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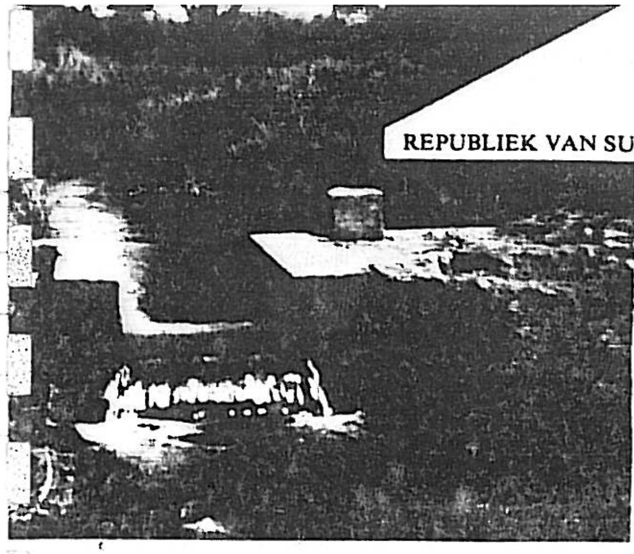

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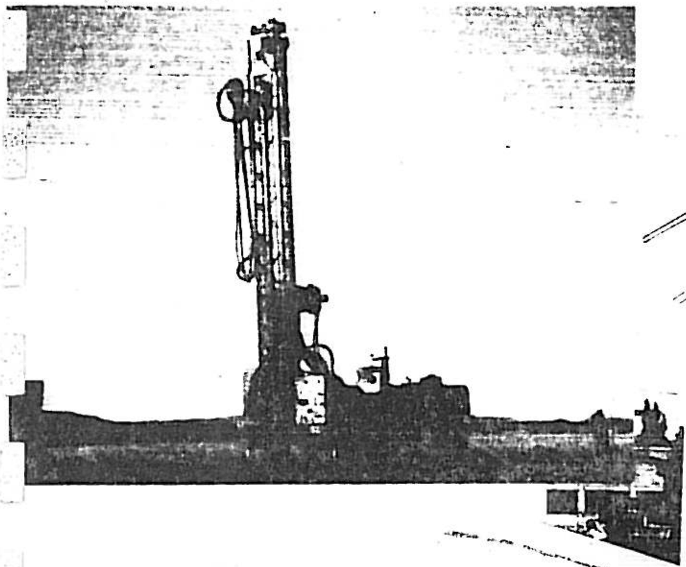

