	Not	4" mono	18,85	5,1	Not used			67,3			Fallen in - will be reopened
6	J.M. Roos	D	2½" mono		15,7	3,8 - 25			60	105	19/8	Fallen in
7	J.M. Roos	Not	None			Not used						Fallen in
8	J.M. Roos	Not	None	12,1	6,1	Not used	19/8	34,08	72,7			
9	J.M. Roos	Not	None	11,3		Dry			33,0			Dry
10	J.M. Roos	Not	Broken W-P			Not used						Fallen in - 28 m
11	J. Becker	Not	None		12,6	Not used			62,3			Fallen in - not used
12	J. Becker	Unknown borehole										Unknown borehole
13	J. Becker	I	4" turb.		+38	12,6 - 60	18/8	43,50	73,4	120	18/8	
14	J. Becker	Not	None		12,6	Not used			55,0			Closed in
15	J. Becker	I	None		44,1	15,7 - 60	18/8	41,07	55,0			Submersible being repaired
16	J. Becker	I	4" turb.		40,4	15,7 - 60			67,3	120	18/8	
17	J. Becker	I	4" turb.		44,1	15,7 - 60			198,7	140	18/8	Weathering down to 198,7 m
18	J. Becker	I	4" turb.		+44,1	15,7 - 60			76,4	120	18/8	
19	J. Becker	Not	None		7,5	Not used	18/8	41,91	62,6			
20	J. Becker	Not	None		2,6	Dry						Fallen in
21	J.M. Roos	Not	None			Not used						Fallen in
22	J.M. Roos	I	4" turb.	14,2		15,2 - 60			62,6	150	18/8	
23	J.M. Roos	Not	None			Not used						Fallen in
24	J.M. Roos	Not	None			Not used						Fallen in
25	J.M. Roos	D	Subm.		2,6	1,3 - 10			39,7	175	18/8	
26	J. Becker	D	Subm..		40,4	10,1 - 60	17/7	36,08	62,6	140		
27	J. Becker	Not	None		10,1	Not used			62,6			Blocked - rocks
28	J. Becker	I	Turb.		40,4	10,1 - 60			67,3	140	18/8	
29	J. Becker	I	4" turb.		+37,8	18,8 - 60			85,6	110	18/8	
30	J. Becker	D	Subm.		7,7	1,6 - 10			55,0	120	18/8	
31	J. Becker	I	4" turb.	40,4		15,18 - 10			70,3	110	18/8	
32	J. M. Roos	I	4" turb.		17,7	11,3 - 90 8 months						
33	J.M. Roos	Not	None		12,6	Not used						
34	J. M. Roos	Not	None		+26,0	18,0 - 90	19/8	44,71	64,2			Pump being repaired
35	J.M. Roos	Not	None	15,7	3,8		19/8	55,15	85,6			
36	J. M. Roos	I	4" turb.	22,7		15,6 - 90			82,6	105	19/8	
37	J. M. Roos	I	4" turb.		7,5	7,5 - 90			64,2	120	19/8	
38	J.M. Roos	Not	None		8,8	Not used	19/8	30,43	58,1			
39	J. M. Roos	I	4" turb.		13,5	10,0 - 48			64,2	118	19/8	
40	J. M. Roos	I	4" turb.		15,7	11,3 - 85			76,5	120	19/8	
41	J. M. Roos	D	4" turb.	20,6		7,5 - 40			36,7	170	19/8	
42	J.M. Roos	Not	None	7,5	1,0	Not used	19/8	32,22	36,7			

CADASTRAL FARM NAME: REDHILL 103 LS

Borehole no.	Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping periods and quantity abstracted (l/s - hrs/week)	Groundwater level		Borehole depth (m)	E.C.		Other information
							Date	Depth below collar (m)		(mS/m)	Date	
RL 1	C.H.P. Blofield Box 88	Not	None	25,1		Not used	7/8	44,41	55			
2	Dendron	I	Turb.		13,3	12,5 - 108		±44 m	60,3	110	7/8	
3	C.H.P. Blofield	Not	None		12,5	Not used	7/8	55,21	66,4			
4	"	Not	None		8,8	Not used	7/8	55,54	-			No casing
5	"	Not	None			Fallen in			46			Fallen in
6	"	I	Turb.	12,5		5,2 - 108			59,9			
7	"	Not	None			Not used	7/8	54,57				
8	"	Not	None		18,8	Not used	7/8	54,84	60 m			
9	"	Not	None		10,0		7/8	59,04	60			
10	"	Not	None	12,5		Dry			58			Dry
11	"	Not	None		10,0	Not used			58			Overgrown with roots
12	"	Not	None	22,5	15,18	Not used	7/8	61,28	64			
13	"	Not	None		18,8	Not used	7/8	62,09	69			
14	"	I	Turb.	18,8		12,5 - 108	7/8	61,10	94,8			
15	"	I	Turb.	22,5		15,2 - 108			+94,8	110	7/8	
16	"	I	Turb.		18,8	7,6 - 108			92	110	7/8	
17	"	Not	None		15,18	Not used	7/8	46,82	64			
18	"	None	Wind			Fallen in						Fallen in

