Sustainability of Environmental Topology & Reuse Water management of Enclosed Land by No Flow Boundaries

Najah M. Lateef [1], Moutaz Al Dabbas[2], Mohammed Kareem Abed[3], Arkan Radi Ali[4],

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1 It is naturally encountered an agricultural and/or populated lands bounded by natural or artificial hydraulic boundaries like rivers and streams or by impermeable barriers like antic lines of mountains or artificial vertical geotechnical barrier as encountered in Tyass area Fig.1. Existence of such barriers makes the affected areas endure many bad environmental problems such as swamping of ground surface, soil water logging, soil salinity, difficulty in drainage and irrigation activities, and environmental unbalance. In this situation a good remediation and optimum management to the aquatic wealth is required to rebalancing the ecosystem.

2 A integrated water management of Tyass area (2508 donams) was adapted. It was planed to be rehabilitated and survived after enclosing it by a subsurface no flow barrier.

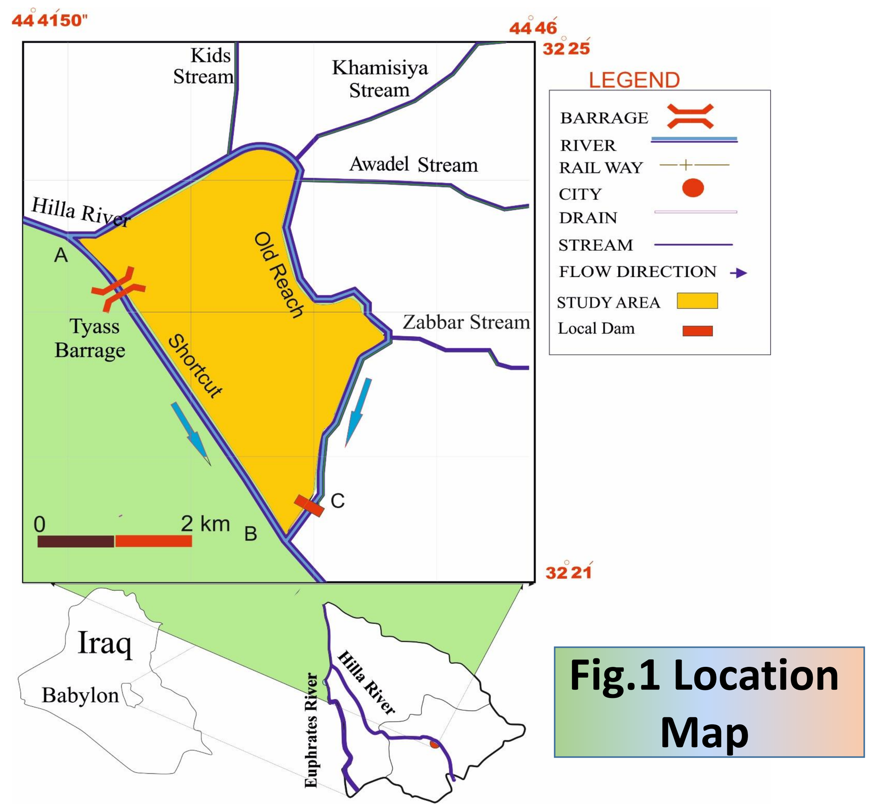

Fig.1 Location Map

3 Fig.2 shows the interior no flow barrier surrounding & penetrating the full depth of the unconfined aquifer to prevent seepage entering a subsurface environment.