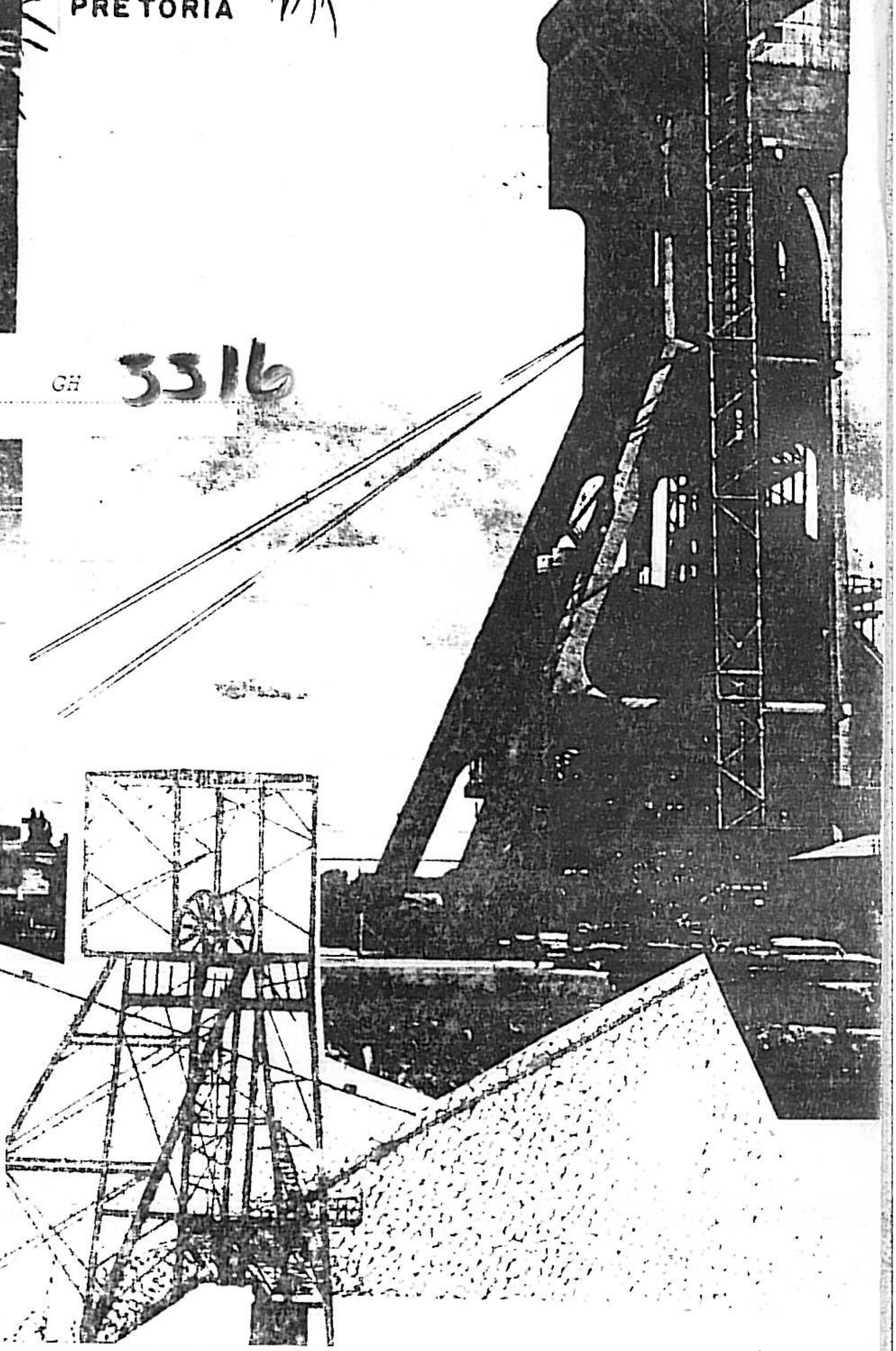

AFDELING/DIVISION GEOHYDROLOGY

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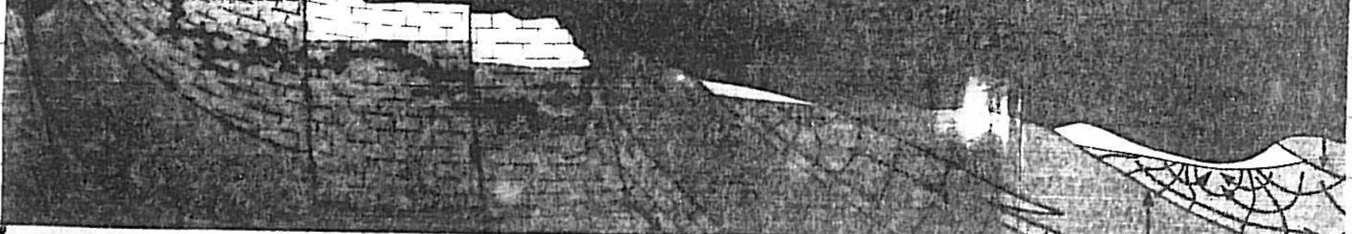
POTENTIAL SUPPLY FROM DOLOMITIC GROUND WATER SOURCES OF EAST RAND



DEUR/BY: A.F. LESKIEWICZ

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1. BACKGROUND

A regional ground water investigation confined within the triangle Bapsfontein, Delmas and Springs was initiated in 1982 by the Division of Geohydrology the aim being to evaluate all aspects of ground water and to attempt to quantify the impact of man's activities on these aspects. The preliminary phases of this investigation have in large measure been completed and further phases are being planned to sharpen the understanding of the dynamics of the ground water system particularly in the dolomite.

Following the severe drought experienced over the Highveld during the summer of 1983 it was considered imperative that more serious attention should be focussed on the role of ground water in the overall water budget in particular over the PWV metropolitan area. The East Rand is but one of the areas that is receiving attention in this way.

This report is an attempt to present the main findings of the geohydrological investigation completed so far in terms that can be of use to water resource planners.

It is believed that the very considerable quantities of ground water contained in the study area could make a substantial contribution to the otherwise limited water resources available to this rapidly developing region particularly during drought periods.