CADASTRAL FARM NAME: ROOIKOP

Borehole no.	Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping periods and quantity abstracted (l/s - hrs/week)	Groundwater level		Borehole depth (m)	E.C.		Other information
							Date	Depth below collar (m)		(mS/m)	Date	
RP 1	G.C. Fick	I	4" turb.			15,18 - 120			135	110	12/8	High rate - winter only
2	"	Not	None		3,2	Dry			45,8			Dry
3	"	Bulldozed										Bulldozed
4	"	Bulldozed										Bulldozed
5	"	Not	None		7,6	Not used	12/8	51,53	107			
6	"	S	Wind		1,3		12/8	42,55	49			
7	"	Not	None		7,6	Not used	7/8	46,34	135			
8	"	I	Subm.		18,8	15,18 - 120			107			
9	"	Not	None		3,2	Bulldozed			64,2			Bulldozed
10	"	I	4" turb.		6,2	6,2 - 20			135	110	12/8	Standby hole only
11	"	I	4" turb.		18,8	15,18 - 70			107	110	12/8	Standby hole only
12	"	Not	None		3,2	Not used	12/8	46,34	47			
13	"	I	Subm.		18,8	15,18 - 70			135			
14	"	Not	None		7,6	Not used	12/8	52,40	64,2			
15	"	I	3" turb.		15,18	12,6 - 70			135	175	12/8	
16	"	Not	None		12,6	Not used	12/8	51,31	135			
17	"	Not	None		6,2	Not used	12/8	51,85	61,2			
18	"	Not	None		7,6	Not used	12/8	64,60	135			
19	"	Not	None		3,2	Dry?			61,2			Dry?
20	"	I	Subm.		18,8	15,18 - 70			116,2	100	7/8	
21	"	Not	None		3,2	Not used			61,2			
22	"	I	Subm.		18,8	15,18 - 70	7/8	57,57	90,5	100	7/8	
23	"	Not	None		18,8	Not used	7/8	46,96	107			
24	"	Not	None		25,2	Not used	12/8	47,34	97,9			)Will be in use
25	"	Not	None		25,2	Not used	12/8	47,45	116,2			)by February 1987
26	"	Not	None		25,2	Not used	12/8	48,38	97,9			)
27	"	D	1¼" mono		3,2	1,0 - 20	12/8		137,6	110	12/8	

CADASTRAL FARM NAME: SOHO
LEKKERLACHT

Borehole no.	Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping periods and quantity abstracted (l/s - hrs/week)	Groundwater level		Borehole depth (m)	E.C.		Other information
							Date	Depth below collar (m)		(mS/m)	Date	
SO 1	S.M. Vorster	Not	Broken W-P			Not used						Blocked
2	S.M. Vorster	Not in existance				Not used						
3	S.M. Vorster	Not	None		0,4	Not used	26/9	41,01	88,7			
4	S.M. Vorster	S	Mono		0,5	0,5 - 15			122,3	70	26/9	
5	S.M. Vorster	Not	None			Not used						Blocked
6	S.M. Vorster	Not	None			Not used						Dry
7	S.M. Vorster	O, I	Mono	1,9		1 - 10				90	26/9	
8	S.M. Vorster	I	Turb.	12,0	8,8	7,6 - 15			92,9	100	26/9	
9	S.M. Vorster	I			12,6	12,6 - 15			88,7			
10	S.M. Vorster	Not	None			Not used	26/9	86,38	104,3			
11	S.M. Vorster	Not	None			Not used						Dry
12	S.M. Vorster	Not	None			Not used	26/9	+100 m				Skew hole
13	S.M. Vorster	I	Turb.		11,4	11,4 - 15			98,5	85	26/9	
LT 1	M. Baikie	Not in existance										
2	"	Not	Broken stroke		3,79	Not used			110,1			
3	"	Not	None		1,26	Not used	26/9	+100 m	153			
4	"	Not	Broken stroke			Not used						Blocked
5	"	Not	Broken W-P			Not used						Blocked
6	"	Not	None			Not used						
7	"	I	Turb.	12,64	7,58	7,58 - 60 60 h/w			81,3			Being drilled deaper
8	"	I	Turb.			15,17 - 60			79,5	75	26/9	
9	"	Not	None		1,26	Not used	26/9	83,50 m	85,63			
10	"	Not	None			Not used						Dry
11	"	I	Subm.	15,1	7,58	7,58 - 60			99,38	75		