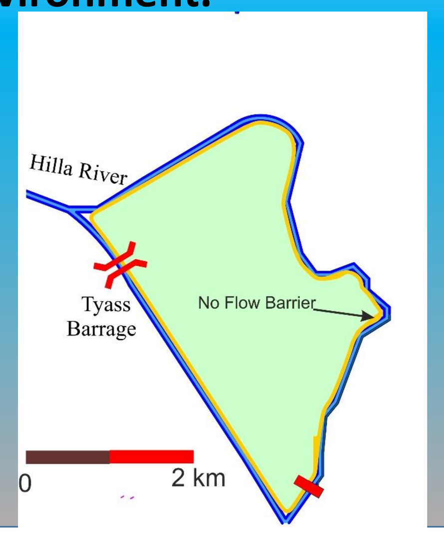

Fig.2 Tyass No Flow Barrier & Discretization of Model Domain

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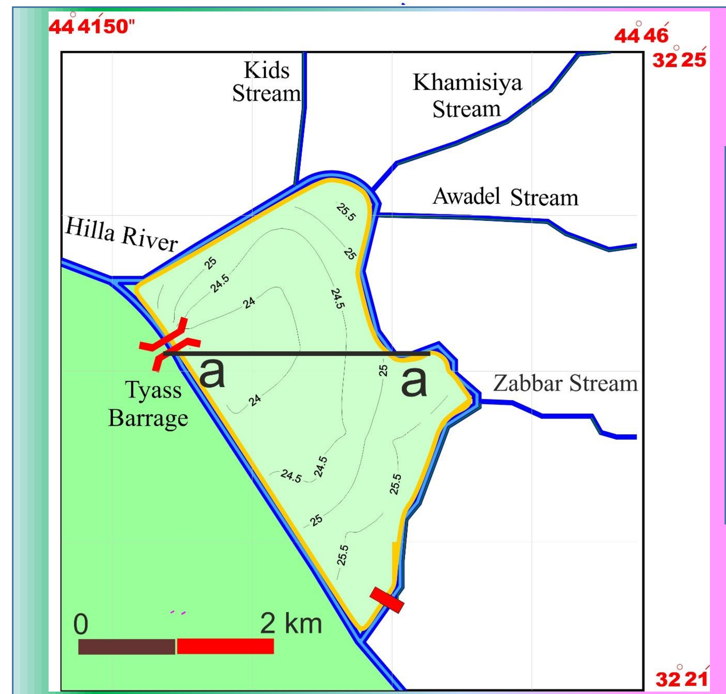

Fig.3 Section aa & Topography

5 section aa of Fig.3 was taken to show a swamping water covers the ground surface as shown In Fig.4

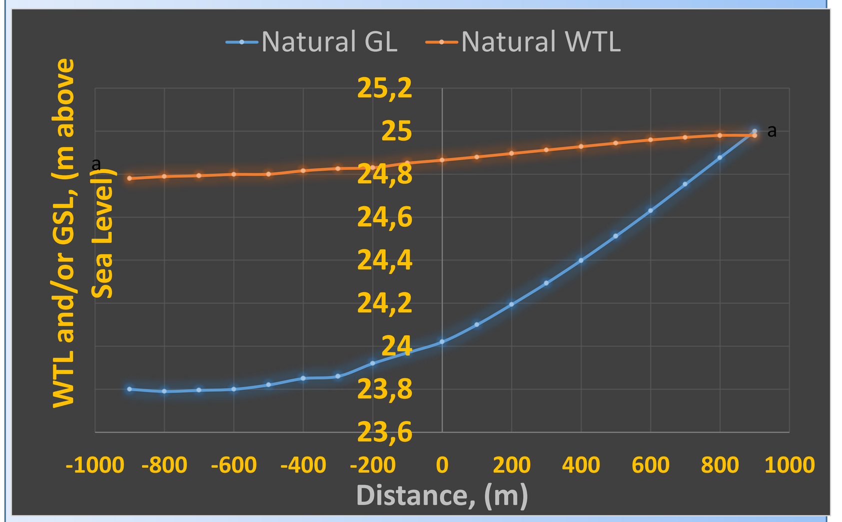

Fig.4 GS & WTL

5 A pumping well was used to evaluate a natural water table level, bed level, geologic stratification, specific storage and transmissivity. A recovery pumping test analysis was carried. A measured properties of about T=193m2/day and a recharge of 2mm/day Fig.5