2. NATURAL FEATURES

The dolomite occurring between Bapsfontein and Delmas, and between Bapsfontein and Daveyton, form two exposed portions of the broad band of dolomite which extends in an arc eastward from Pretoria into the eastern Transvaal. The dolomite dips regionally towards the north-north-east at about 15° beneath formations of the Pretoria Series to the north of the area. To the south a semi-detached basin locally known as the East Rand basin forms an appendage to the broad band of dolomite to the north and northeast. Between this basin and the dolomite extending from Bapsfontein to Delmas are varying thicknesses of Karoo sediments including coal measures, up to 120 m, which overlie the dolomite and which thicken toward the east. The dolomite is exposed through "windows" in the Karoo sequences the expansion of which are controlled by the activity of the surface drainage.

Beneath the dolomite formations which can reach thicknesses in excess of 1 000 m are the gold-bearing formations of the Witwatersrand System which have been extensively mined in proximity to the town of Springs located toward the west of the East Rand basin. The area of the triangle formed by the towns Bapsfontein, Delmas and Springs which is the subject of this report is about 905 km^2 in extent of which 550 km^2 is Karoo formations at the surface and the remainder dolomite.

The dolomite and Karoo sediments are known to be heavily intruded by dykes and sills. The intrusions have been carefully observed during mining operations in the area and are known to significantly effect the circulation of deep ground waters. Beyond the confines of the mines however less is known about the role of these intrusions except that they are seldom present in their original state at depths less than 30 m from the surface. The average depth to ground water in the study area is about 12 m. For this reason the ground water contours as compiled from measurements of ground water levels in the upper dolomite are expected to reflect in general the surface topography and not to be greatly effected by the presence of dykes.

At this stage the existence of well-defined compartments within the dolomite has not been confirmed. The presence of sills in the Karoo formations is expected to have a bearing on the rates of percolation of water under ground as well as on the occurrence of perched water bodies. (Refer to Map 1).

Dolomite has a reputation for its excellent ground water-bearing properties despite its known inhomogeneities. The development of secondary porosity within dolomite is largely responsible for the permeability that it possesses. Circulating ground water has furthering developed fractures and fissures of structural origin by carbonate solution. Large-scale leaching and karstification of dolomite can result in very substantial storage of ground water. There is strong evidence of paleokarstification of the dolomite prior to the deposition of the Pretoria Series and prior to and after deposition of the Karoo System. This can result in various systems of deep ground water circulation which are not necessarily interconnected.

The porosity of the dolomite formations is known to vary considerably both laterally and vertically depending on the degree of leaching. Average effective porosities can vary between 9% at or near the surface to 1% at depths of 150 m. Using these values it is assumed that the likely storage of ground water in the dolomite to depths of 150 m is of the order of $4.10^6 m^3$ per km^2. Assuming that conditions for the storage of ground water in the dolomite beneath of the Karoo sequences are similar then the total quantity of ground water in storage in the dolomite in the study area totals approximately $3\ 600.10^6 m^3$. This estimation is made on the assumption that storage provided by possibly major paleokarst features is not included.

The low permeabilities of the Karoo sequences in general do not favour the development of strong-yielding boreholes and yields of boreholes are generally only sufficient for domestic and stock-watering purposes. However, the Karoo sequences can provide substantial storage for ground water which can act as a significant source of recharge to the underlying dolomite. Circulations of ground water within the upper Karoo sequences are manifest in the numerous low-yielding springs and seepages which on occasions feed shallow vlei areas and pans.

Several sinkholes at similar degrees of development have been observed in the study area. The danger of sinkhole development and of the occurrence of land subsidences is greatest in those areas where the ground water table is shallower that 20 m from the surface. However, in these areas the chances are considerably reduced if fluctuations in ground water levels are less than 6 m.

The study area is divided into two major drainage areas by a catchment divide striking approximately southeast from near Bapsfontein. (Refer to Map 1).

The northern catchment area (referred to as the northern unit) and extending from Bapsfontein to Delmas of total area 390 km^2 which includes 190 km^2 of dolomite exposed at the surface is drained by relatively short rivers namely the Bronkhorstspruit, Koffiespruit and their tributaries flowing towards the north east. These rivers are partially fed by at least six springs that were flowing and measured during 1983.

The southern catchment area (referred to as the southern unit) extending from Bapsfontein to Springs of total area 515 km^2 which includes 165 km^2 of dolomite exposed at the surface is drained by the Blesbokspruit centrally located in the catchment and which flows towards the south.