CADASTRAL FARM NAME: BURG
STETTINBURG (BURG)

Borehole no.	Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping periods and quantity abstracted (l/s - hrs/week)	Groundwater level		Borehole depth (m)	E.C.		Other information
							Date	Depth below collar (m)		(mS/m)	Date	
BG 1	Badenhorst	Not	None			Not used - closed in						
2	"	Not	None			Not used - closed in						(Farmer not in the area)
3	"	Not	None			Not used - closed in						Sealed closed
4	"	S	Turb.							100	19/9	
5	"	Not	None			Not used						Blocked up
6	"	Not	None			Not used	19/9	48,32				
7	"	Not	None			Not used						Blocked up
8	"	Not	None			Not used	19/9	34,14				
9	"	Not	None			Not used	24/9	34,09				
10	"	Not	None			Not used	24/9	34,05				
11	"	Not	Broken W-P			Not used						W-P broken
12	"	D	Turb.			2 - 10	24/9	35,59		120		
13	"	Not	None			Not used	24/9	32,33				
14	"	Not	None			Not used	24/9	34,05				
SG 1	Lebowa	No longer exsits										
2	"	N	Turb.									
3	"	S	Spiral			Not used 2 - 15				150	24/9	(T45484)

CADASTRAL FARM NAME: TWEEFONTEIN

Borehole no.	Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping periods and quantity abstracted (l/s - hrs/week)	Groundwater level		Borehole depth (m)	E.C.		Other information
							Date	Depth below collar (m)		(mS/m)	Date	
TN 1	H.J. Visagie	Not	Broken stroke			Not used						
2	H.J. Visagie	Not	Stroke			Not used						
3	C.J. v.d. Merwe	Not	None			Not used			± 90 m			Fallen in - dry
4	C.J. v.d. Merwe	I	3" mono	7,5		7,5 - 72			91,7			
5	H.N. Labuschagne	D	3" turb.	4,3		1,76 - 12			61,7			
6	H.N. Labuschagne	Not	None			Not used						Fallen in (3 m)
7	J.H. de Jager	S	2" mono	15,18		2,6 - 2			45,8	115	26/8	
8	J.H. de Jager	D	W-P		0,48		26/8	17,36	61,7	120	26/8	
9	H.J. Visagie	D, I	Subm.	22,7	7,35	7,35 - 96			58,1	210	28/8	
10	H.J. Visagie	Not	Broken W-P			Not used						Dry
11	H.J. Visagie	Not	W-P			Not used						Dry - Fallen in
12	H.J. Visagie	I	4" mono		18,94	15,18 - 72			48,9	120	28/8	
13	H.J. Visagie	Not	Turb.		3,83	Not used						Dry
14	H.J. Visagie	Not	None	15,18		Not used	28/8	34,54				
15	H.J. Visagie	Not	None			Not used						Bulldozed over
16	H.J. Visagie	Not	None			Not used						Bulldozed over
17	H.J. Visagie	Not	None		7,6		28/8	23,87	61,1			
18	H.J. Visagie	I	4" mono		15,18	15,18 - 96	28/8	± 15,3	138,8	300	28/8	
19	H.J. Visagie	Not	Broken stroke			Not used						
20	H.J. Visagie	Not	None	1,92		Not used	28/8	21,22	91,7			
21	C.J. v.d. Merwe	I	3" mono	7,5		7,5 - 72			91,7	130	28/8	
22	H.J. Visagie	I	Mono	3,8					58,1	140	28/8	Yield drops to 1 l/s after 6 hours
23	C.J. v.d. Merwe	Not	None				28/8	68,65				
24	J.H. de Jager	D	WP						61,2			
25	J.H. de Jager	D	Subm.			1,2 - 20				120	26/8	
26	W. Labuschagne	Not	None			Not used	26/8	27,86				
27	W. Labuschagne	Not	None			Not used	26/8	31,74				