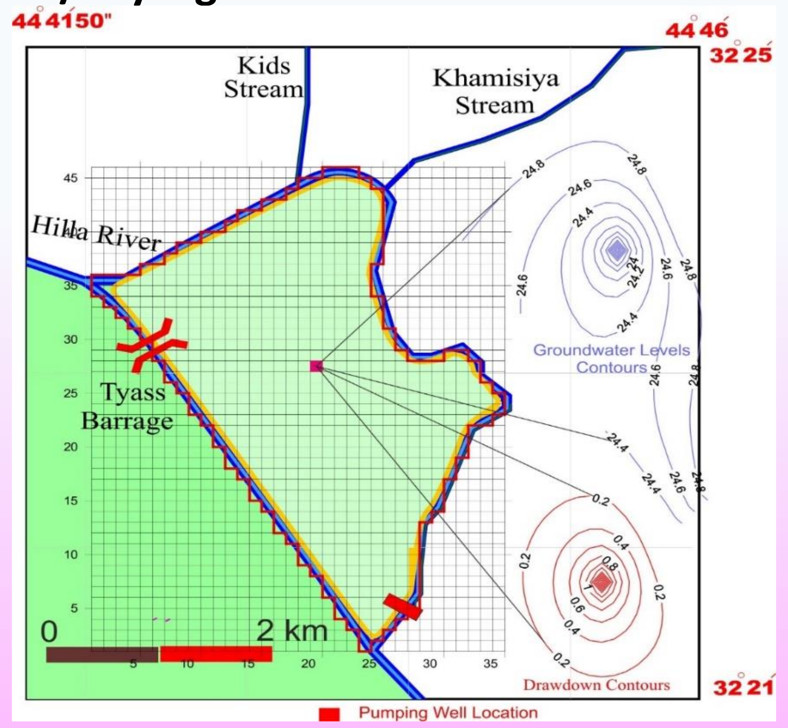

FIG.5 A drawdown and WTL contour in M.a.s.L

Groundwater Simulation requires to implement a discretization of model domain into NC=36 & NR=46 No. of columns & rows respectively, preparation of input data files of aquifer properties, such Bed level, initial WTL, specific storage ...etc.

6 Mathematical Model requires a calibration, verification, and justification to a tolerated value before any environmental applications:

Model Calibration: This step was achieved by the comparison between the natural and a measured WTL as in Fig.6.