3. MINING ACTIVITIES

The area centred on the town of Springs has a long history of gold mining and detailed records have been kept by various mining companies. At present only two mining groups are active in the area namely Consolidated Modderfontein Mines Ltd, and Union Corporation (Gencor).

The former group has operations at two mines viz Government Gold Mining Areas (GGMA) and Modder Deep. Both of these mines are labelled as 'dry' mines and only very limited quantities of ground water have in the past been 'made' in these mines. Process water for the mines has actually to be provided by the Rand Water Board. At present three shafts are in operation. (Refer to Map 2).

The latter group operates two mines viz Geduld and Grootvlei at which at present four shafts are in operation. An estimated $28.10^6 m^3$ of ground water has been accounted for annually in these two mines i.e. that which is removed from underground and that which is monitored as it enters or leaves various underground workings. These two mines have been subject to flooding in the past as a result of dolomitic water entering the mines through the roof, walls and shafts. In order to maintain access to the operating areas of these mines this superfluous ground water is at present removed at shaft No. 1 of the now abandoned SA Lands Mines further to the west at a deeper level. Abstractions on average 55 000 m^3/d has stabilized ground water levels in the operating mines. Of the ground water pumped to the surface totalling about $20.10^6 m^3$ annually about 90% is consumed by the Ergo Company in its reclamation and refining processes, involving gold and uranium, and the remaining 10% is discharged into the Rietspruit outside of the Blesbokspruit drainage system. It is estimated that a further $3,3.10^6 m^3$ of ground water which is not captured at shaft No. 1 of SA Lands Mines leaves the area underground toward the south. A further 12 500 m^3/d, or $4,5.10^6 m^3$ annually of ground water is abstracted from the Grootvlei mine for its own internal consumption in reduction works and for dewatering operating areas.

It should be emphasized that this quantity of $28.10^6 m^3$ of ground water most likely originates in the overlying dolomite formation in relation to the deep mine workings but has been accounted for as it makes it way through various operating or abandoned mine levels.

Various abandoned mine shafts, namely Grootvlei no.1, Geduld no. 1 and 6 and East Geduld no. 1 have been sealed off following flooding by ground water in the past.

Information provided by the Chamber of Mines indicates that the mined-out volume of the gold mines in the East Rand basin, both operative and abandoned, can provide storage for about $50.10^6 m^3$ of water.

4. HYDROLOGY

Northern unit

This area forms part of the catchment of the Bronkhorstspruit Dam which is drained by the Bronkhorstspruit, Koffiespruit, Oospruit and their tributaries. Of the total catchment of Bronkhorstspruit Dam of 1 260 km^2, 390 km^2 lies in the northern unit. A number of perennial springs issuing ground water from the dolomite formations are locatd in an approximate line in proximity to the northern boundary of the dolomite prior to it dipping beneath sequences of the Pretoria Series. It is assumed that these springs provide the bulk of the dry-period flow into the Bronkhorstspruit Dam. From the record of inflows into the dam available over the 35-year period 1945/46 to 1979/80 the average monthly flow for the five largely rainless months i.e. May to September was estimated to be about $1,1.10^6 m^3$ equivalent to $13,2.10^6 m^3$ per annum assuming the base flow to remain constant throughout the year. It is assumed that about 50% of this base flow is contributed by springs of northern unit.

During October and December 1983 an attempt was made to measure the flows in the major streams in the northern unit area at certain selected sites. It is assumed that these flows originate primarily from ground water stored in the dolomite formations. These measurements followed a particularly dry summer and therefore the flows do not represent average flow conditins in the catchment. The total flow measured was about 46 l/s equivalent to about $1,5.10^6 m^3$ per annum. This value is about 25% of the base flow as calculated from the dam record, i.e. $6,6.10^6 m^3$.

The mean annual runoff into Bronkhorstspruit Dam is estimated to be about $60.10^6 m^3$ using the same dam record. The base flow contribution to the dam from the northern unit is therefore expected to be at least 10% of the MAR, which is considered to be significant.

From this information it is possible to make an approximate estimate of the rainfall recharge to the dolomite in order to sustain the flow of the springs. The volume of the annual base flow divided by the area underlain by dolomite in the northern unit from which it is assumed that the ground water largely originates is equivalent to the depth of ground water recharged by rainfall over a period of one year namely:

$$\frac{6,6.10^6 m^3}{390.10^6 m^3} = 17 \text{ mm}$$

This is equivalent to 2,5% of the annual average rainfall assumed to be 725 mm. This recharge percentage could be considerably in error but is useful in obtaining a first approximation. Some investigators accept an annual recharge value as high as 12,5%.