CADASTRAL FARM NAME: WALDBURG

Borehole no.	Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping periods and quantity abstracted (l/s - hrs/week)	Groundwater level		Borehole depth (m)	E.C.		Other information
							Date	Depth below collar (m)		(mS/m)	Date	
WG 1	D. Fick	Not	None			Not used - Ploughed over						
2	D. Fick	Not	None			Not used - Ploughed over						Hired by D. Fick
3	H.A. Snyman (owner)	I	Turb.			3,79 - 80			45,8	200	17/9	
4	H.A. Snyman	I	Turb.			3,79 - 80			45,8	150	17/9	Hired by J. Becker
5	H.A. Snyman	Not	None			Not used						
6	H.A. Snyman	Not	None			Not used						Fallen in
7	Pistorius	Not	None			Not used	18/9	22,53				Fallen in
8	Pistorius	Not	None		0,1	Not used	18/9	30,56				Owner (Pistorius)
9	H.A. Snyman	I	Turb.			5,0 - 80			27,5			about to sell farm
10	H.A. Snyman	I	Turb.			7,58 - 80			39,7			
11	Pistorius	Not	None	18,6	3,79	Not used	18/8	21,98				
12	Pistorius	Unknown borehole										
13	Pistorius	Not	None			Not used						
14	Pistorius	I	Mono		35,0	25 - 60						Fallen in
15	Pistorius	I	Mono		35,0	31 - 60			67,3	240	18/9	
16	Pistorius	I	Turb.		35,0	25 - 60			73,4			
17	Pistorius	Not	None			Not used				230	18/9	
18	Pistorius	Not	None			Not used						Fallen in
19	Pistorius	Not	None			Not used						Fallen in
20	Pistorius	D, I	Subm.	18,9	12,6	Not used						Fallen in
21	Pistorius	Not	None			Not used	18/9	30,42	45,8	200	18/9	
22	Pistorius	Not	None			Not used	18/9	30,15				
23	Pistorius	I	Turb.		31,4	22,8 - 60			61,2	200	18/9	
24	Pistorius	Not	None			Not used	18/9	30,15				
25	Pistorius	Not	None		8,3	Not used	18/9	31,50	70,3			
26	Pistorius	D	Subm.			1 - 3			36,7			
27	Pistorius	D	Subm.			1 - 3			36,7	200	18/9	
28	H.A. Snyman	I	Turb.			7,5 - 80			45,8			
29	H.A. Snyman	D	Turb.			2,5 - 80			39,7	130	17/9	
30	H.A. Snyman	Not	None			Not used	17/9	45,84				
31	Pistorius	Not	Not	35	25	Not used			55			
32	Pistorius	D	Subm.		16	12,5 - 60			45,8			

CADASTRAL FARM NAME: WESTHEIM
PERSIE
TARANTAALPAN

Borehole no.		Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping periods and quantity abstracted (l/s - hrs/week)	Groundwater level		Borehole depth (m)	E.C.		Other information
								Date	Depth below collar (m)		(mS/m)	Date	
TN	1	M. Baikie	Not	Broken stroke			Not used						
WM	1	Lebowa	Not	None			Not used	2/10	27,61				
	2	Lebowa	Not	None			Not used	2/10	28,73				
	3	Lebowa	Not	Stroke			Not used						
	4	Lebowa	D	Hand			300 l/day				140	2/10	
	5	Lebowa	D	Hand			500 l/day				140	2/10	
PE	1	Lebowa	D	Mono			1 - 30				100	2/10	
	2	Lebowa	D	Mono			2 - 60				100	2/10	

CADASTRAL FARM NAME: WURTHSDORP AND KONINGRATZ

Borehole no.	Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping periods and quantity abstracted (l/s - hrs/week)	Groundwater level		Borehole depth (m)	E.C.		Other information
							Date	Depth below collar (m)		(mS/m)	Date	
WD 1	Lebowa/SADT?	Not	None			Not used						Sealed closed (T56050)
2	"	Not	None			Not used						Fallen in
3	"	Not in existence										Doesn't exist
4	"	Not in existence										Doesn't exist
5	"	S,D,I	Turb.			6,5 - 72				145	28/9	
6	"	Not	None			Not used						Sealed closed
7	"	Not	None			Not used						Sealed closed
8	"	D	Spiral			13 - 72				120	28/9	
9	"	Not	Broken			Not used						Fallen in
10	"	Not	None			Not used						Blocked (stones)
KZ 1	Lebowa/SADT?	D	Spiral			3,5 - 72				130	28/9	
2	Lebowa/SADT?	D	Spiral			3,5 - 72				120	28/9	

