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Sustainable Yield of West Bank Aquifers

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- **Groundwater availability**

It is the amount of groundwater that can be available from a groundwater basin for domestic consumption, industrial use, irrigation etc.

GW availability can be looked at the long and short term strategies.

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LONG TEARM STRATEGY

Which usually covers period of many years:

1. Safe yield approach:

The abstraction do not significantly reduce the amount of groundwater stored in the GW Basin in the long run (*The abstraction that can be maintained over a long period of time without causing an unacceptable reduction in GW storage and GW level or decline in GW quality***)**

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- **a) Determination of Maximum GW availability,**

(It's defined as the total long-term natural GW inflow (outflow) of the basin)

  - **Groundwater balance**
  - **Groundwater modeling**

b) Optimum GW Availability

- · It is usually less than the maximum amount of available GW taking into consideration several constraints affecting the abstractions:
  - Technical constraints
  - Environmental constraints
  - Socio-economic constraints

*There are no hard rules to assess how to estimate the maximum GW availability and the effect of constrains and the optimum GW availability.

* In many GW basins the optimum GW availability range of 30%-80% of the maximum GW availability.

2. Depletion Approach:

this allows serious reduction in the amount of GW stored in the basin

(this approach carries the risk that the GW resources will be depleted)

SHORT TEARM STRATEGY

From several months to some years (Resilience Approach: Suitable to Palestinian Aquifers)

Extract amount of water from storage in dry seasons or during years with recharge values below average in a way that allows the aquifer to recover during short cycles of time (I,e during wet seasons)

Subject to:

Part of the amount of water stored in the GW Basin can be used.

Volumes of GW stored are sufficient

GW quality does not deteriorate

b) Optimum GW availability

(similar to the long term availability assessment)

It is usually less than the maximum amount of available GW taking into consideration the following:

Technical constraints

Environmental constraints

Socio-economic constraints

Notes

GW flow model,

mass transport models and

salt balances may be used for the

purposes to determine the

optimum GW availability in both

.quality and quantity

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Eastern Aquifer Basin

Sustainable yield Criteria

*The WL should not drop to a level such as 50% of the aquifer dewatered.

* WL should be maintained higher than head in the adjacent other Aquifers.

* Flow of springs in should not drop by 50% of the historical long-term average.

* Aquifer where it borders to Dead Sea & Jordan River: WL shouldn't drop below the Dead Sea water level.

Abstraction scenarios to evaluate Sustainable Yield

Three different scenarios were evaluated using the GW model:

1st Scenario, Existing wells pump at current rates and phase 1&2 proposed wells at design rates. (it's a baseline case, & the most probable scenario in short term):

All existing wells will continue to pump at their current rate for the next 20 years

The new phase 1&2 production wells pump at their design rate (1.825MCM/Y).

- **The model results of these abstractions, d.down occurring at various well fields(excessive d.down in Herodian & Bani Naem >500m).**

This modeling scenario indicates that this is not a long – term sustainable alternative .

.**2nd** Scenario, Existing wells and phase 1&2 wells pump at reduced rates

It was designed to evaluate the maximum amount that could be pumped from the Mountain Aquifer, without causing WL elevations to drop below the critical elevation.

***runs for the scenario of reduced pumping rates (with different rates) from the well fields**

***The maximum abstraction that could be obtained without lowering the WL below the critical elevation was approximately 51.7MCM/yr.**

The maximum sustainable yield of the EAB is approximately 50MCM/yr.

This Scenario suggests, that if production wells have wider geographic dispersal, the sustainable yield will increase.

3rd Scenario, Existing wells and phase 1&2 wells pump at reduced rates in addition to operating additional 30 new wells.

*The additional new well fields will result in a wider geographic distribution of abstraction and minimal local d.down.

The d.down occurring at various well fields are:

0 – 50m In	Jericho, Auja , Fasayil and Gitit well field
50 – 100M	In Ein Samia Well Field
100 – 200m	In the Jerusalem Well Field
200 – 300m	In the Heridian Well Field
300 – 400m	In Bani Naim Well Field

Therefore, a conservative estimate of sustainable yield of the EAB aquifer should not exceed 50MCM/yr.

Northeastern Basin

*Based on the calibrated steady state model, the average long-term recharge to the G.W body underlying the NE Basin and Eastern Tip is approximately 165MCM/yr.(Upper limit on the sustainable yield)

*Recent studies in the North Eastern Basin indicate that the amount of GW that can be safely extracted using wells is approximately 50% of the total recharge to that area.

(MEG, 2000)

*The current abstraction from NE Basin &Tip is approximately 82MCM/yr

*The conclusion of the analysis that the abstraction in the NE Basin & Eastern Tip is currently near their respective sustainable yield.

*Additional deep wells may be feasible in the northern portion of NE Basin (from Turonian);

The result decreases of flow to Gilboa area & draw down in shallow and deep zones about 20m (in case of increasing 20mcm/yr)

*Thus, the sustainable yield of the basin is estimated at 80 – 100MCM/yr,

Western Basin

***Based on the calibrated transient model (1987-1998), the average long-term recharge to the G.W body underlying the Western Basin is approximately 360-430MCM/yr.**

Coastal aquifer Basin –CAMP

Outflow = Total abstraction + Lateral outflow (including the natural recharge to the sea(

Inflow = effective recharge + lateral inflow + total return flows + saltwater intrusion

The total inflow = 116.1 – 152.2 MCM/yr

The total outflow= 142 – 170 MCM/yr

The total capacity of the aquifer indicates that if the recommended and assumed components of the CAMP are implemented in timely manner, the fresh water capacity should grow from its current 108.78MCM/yr to 154.45 MCM/yr by year 2020.

Based on the above, the sustainable yield of the Gaza Coastal Aquifer is around **110MCM/yr** based in the present condition.

Thank you