In the above calculation the base flow could have been assumed to be substantially greater in the summer months than in the winter months.

Attention is also drawn to a number of artesian boreholes some of which are located directly on the dolomite and others on the Pretoria Series sequences but which are assumed to penetrate the dolomite at depth.

Southern unit

The major drainage course through the area is the Blesbokspruit which drains southward and exits the area just north of Nigel where rocks of the Witwatersrand System are exposed. It can be expected that the natural flow regime of the Blesbokspruit could have been substantially altered over the recent past mainly as a result of mining activities in the area. No flow gauging station has been provided in this river however so long-term changes in flow patterns cannot be studied.

Just to the north of the Delmas road from Springs a sampling station R2.0 has been established on the Blesbokspruit by the Department from which surface water is periodically sampled for bacteriological and

chemical analysis. It has been suggested that a more or less constant flow of 0,6 m^3/s passing this sampling station is realistic. This is equivalent to about $19.10^6 m^3$ per annum.

This discharge can in large measure be composed of controlled releases of municipal, industrial and mine process effluents originating in the East Rand basin, most of which it is expected to be derived originally from raw water supplied by the Rand Water Board.

The following information on gross consumptions of treated water supplied by the Rand Water Board and discharges of municipal, industrial and mine process effluents into the Blesbokspruit was abstracted from Report - 'PWVS Pollution Study: Summary of reports'. The values represent average values over the period 1977/78to 1981/82.

	Intake ($10^6 m^3$)	Discharge ($10^6 m^3$)	Return ($10^6 m^3$)
Benoni	18	12	67
Springs	19	11	58
Brakpan	5	3	60
Sappi	12	11	92
Grootvlei	8	5	63
	62	42	68

Attention is drawn to the discharge of $42.10^6 m^3$ as compared with the flow in the Blesbokspruit of $19.10^6 m^3$ as estimated from observations. The reason for this significant discrepancy cannot be fully explained. Three major dams in the area namely President, Alexander and Cowels are heavily polluted (levels of iron are particularly high) but are useful hydrological controls in the discharge of return flow to the Blesbokspruit.

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5. WATER QUALITY

In order to provide some indication of the likely quality of surface and ground water contained in the study area the results of five chemical parameters from ten typical waters sampled in the area during 1982/83 are shown in the table below including raw water from Vaal Dam and treated water of Rand Water Board for comparison.

The water of the best quality is that sampled from a dolomite spring no. 5 in the northern unit. Other dolomite waters are slightly inferior but of similar quality to that of water in Vaal Dam. Significant is the poor quality of the water sampled from Blesbokspruit particularly the high levels of sulphate and chloride, and the quality deterioration downstream. Also noticeable is the difference in quality between raw water in the Vaal Dam and the treated water of te Rand Water Board.

Sampling source	TDS mg/l	pH	Total hardness mg/l (as $CaCO_3$)	SO_4 mg/l	Cl mg/l
Vaal Dam (raw water)	140	8,3	88	?	?
Rand Water Board (treated water at Zuikerbosch)	295	8,7	170	88	29
Spring 5 (Rietfontein)	88	7,3	67	5	1
Bronkhorstspruit (fed from dolomite)	135	7,7	99	5	2
Borehole VAR8 (dolomite)	123	7,3	84	0	7
Borehole RIE4 (flowing, dolomite)	137	8,0	106	7	1
Borehole STR2 (Karoo)	369	8,2	330	0	17
Grootvlei no. 1 shaft	680	7,3	85	151	77

Sampling source	TDS mg/l	pH	Total hardness mg/l (as $CaCO_3$)	SO_4 mg/l	Cl mg/l
Sampling station R2-0	1 020	7,3	?	389	247
Blesbokspruit downstream GRV-1	2 582	7,4	390	516	887
Potable water standards*	2 000	9,0	200	400	600

* Standards for max. contents as in SABS norms

6. GROUND WATER INVENTORY

Consumption

Northern unit:	m^3/d	$10^6m^3/y$
Agribusinesses	11 000	4,0
Smallholdings	4 000	1,5
Sentrarand	1 000	0,5
Delmas municipality	3 000	1,0
Schoeman Boedery Bpk.	1 500	0,5
	20 500	7,5