CADASTRAL FARM NAME: YORK

Borehole no.	Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping periods and quantity abstracted (l/s - hrs/week)	Groundwater level		Borehole depth (m)	E.C.		Other information
							Date	Depth below collar (m)		(mS/m)	Date	
YK 1	F.J. Kloppers	S	Stroke		8,8	2,6 - 12			76,5	87	6/8	
2	"	S	Wind		1,3		6/8	54,10	76,5			
3	"	I	4" turb.			16,3 - 144		± 57 m	91,7	110	6/8	
4	"	Not	None		8,8	Not used	6/8	38,32	48,9			
5	"	D	Subm.			1,3 - 18				150	6/8	
6	"	Not	Broken W-P			Not used	6/8	22,32				
7	"	Not	None		10,0	Not used	6/8	53,10	84			Yield decreased
8	"	I	Subm.		20,8	15,1 - 144			82,5	100	6/8	
9	"	S	2" mono		20,8	12,5 - 14			-	85	6/8	
10	"	Not	None	21,3	21,3	Not used	6/8	53,46	91,7			)Will be used in
11	"	Not	None	33,8	33,8	Not used	6/8	46,90	91,7			)1987
12	"	I	Subm.		33,8	25,1 - 144			91,7	110	6/8	
13	"	I	Subm.		25,1	16,3 - 144			91,7	105	6/8	
14	"	I	Subm.		18,1	11,3 - 144			91,7	105	6/8	
15	"	I	4" mono		33,8	15,1 - 144			100,9	105	6/8	
16	"	Not	None		33,8	Not used	6/8	44,17	91,7			)To be used during
17	"	Not	None		25,1	Not used	6/8	45,50	91,7			)late 1986
18	"	Not	None		33,8	Not used	6/8	51,10	84,1			)
19	"	Not	None		8,8	Not used	6/8	43,45	76,5			
20	"	Not	None		1,3	Not used	6/8	46,99				

CADASTRAL FARM NAME: ZANDPUT

Borehole no.	Owner	Water use	Type of pump	Tested yield (l/s)	Present yield (l/s)	Pumping periods and quantity abstracted (l/s - hrs/week)	Groundwater level		Borehole depth (m)	E.C.		Other information
							Date	Depth below collar (m)		(mS/m)	Date	
ZP 1	T. Youngbloed	Not	None		3,16	Not used			36,7			
2	T. Youngbloed	I	Subm.		6,32	6,32 - 80			67,3	120	25/9	
3	T. Youngbloed	Not	None			Not used						Blocked
4	T. Youngbloed	Not	None		8,85							Dry
5	T. Youngbloed	I	Mono		15,16	10,11 - 80			81,04	100	25/9	
6	T. Youngbloed	I	Mono		20,22	12,64 - 80			88,68	75	25/9	
7	T. Youngbloed	I	Mono		20,22	15,16 - 80			64,2	100	25/9	
8	T. Youngbloed	Not in existance										
9	T. Youngbloed	Not	Subm.	3,79		Not used			42,8			
10	T. Youngbloed	Not	None		18,96	Not used			88,7			
11	T. Youngbloed	I	Turb.		25,28	12,64 - 80				110	25/9	

JLJ/ad/0133D/0410A

DORINGLAATE CATCHMENT: GROUNDWATER CONDUCTIVITY

BOREHOLE NUMBER		CONDUCTIVITY (mS/m)
Altenburg	8	250
Altenburg	11	220
Anex Alion	2	95
Anex Alion	7	120
Anex Alion	8	130
Anex Alion	14	105
Anex Alion	15	100
Anex Alion	20	180
Anex Alion	22	125
Appelfontein	2	180
Appelfontein	8	120
Appelfontein	10	130
Appelfontein	11	110
Appelfontein	15	100
Appelfontein	18	100
Baviaanspoort	6	100
Baviaanspoort	10	75
Bellvue	1	95
Bellvue	2	125
Bellvue	5	120
Bellvue	6	120
Bellvue	7	110
Bellvue	14	135
Bellvue	16	210
Bellvue	17	175
Bellvue	18	105
Bloemetjiesvlei	6	190
Bloemetjiesvlei	8	150
Bloemetjiesvlei	11	190
Bloemetjiesvlei	13	125
Bloemetjiesvlei	14	110
Bloemetjiesvlei	15	110
Bloemetjiesvlei	16	110
Bloemetjiesvlei	18	180
Bloemetjiesvlei	19	180
Bloemetjiesvlei	22	180

