

Groundwater Modelling

Introduction

The Gash River basin is one of the most famous alluvial basins in Sudan. Groundwater basins are part of the ecosystems, therefore studying and addressing of any ecosystem problems in Gash basin requires understanding of the present and future performance of the aquifers within the basin.

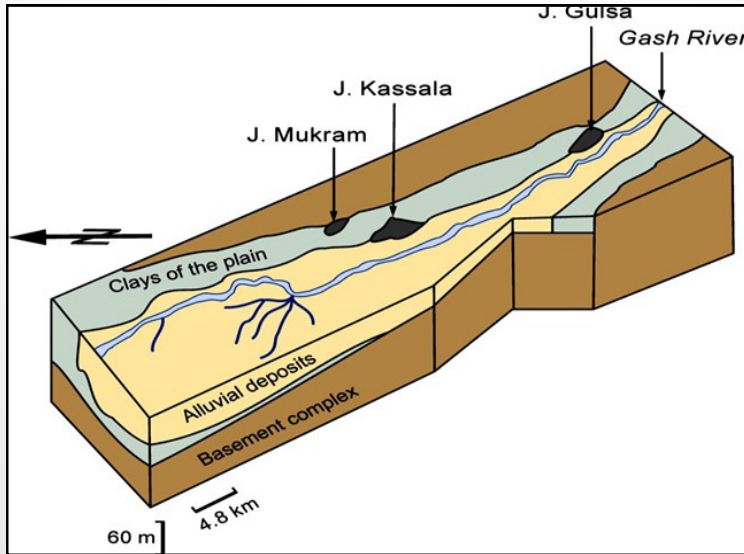


Diagram of the geology of the area (After Bireir, 2002)

Objective

To investigate the groundwater table draw-down under different Gash floodwater allocation scenarios to GAS, domestic and livestock water supplies, Gash Die and other uses. This is to:

- Develop a strengthened conceptual foundation for local catchment and groundwater basin using an ecosystem approach.
- Demonstrate alternate management approaches for groundwater in the basin.
- Raise awareness of stakeholders, wo/men and youth on groundwater management.

Approach/Methodology

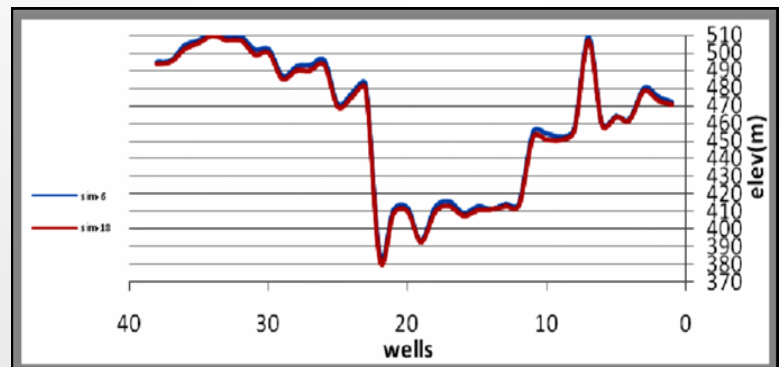
The ModFlow2000 software was adopted to develop a groundwater flow model for the Gash basin.

The following data was used :

- Hydro-geological structure: top elevation, bottom elevation, and extent.
- Aquifer properties: transmissivity, storage coefficient, effective porosity and related parameters.
- Boundary Conditions.
- Recharge data, discharge rates for different uses, etc...

Model calibration

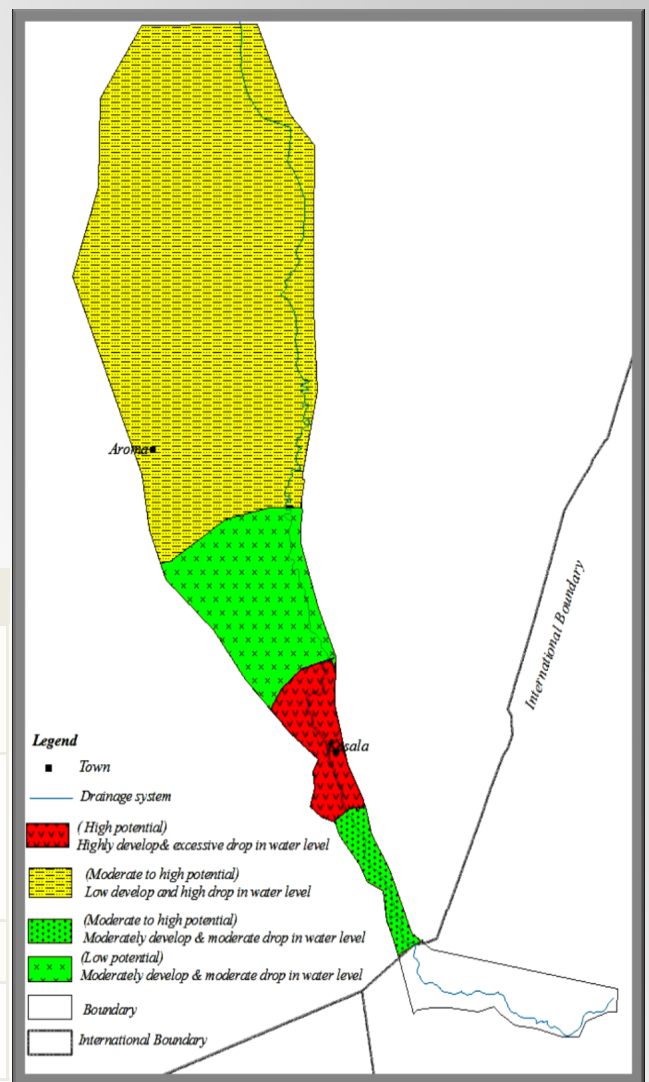
The model calibration of Gash basin was acceptable within the average Root Mean Square error, Residual Mean, and standard error of estimate to be in order of 0.11 m, 0.09 m and 1.74 % respectively.



Results

1. The Gash aquifer is highly depending on annual recharge of the Gash River seasonal flood.
2. The water table elevations in the aquifer rise during and after the rainy season (July- December) and start to drop during dry season.
3. The water level in the basin is highly sensitive to amount of recharge and to rate of pumping by wells for irrigation and drinking water supply uses.
4. **Potentiality of Gash basin aquifer is classified as follows :**

Location	Classification	Remarks
Sudanese/Eretria boundary to Wad Sharefaae	moderate	alluvium deposits (9-14), thin aquifer (2-14m)
Around Kassala town, El Sawagi north and south, Khor Esshigia, and Salaam Elekum	high	big alluvium sediments (23-48 m), aquifer thickness (10-30m), high to moderate hydraulic conductivity
Around Jammam	moderate	wide and big thickness (15-20)
North Jammam area to Gash Die	moderate to low	



Recommendations

⇒ To reduce the amount of pumping by wells for irrigation purposes around Kassala and El Swagee areas in the midstream at least by one fourth up to half of the existing rate.

⇒ Top priority is to serve the town and the villages of downstream with drinking water by utilizing aquifer around Kassala and Jammam areas.

⇒ Downstream parts should be utilized to drink the livestock.

⇒ The recharging of the downstream and delta aquifers can be supported by applying the basin method as an artificial recharge technique.



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