Southern unit:	m^3/d	$10^6m^3/y$
Agribusinesses	6 500	2,5
Smallholdings	2 000	1,0
Grootvlei mine	12 500	4,5
Ergo	55 000	20,0
	76 000	28,0

Total consumption: 96 500 m^3/d
35,5.$10^6m^3/y$

Attention is drawn to the following:

The largest consumers of ground water are the agribusinesses, Ergo and the Grootvlei mine. The total ground water consumed by irrigators is estimated to be $6,5.10^6 m^3$/yr sufficient to irrigate 800 ha at an irrigation duty of 8 000 m^3/ha/yr. These farms are concentrated within a radius of 15 km of Bapsfontein in the north west of the study area.

The consumption of ground water by smallholders is estimated from random samples selected from amongst about 700 smallholdings concentrated around the major urban areas.

The Delmas municipality is the only municipal authority in the study area which makes use of ground water on a large-scale and is fully dependent on it for domestic supplies. All other municipal and peri-urban authorities are supplied with treated water by the Rand Water Board including villages like Eloff and Sundra. The dependence of consumers in the southern unit on water supplied by the Rand Water Board is reflected in the above table.

Recharge

In the estimation of ground water recharge a mean annual rainfall of 725 mm was assumed over the whole of the study area. In addition recharge rates of 12,5% and 5% of the mean annual rainfalls were assumed over the dolomite and Karoo formations respectively. These values were assumed on the basis of experience gained in other areas.

Northern unit:

		Area: km^2	Recharge: $10^6 m^3$/yr
Dolomite		190	17,20
Karoo		200	7,25
	Total	390	24,50

		Area: km^2	Recharge: $10^6m^3/yr$
Southern unit:			
Dolomite		165	14,95
Karoo		350	12,70
	Total	515	27,70

Total recharge: $52,2.10^6m^3/yr$

Audit

Under this heading all gains and losses of ground water are considered which have previously been dealt with in this report. It is assumed that the only gains to ground water in both northern and southern units are from rainfall recharge.

Northern unit — All values in $10^6m^3/yr$

Recharge	24,5	
Consumptions		7,5
Base flow		6,6
Flowing boreholes		0,5
		14,6
	Surplus	9,9

Southern unit

Recharge	27,7	
Consumptions		28,0
Ground water discharge		3,3
		31,3

Attention is drawn to the following:

In the northern unit it follows from the audit that there is a surplus of gains over losses of $9,9.10^6 m^3$ per year of average rainfall. It is suggested that this amount of ground water could quite reasonably leave the area as ground water flow. It is conceivable that this ground water flow could occur over a broad front of the drainage area say 10 km in length. This would be equivalent to about 990 $m^3/m/yr$, or about 2,7 $m^3/m/day$ over the full saturated depth of the dolomite through which it flows as it drains from the catchment.

As mentioned previously the estimation of base flow is extremely difficult and could be greatly in error. Any additions to this value however would correspondingly lower the surplus value referred to above.

Ground water leaving the southern unit underground is difficult to quantify but it was reported with authority that the $3,3.10^6 m^3$ as listed in the audit could represent the bulk of the ground water discharging the area in this way.

Two explanations are suggested why a deficit in the ground water audit should exist.

First the percentage of rainfall recharged to the ground water could be underestimated. A value of about 17% would remove the deficit from the audit. Alternatively it is feasible that a portion of the return flow discharged into the Blesbokspruit, estimated to be as much as $42.10^6 m^3$ annually, could find its way underground. The deficit only represents about 8,5% of this return flow.

Although the values presented in the audit are considered approximate at this stage and would require further investigating to increase their level of reliability they are probably of the right order of magnitude and can be usefully used as a basis for water resource planning. Records maintained by the various mining companies have been of great value in compiling the ground water inventory and audit.

7. POTENTIAL FOR GROUND WATER UTILISATION

In this section a realistic appraisal is presented of the likely potential of the ground water in the study area as a source of domestic/municipal and industrial water in the East Rand and details of a strategy that can be adopted to realise this potential is outlined. Although the appraisal could be refined by actually utilising the ground water on a large-scale in a controlled manner over a period of several months or years the geohydrological basis provided below which is derived from the current knowledge of the ground water in the area can be of value to water resource planners.