BOREHOLE NUMBER		CONDUCTIVITY (mS/m)
Boomzien	11	140
Boomzien	13	150
Boomzien	17	120
Boomzien	23	120
Boomzien	25	140
Boomzien	29	190
Boomzien	30	190
Boomzien	31	110
Boomzien	33	125
Boomzien	35	145
Boomzien	37	130
Bornst	1	105
Bornst	3	105
Bornst	6	105
Bornst	11	95
Bornst	16	120
Bornst	26	175
Bornst	28	85
Bornst	29	103
Bornst	30	103
Bornst	32	105
Bornst	33	105
Bornst	34	105
Bornst	36	130
Burg	4	100
Burg	12	120
Claudius Hoop	13	135
Claudius Hoop	14	100
Claudius Hoop	17	120
Claudius Hoop	19	115
Claudius Hoop	20	120
Claudius Hoop	21	110
Claudius Hoop	22	120
Claudius Hoop	23	120
Claudius Hoop	25	100
Claudius Hoop	29	110
Claudius Hoop	32	110
Claudius Hoop	33	110
Combro	2	110
Combro	5	120
Combro	6	130
Combro	10	140
Dedimus	4	95
Dedimus	5	95
Dedimus	8	120
Dedimus	15	95
Dedimus	16	95
Dedimus	23	270
Dedimus	24	210

JLJ/ad/0133D/0410A

DORINGLAATE CATCHMENT: GROUNDWATER CONDUCTIVITY

BOREHOLE NUMBER		CONDUCTIVITY (mS/m)
Altenburg	8	250
Altenburg	11	220
Anex Alion	2	95
Anex Alion	7	120
Anex Alion	8	130
Anex Alion	14	105
Anex Alion	15	100
Anex Alion	20	180
Anex Alion	22	125
Appelfontein	2	180
Appelfontein	8	120
Appelfontein	10	130
Appelfontein	11	110
Appelfontein	15	100
Appelfontein	18	100
Baviaanspoort	6	100
Baviaanspoort	10	75
Bellvue	1	95
Bellvue	2	125
Bellvue	5	120
Bellvue	6	120
Bellvue	7	110
Bellvue	14	135
Bellvue	16	210
Bellvue	17	175
Bellvue	18	105
Bloemetjiesvlei	6	190
Bloemetjiesvlei	8	150
Bloemetjiesvlei	11	190
Bloemetjiesvlei	13	125
Bloemetjiesvlei	14	110
Bloemetjiesvlei	15	110
Bloemetjiesvlei	16	110
Bloemetjiesvlei	18	180
Bloemetjiesvlei	19	180
Bloemetjiesvlei	22	180

BOREHOLE NUMBER		CONDUCTIVITY (mS/m)
Boomzien	11	140
Boomzien	13	150
Boomzien	17	120
Boomzien	23	120
Boomzien	25	140
Boomzien	29	190
Boomzien	30	190
Boomzien	31	110
Boomzien	33	125
Boomzien	35	145
Boomzien	37	130
Bornst	1	105
Bornst	3	105
Bornst	6	105
Bornst	11	95
Bornst	16	120
Bornst	26	175
Bornst	28	85
Bornst	29	103
Bornst	30	103
Bornst	32	105
Bornst	33	105
Bornst	34	105
Bornst	36	130
Burg	4	100
Burg	12	120
Claudius Hoop	13	135
Claudius Hoop	14	100
Claudius Hoop	17	120
Claudius Hoop	19	115
Claudius Hoop	20	120
Claudius Hoop	21	110
Claudius Hoop	22	120
Claudius Hoop	23	120
Claudius Hoop	25	100
Claudius Hoop	29	110
Claudius Hoop	32	110
Claudius Hoop	33	110
Combro	2	110
Combro	5	120
Combro	6	130
Combro	10	140
Dedimus	4	95
Dedimus	5	95
Dedimus	8	120
Dedimus	15	95
Dedimus	16	95
Dedimus	23	270
Dedimus	24	210