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UNIVERSITY OF PRETORIA
DEPARTMENT OF GEOLOGY

Groundwater GLY 265

Semester Test 1
04 August 2008

Examiner(s): Mnr. M. A. Dippenaar
Moderator(s): Prof J. L. van Rooy

Time: 80 min
Marks: 40

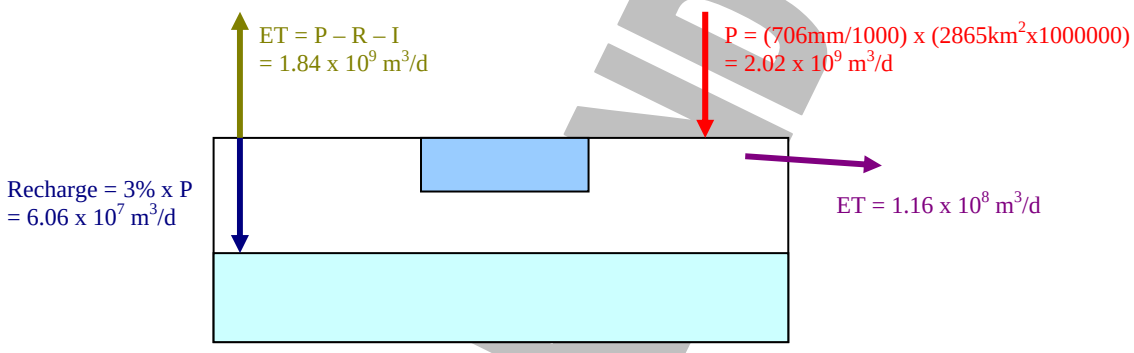
Answer all questions, show all calculations and write legibly. Good luck!

Question 1 [16]

The De Hoop Dam is presently being constructed in the Steelpoort River between Roossenekal and Steelpoort. The catchment covers an area of 2 865 km^2 with mean annual precipitation of 706 mm and mean annual runoff of 116 million m^3. Assuming recharge at 3.0% of MAP, answer the following questions:

a. Schematically depict the water budget and balance the inflows and outflows (calculate and show all volumes in m^3/a). [10]
b. Calculate the actual annual evaporation in millimetres. [3]
c. 80 million m^3 of water from the dam is to be used to supply water to the proximate properties. What – in your opinion – will be the influence of this on the water balance? [3]

a.



Precipitation = Evapotranspiration + Runoff + Recharge

b. ET = ((1.84 x 10^9 m^3/a) x 10^{-3}) / 2865 km^2 = 643 mm

c. Removing water from dam → probably removal from surface runoff; i.e. 116 000 000 – 80 000 000 = 36 000 000 m^3/a.

Question 2 [24]

For the surface area and precipitation data supplied:

a. Calculate the average precipitation depth (mm) using the Thiessen method. [12]
b. Calculate the precipitation volume V_P (m^3/a) and precipitation yield Q_P (ℓ/km^2·s). [6]
c. Assuming 2.5 % recharge of mean annual precipitation, no groundwater inflow and no change in groundwater storage, determine the influence of a farmer pumping borehole BHA at 1.4 ℓ/s. [6]