Southern unit

Apart from the little known and largely unutilised quantities of ground water in storage in the dolomite formations overlying the mined-out areas in the East Rand basin, the southern unit is considered to have very limited additional ground water potential. Despite the large quantities of ground water that have been and are still being abstracted from deep mining levels (water which it is believed originates in the dolomite) ground water referred to above remains in storage in the dolomite as evidenced by ground water levels observed in mine shafts and boreholes in the area. Most of these shafts were abandoned during sinking operations when problems with ground water were encountered. Relevant information available about these shafts and the ground water encountered is tabled below. Reported fissure flows shown in column 3 were estimates made at the time the ground water was encountered and annual yields available as shown in column 4 were derived from these values. The reliability of these flows is not known, but their occurrence are documented by the various mines.

The total of flows entering the shafts is estimated to be about $8.10^6 m^3$ per annum which represents a first approximation of the quantity of exploitable ground water in storage, in this overlying dolomite. This would have to be confirmed by further controlled pumping tests undertaken in the shafts. It has been suggested that the yields may be considerably greater.

Name of the mine	Shaft no.	Reported free fissure flow (1/s)	Yield available ($10^6 m^3/y$)	Depth of shaft (m)	Remarks
1	2	3	4	5	6
Geduld	1 (East Geduld)	23	0,75	?	Water level in December 1983 - 34.1 m
	1 (Old Geduld)	27	0,85	130	
	6 (Old Geduld)	12	0,37	45	
Subtotal	3 Shafts	62	1,97		
Grootvlei	1	115	3,60	115,8	Water level in December 1983 - 15,4 m
	3 and 4	142	2,50	?	-Shafts are presently pumped at the total rate of 4.50 x $10^6 m^3/y$ but 2,00 x $10^6 m^3/y$ is consumed by the mine
Subtotal	3 Shafts	257	6,10		
Total:	6 Shafts	319	8,10		

Exploitation of this ground water on a large scale will almost certainly impact on the ground water levels in the vicinity of the shafts and probably further afield. The effect that this may have on sinkhole formation and land subsidences in the surrounding areas is not at this stage known. This possibility would have to be examined in detail before the ground water can be exploited on a large scale, particularly in those areas that are heavily urbanised.

This ground water is the most accessible in terms of recovery and proximity to pipelines and consumers of the East Rand and it is recommended that its full potential be further investigated as well as possible impacts that is exploitation may have on ground stability in the area.

The ground water sampled in one of the shafts, some of the chemistry of which is tabled in this report, appears to be of potable quality although a little contaminated particularly with sulphates. It is recommended that the chemistry of the water contained in the shafts be fully examined before final recommendations are made regarding its petability.

Once mining operations have been discontinued in this area an additional $50.10^6 m^3$ of storage will become available for ground water.

Northern unit

The northern unit is primarily an agricultural area served by the towns of Bapsfontein and Delmas established at either extremity. Drainage of surface and ground water is towards the north-northeast which contributes towards the inflow of Bronkhorstspruit Dam. Ground water of dolomitic origin issues from a number of perennial springs in the area. No major sources of contamination are known to exist in this drainage unit hence the ground water retains its excellent quality.

The main subareas possessing considerable potential for supplying ground water are identified as follows: (refer to Map 2)

- The drainage area surrounding Delmas totalling about 200 km^2. At present ground water is abstracted from this subarea at the rate of about $2,5.10^6 m^3$ per year for municipal and irrigation purposes. It is estimated that this subarea has the potential to supply considerably more ground water than is presently consumed. It is proposed that the ground water that occurs here be reserved for future growth projected in the area in other words that no exports of ground water should be planned from this subarea at this stage.

- The second subarea is in the immediate vicinity of Bapsfontein where large agribusinesses are sustained by the availability of large quantities of ground water that occur there. Large investments have been made in irrigation equipment. Until the full potential of the ground water is known it is proposed that consumption of ground water be confined to agribusinesses as at present.

- The third subarea located midway between Bapsfontein and Delmas extends from the farm Katsbosfontein in the west to the farm Leeufontein in the east, a distance of about 17 km, an area which is underlain by about 85 km^2 of dolomite at the surface. Although a number of strong yielding boreholes (20 l/s) are known to exist in this subarea only limited quantities of ground water are abstracted at present.

If ground water were to be abstracted from this area on a sufficient scale to lower the ground water levels in the dolomite by say 10 m a total of $42,5.10^6 m^3$ of ground water could be recovered assuming a 5% effective porosity in the dolomite. The effects of abstracting this ground water would almost certainly be felt in the dolomite beneath the Karoo formations immediately toward the south. The additional ground water recovered in this way could increase the overall volume recovered by an estimated 50% to a total of about $60.10^6 m^3$ assuming the same porosity.

