Water Balance: Wadi Shueib, Al Balqa, Jordan

Current status and scenario development

Results from data analysis, budget calculations and scenario planning modeling

Reference:

my thesis, recently submitted, reference:

Riepl (2013): "*Knowledge Based Decision Support for Integrated Water Resources Management with an application for the Wadi Shueib, Jordan*", PhD-Thesis, Institute of Applied Geoscience, Karlsruhe Institute of Technology

Data basis:

Ministry of Water and Irrigation (MWI),
Water Authority of Jordan (WAJ),
Jordan Valley Authority (JVA),
Higher Population Council (HPC),
Department of Statistics (DOS),
Ministry of Agriculture (MoA),
Ministry of Health (MoH)
GIZ,
BGR,
Dorsch Consult.

Table 0.1: Overview of temporal and spatial scale of the available data for the water balance modelling in the Wadi Shueib catchment (UFW = "Unaccounted for Water").

Some quick general remarks on the CUWR-Table

- **Sources of Water:** This does not separate between all available freshwater and that share that is ready to use. For example, the multitude of small springs in the Wadi Shueib sum up to a considerable discharge. But using them is not very practical, or only for the local landowners, due to their little discharge.
- **Water Demand:** is actually a very ambiguous term, especially for the municipal sector. It needs to clarify a supply goal (how much water should be available per person). In Jordan, the National Water Strategy sets this goal to: an absolute minimum of 100 l/c/d and up to a goal of 125 l/c/d (and 150 l/c/d in high development areas). Furthermore: Municipal Supply does not equal Domestic Supply. The former is higher (~10-30%). For water strategy planning I would recommend to use a term that expresses the water required to meet these goals: e.g. Water Supply Requirement (if interested I can provide more information).
- **Minimized:** Does this already imply several development assumptions? And which? What should loss of Treated Wastewater express (maybe treated waste water that is not used)?
- **Future CUWR:** Does the table imply that there is a one way road into the future? Should current developments (there are already infrastructure projects to improve water supply/sanitation) be regarded, or only the status quo projected into the future? Does it make any scenario assumptions (e.g. wet, dry, average future, etc.)?

Water Balance:

All following figures are related to the study area: Wadi Shueib above the Shueib Reservoir! The downstream area is investigated by Paulina Alfaro (KIT).

Current status: 2008/09

Remarks:

Population (downscaled from estimation HPC): 125,610 capita
Current consumption per capita (calculated from WW returns): ~39.5 m^3/c/a
Supply goal (according to national water strategy): 46-55 m^3/c/a
Current supply Losses (according to MWI): ~29%
Irrigated area: ~4.5 km^2 (*other agricultural area is rainfed*)
Industrial water demand:~0.7 MCM/a.
Tourism has no separate water demand center.

The four larger springs (Ain Baqqouria, Ain Al-Azraq, Ain Shorea, Ain Hazzir) and a couple of wells are currently used for water supply. Several smaller springs are used locally by land owners for agriculture or other purposes, or are not used. Their small and unreliable discharge makes municipal use not feasible. Some wells and one spring is also used for industrial purposes by the La Farge Cement company. On the other there are already high water imports for municipal supply necessary. **In Wadi Shueib, actually all water that is not used (or lost) in the study area is used downstream for agriculture. Issues here are essentially related to improve utilization of quality freshwater before it becomes blended with treated WW (resources protection and loss reduction).**

The figure on the next page shows the full balance.