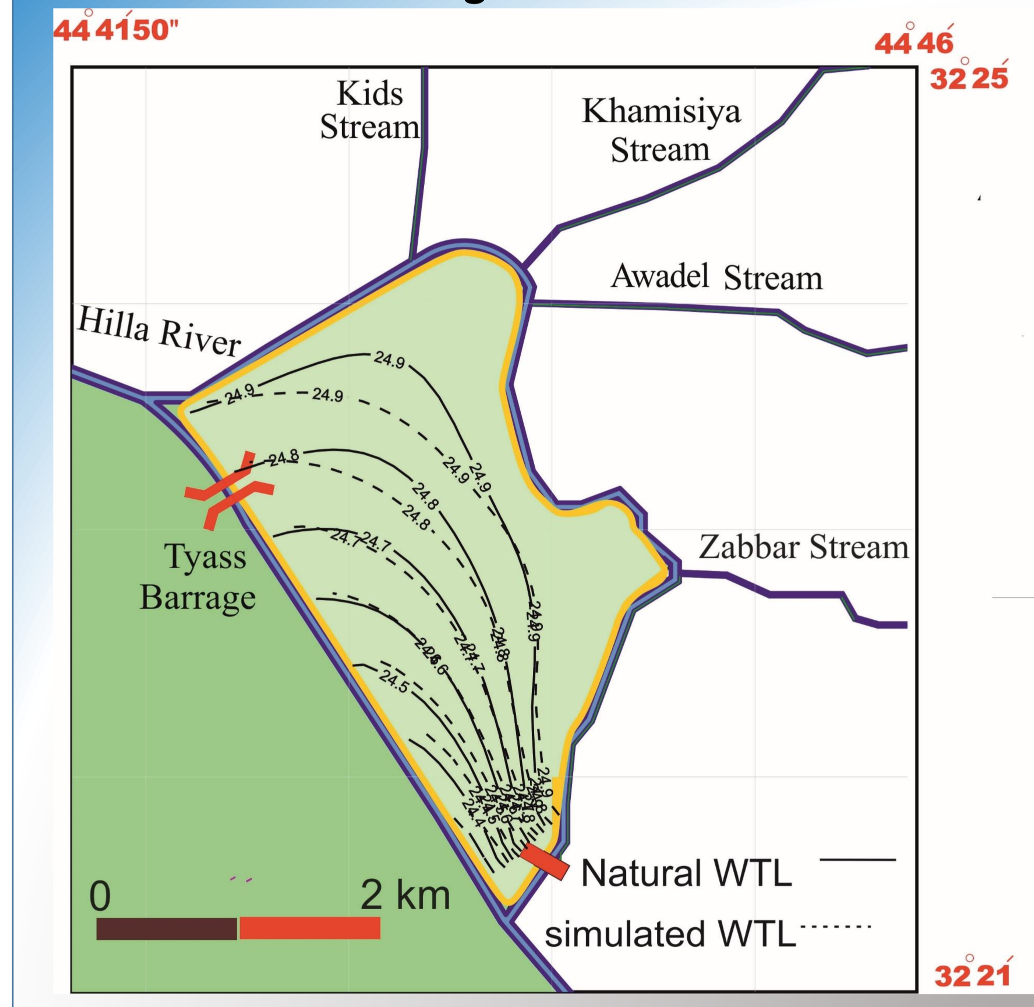

Fig.6 Natural & Simulated WTL

7 **Model verification: This involves a comparison of model results with the analytical solution of Theis as in Figs.7&8**