In order to abstract this volume of ground water over a period of say 12 months a total of 75 production boreholes would be required yielding 25 l/s each on a continuous basis. The boreholes would have to spaced about 1 per km^2 over the dolomite outcrop.

This amount of ground water abstracted from the upper 10 m of the saturated dolomite formations is far in excess of the annual recharge from rainfall expected over the area in an average rainfall year. It is expected that a total of about four consecutive years of average rainfall would be required to replenish the ground water in storage.

The effect of lowering the ground water levels in the dolomite by 10 m will have an immediate impact on the flow of the springs in this subarea and consequently the base flow into the Bronkhorstspruit Dam. Over a period of 4 years, a total of perhaps $25.10^6 m^3$ of base flow would be lost to the dam. This would reduce the effective gain made by abstracting ground water in the subarea on a large scale to about $\underline{35.10^6 m^3}$.

Although production boreholes would be sited geophysically a success rate of 1 in 5 could still only be expected. This would require the drilling of perhaps 350 boreholes. The centre of the subarea is approximately 15 km from the nearest pipeline of the Rand Water Board. This would mean high conveyance costs of the ground water if pumped over this distance.

In total therefore $35.10^6 m^3$ of ground water from the northern unit and a further say $10.10^6 m^3$ from the abandoned shafts in the southern unit, could provide an estimated $\underline{45.10^6 m^3}$ of bulk water over a period of 12 months to assist in averting a possible major water crisis in the area. This total is equivalent to about 70% of the total annual quantity of bulk water provided to muncipalities and industries in the East Rand by the Rand Water Board.

Another source of ground water that has not been given much prominence in this report largely because of the large uncertainties that exist concerning its volume, is the possibility of large quantities of ground water in storage in major paleokarst repositories in the dolomite. It is suggested but not confirmed that these may occur on a large scale in the dolomite that dips below the sequences of the Pretoria Series to the north. Isotope determinations on samples of artesian ground water issuing from deep exploration boreholes in the area presumably penetrating the underlying dolomite suggest an age of about 30 000 years. Correlation of age with storage volumes still requires investigating.

8. OVERVIEW

Values derived from the ground water inventory study indicate that only limited quantities of surplus ground water are available in the study area i.e. ground water that is not already committed to other users or uses. In the event of utilising ground water known to exist in storage on a large scale (relative to quantities utilised by the Rand Water Board) for relatively short periods of time for instance during drought situations, resort must be made to mining ground water in the knowledge that it will only be replenished after several subsequent rainy seasons.

It is not suggested though that ground water in storage in the dolomite in the study area be mined to the extent of abstracting the maximum estimated quantity of $4.10^6 m^3/km^2$. Alternatively a rather more conservative abstraction figure of $0,5.10^6 m^3$ is suggested and this only over a rather confined area in the northern unit where economic development and demand for ground water is minimal.

Before a large-scale ground water recovery programme is planned and implemented however it is strongly adviced that a further phase of the regional ground water investigation be completed as already detailed in order that the values presented in this report may be upheld at a higher level of confidence, and that the dynamics of the ground water system operating within the dolomite might be more fuller understood.

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BG4/8/C2/7

Director: Division of Geohydrology

GROUND WATER IN THE EAST RAND DOLOMITES

Please find attached Report GH3316 entitled 'Potential supply from dolomitic ground water sources of East Rand' by A.F. Leskiewicz. An attempt has been made in the presentation to highlight the most important geohydrological aspects in a concise and objective manner that can be of value to water resource planners.

Although it is almost two years since this regional ground water investigation was initiated there are still aspects which require further investigating both geohydrological and geological. In the event of large-scale abstraction of ground water being planned and implemented in the area it is imperative that this second phase of the investigation proceed without delay.

An amount of R56 000 was budgetted for exploration drilling in this area during the 1983/84 financial year, but the drilling programme has been postponed. Other aspects which require attention and/or rounding-off include pump testing, geological mapping and an extension of the borehole survey, and possibly a gravimetric survey over selected areas on a wide grid. Sampling of waters and monitoring ground water levels and spring flows will proceed as an on-going programme.

It is estimated that the above programme plus report could be completed within a period of six months.

Please could you comment both on the attached report and on the proposed work programme so that planning details and field work can proceed in due course.

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