MEMORANDUM

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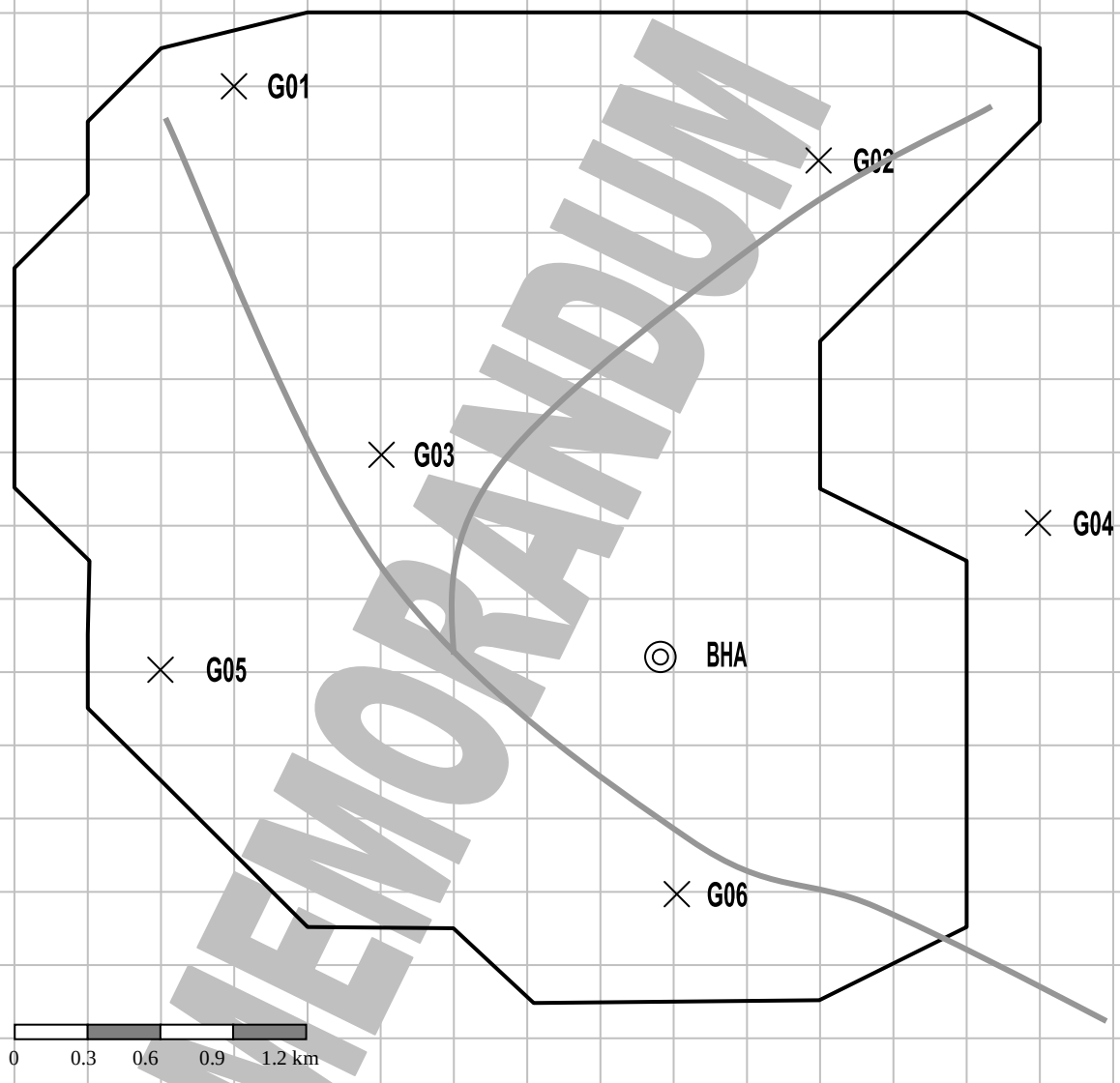
Station	Depth of precipitation [mm]	Blocks	Area (km^2)	Wi	Pi
1	990	~ 22	1.98	0.15	148.5
2	1030	~ 25.5	2.96	0.22	226.6
3	940	~ 32	2.88	0.22	206.8
4	970	~ 9.5	0.86	0.06	58.2
5	880	~ 20.5	1.85	0.14	123.2
6	920	~ 30.5	2.75	0.21	193.2
	TOTAL	**~ 140**	**A=13.28**	**1.00**	**EUD=956.5**



MEMORANDUM

a. P_{ave} = 956.5mm per annum

b. $V_p = P_{ave} \times A = (956.5mm \times 0.001\ m/mm) \times (13.28km^2 \times 10^6\ m^2/km^2 = 1.27 \times 10^7\ m^3/a$

$P_q = V_p/TA = (1.27 \times 10^7\ m^3/a) / (13.28\ km^2)(3\ 153\ 600\ sec) = 30.33\ \ell/km^2 \cdot s$

c. $Q_w = 1.4\ \ell/s \times (0.001\ m^3/\ell) \times (3153600 s/a) = 4.42 \times 10^4\ m^3/a$

Recharge = 2.5% x P = $0.025 \times 1.27 \times 10^7\ m^3/a = 3.18 \times 10^5\ m^3/a$

Should be safe pumping, assuming no other proximate abstraction

TOTAL MARKS **[40]**