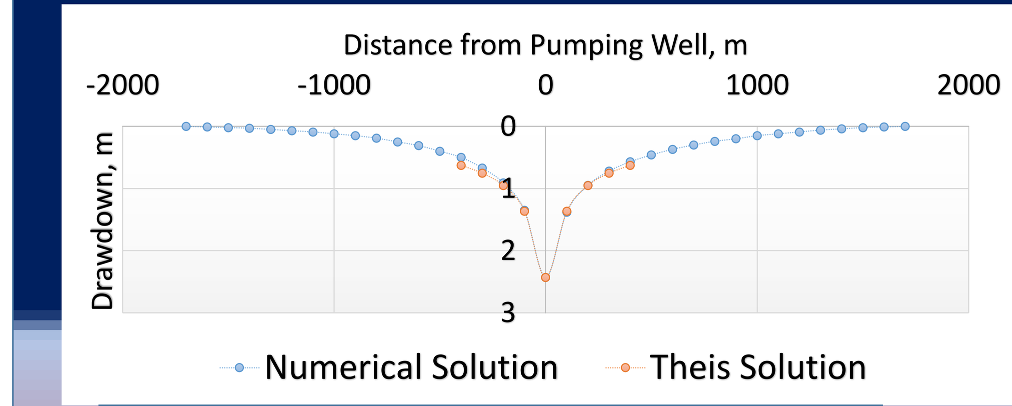

Fig.7 Distance-Drawdown Comparison

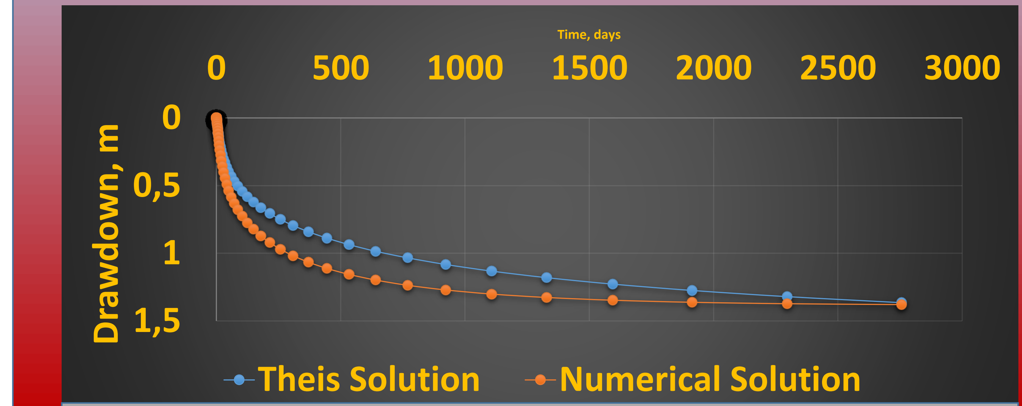

Fig.8 Time-Drawdown Comparison

8 **Model justification: The error term represents the majority of model justification which is defined as the summation of the errors between the WTL of two successive iterations of all meshed per single iteration. The error term results shown in Fig.9**

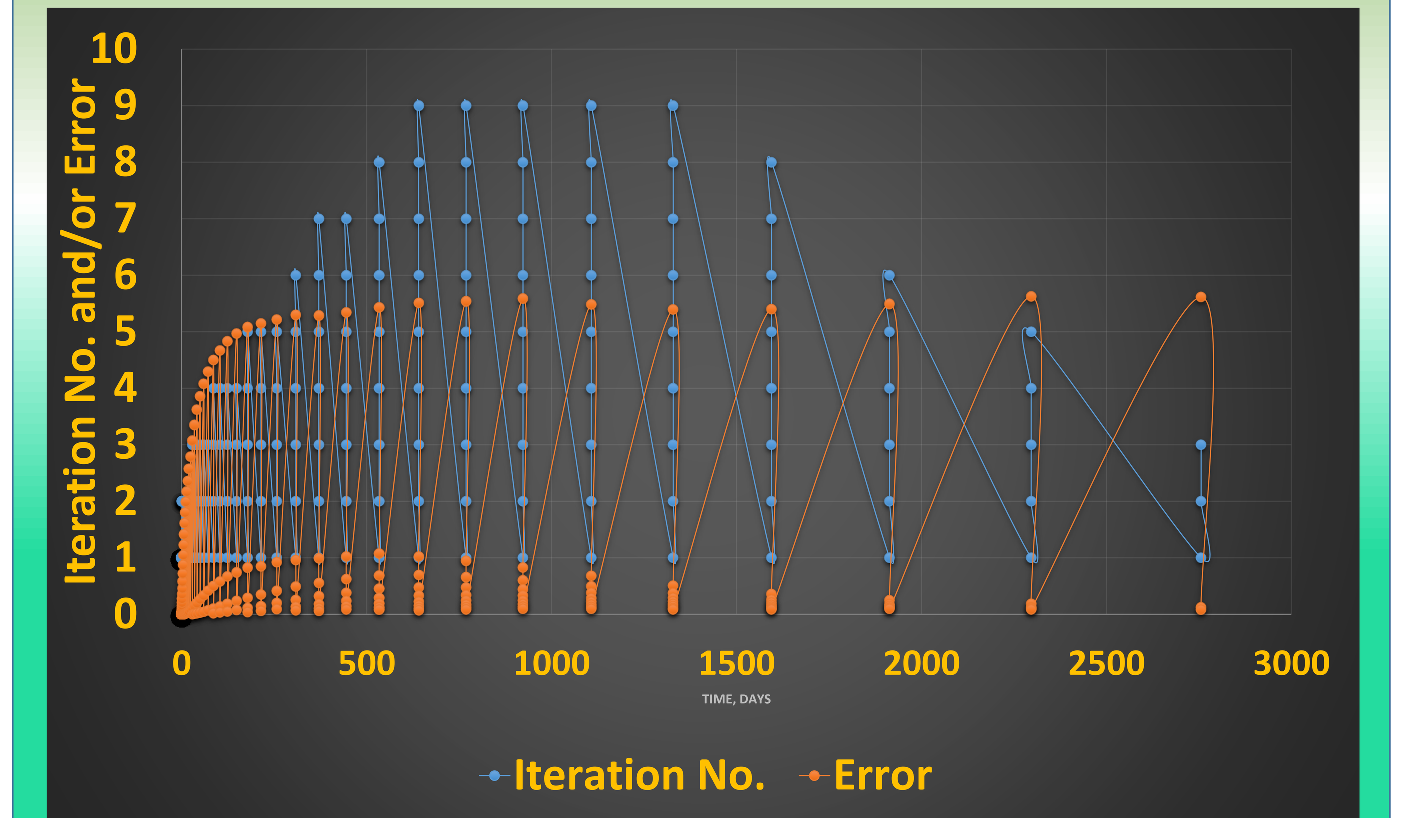

Fig.9 Iter No. & Error Sum Versus Time

9 A pumping well was used to evaluate a productivity and a drawdown. The maximum discharge is (400 m³/day) that can be exploited with a drawdown of (2.43m) at the center of pumping well.

10 Environmental of subsurface rehabilitation involves to evaluate the recharge capacity of an injecting well as in Fig.10 the WTL rises considerably as the recharge capacity increases.

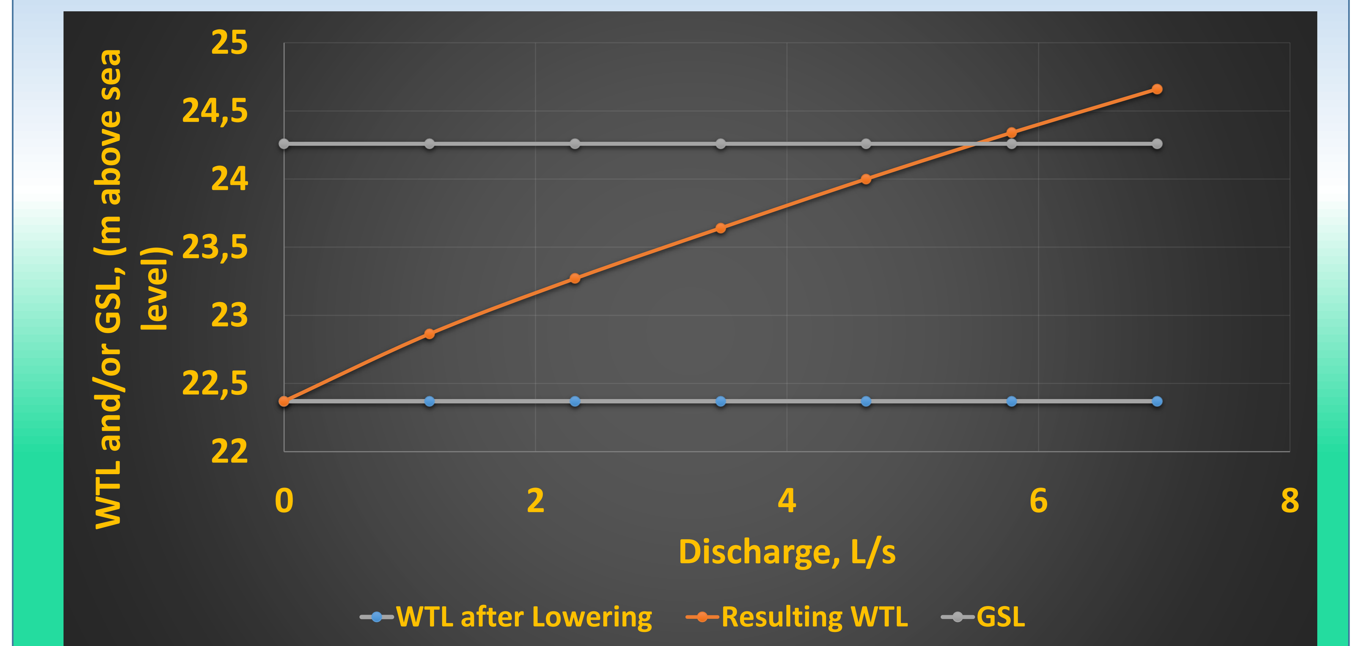

Fig.10 WTL Rise & Recharge Capacity

Environmental Remediation of Tyass

11 Lowering of WTL requires to discharge no less than 4.6L/sec by using a pumping well to lower WTL in no less than 1m drawdown and corresponding to Fig.4.

12 Hydrologic Solution

a) It was planned to supply a net WD Col.4, Table.1 by a SW from Hillah River after adding 20% of WD, Col.5. B) Discharging the additional 20%WD in Col.6 by discharging wells of 4.6L/s discharging capacity scattering along Hillah River embankments Fig.11.

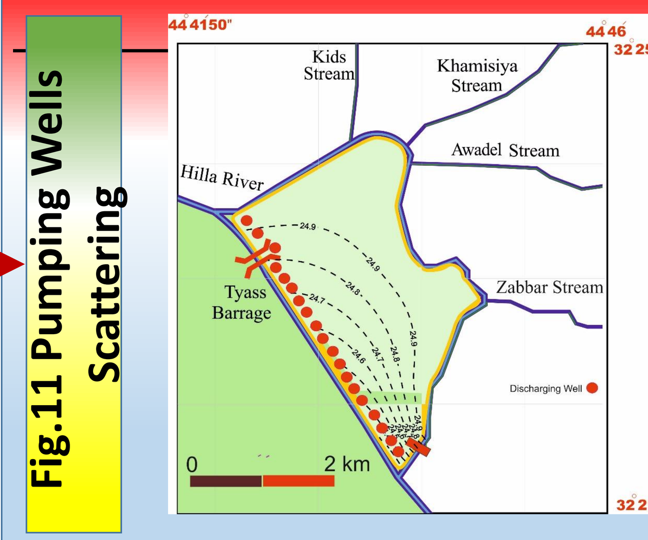

Fig.11 Pumping Wells Scattering

13 Hydrogeologic Solution a) It was planned to satisfy the 1.2WD, by using a SW to recharge the aquifer by wells drilled adjacent to the old reach. B) Discharging the injected water to satisfy WD for agricultural purposes.. The mathematical model reveals that a recharging of 5L/s will maintain WTL at 0.25m below GSL Fig.10 Note: In order to satisfy the 1.2WD the number of discharging are (89wells) scattering over the area and recharging wells of (104) are scattered along the old reach of Hillah River Fig.12

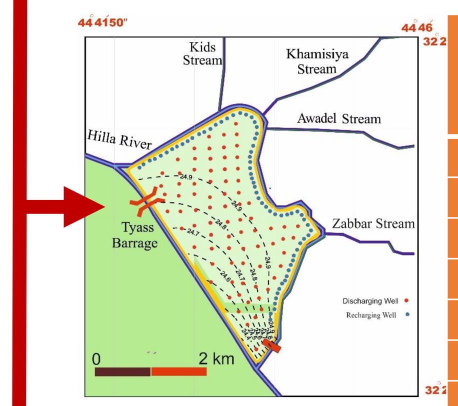

Fig.12

Month	WD, m³/s	Rainfall, m³/s	Net WD m³/s	SW m³/s	SY, L/s	Well No.
	Col.2	Col. 3	Col..4	Col.5	Col.6	Col.7
OCT	0.105	0.010	0.095	0.114	19	4
NOV	0.070	0.049	0.021	0.025	4.2	1
DEC	0.052	0.065	0	0	0	0
JAN	0.052	0.053	0	0	0	0
FEB	0.077	0.034	0.043	0.052	8.7	2
MAR	0.172	0.032	0.140	0.168	28	6
APR	0.315	0.030	0.286	0.343	57.1	12
MAY	0.440	0.007	0.432	0.520	86.5	19
JUN	0.396	0	0.396	0.475	79.1	17
JUL	0.304	0	0.304	0.365	61	13
AUG	0.263	0	0.263	0.316	52.7	11
SEP	0.196	0.000484	0.195	0.234	39	9

14 A hydrogeologic solution is more effective and economic solution.

- shallow aquifer requires a high number of pumping wells.
- Recharging capacity is reduced considerably as WTL be close to GS.