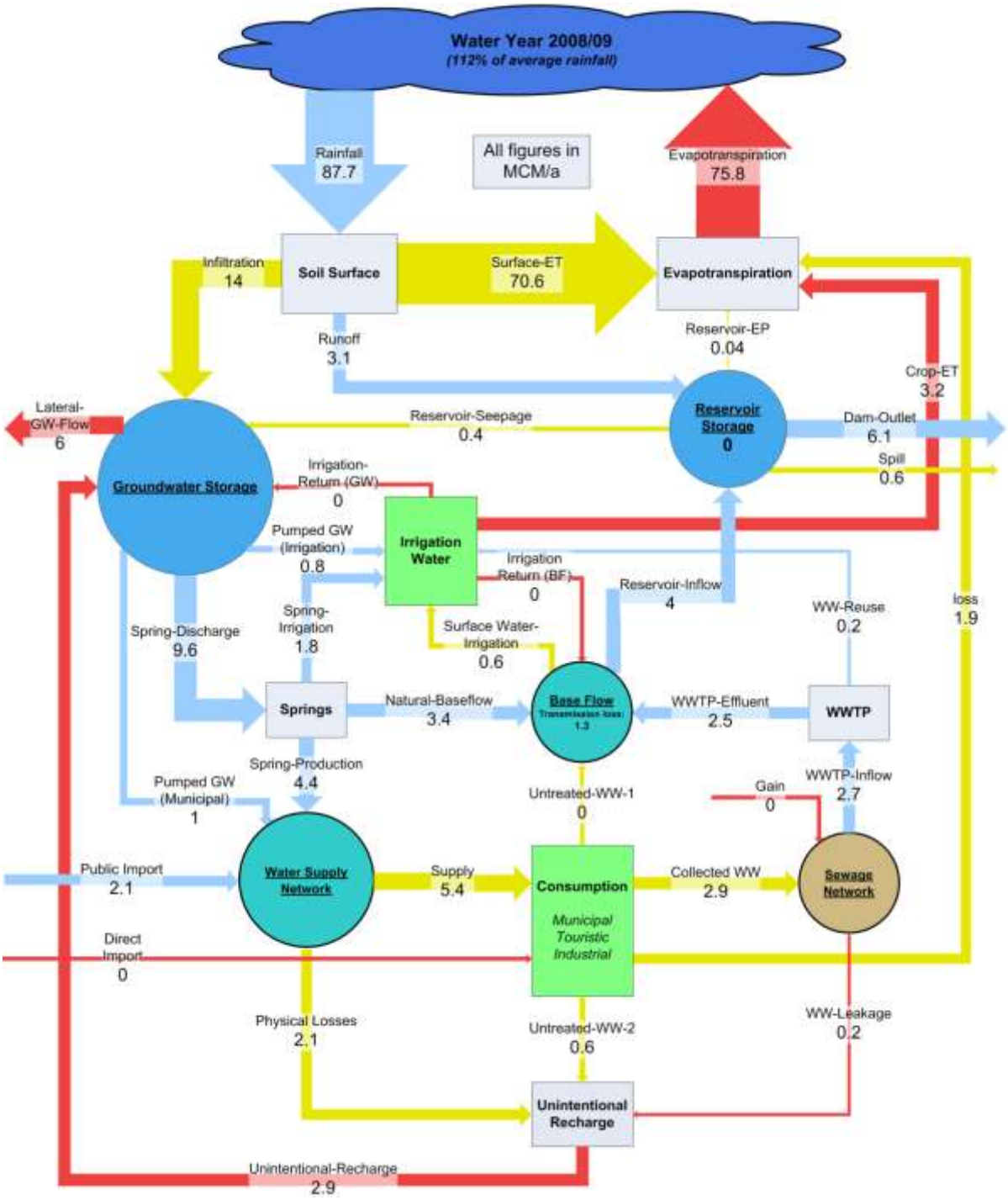


Fig. 0.1: Water Balance for Wadi Shueib compiled from the pre-processed data. All values are given in MCM for the water year 2008/09. The colour of the flow arrows indicates the confidence in the data quality: blue: good (measured); yellow: medium (balance derivate); red: poor (expert or literature estimates or no data). Transmission losses (baseflow) are considered as outflow component.

Scenario HRP-BAU: 2024/25

(High-Resources-Pressure-Business-as-Usual)

Remarks:

Scenario Story: dry water future, high population growth, high demand development, the current action plans of the water sector institutions are realized, but nothing else is implemented:

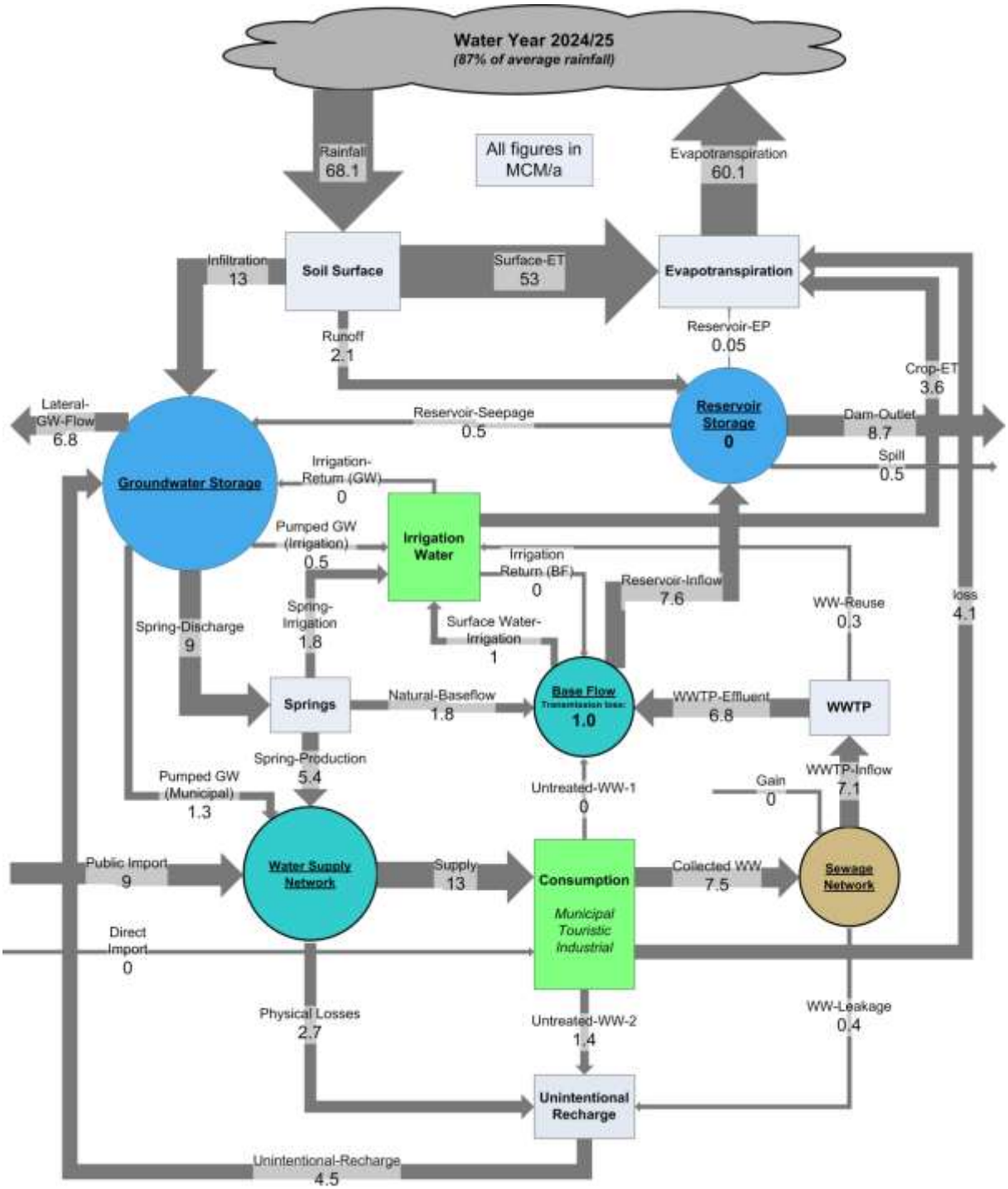
Population-projection: 184,500 capita
Consumption-projection according to supply goal: ~54.5 m^3/c/a
Supply Losses-projection (physical): ~17.5%
Irrigated area: ~4.5 km^2, but TWW-irrigation rises from 0.15 to 0.3 MCM/a
Industrial water demand: 1.0 MCM/a.
TWW –projection: 83%
…*and more*

This provides a quick and incomplete overview over one of the Scenario calculations, I am happy to provide more information on all scenario assumptions and also the other scenarios. I can also provide cost estimations for planned and potential investments in the Wadi Shueib Scenarios.

The HRP-BAU Scenario represented here is actually the more “extreme” scenario (ergo “High Resources Pressure”). Other Scenarios build a future of more moderate constraints (“Low Resources Pressure”) and some include further implementation steps…

The figure on the next page shows the projected HRP-BAU-Balance
(the colour code is of course not applied for future projections)

For any questions, clarifications or wishes please don’t hesitate. I am also especially happy for suggestions and comments.


Water Year 2024/25
(87% of average rainfall)
All figures in MCM/a
Rainfall 68.1
Evapotranspiration 60.1
Infiltration 13
Soil Surface
Surface-ET 53
Evapotranspiration
Runoff 2.1
Reservoir-EP 0.05
Crop-ET 3.6
Lateral-GW-Flow 6.8
Reservoir-Seepage 0.5
Reservoir Storage 0
Dam-Outlet 8.7
Spill 0.5
Groundwater Storage
Irrigation-Return (GW) 0
Pumped GW (Irrigation) 0.5
Irrigation Water
Irrigation Return (BF) 0
Reservoir-Inflow 7.6
loss 4.1
WW-Reuse 0.3
Spring-Discharge 9
Spring-Irrigation 1.8
Surface Water-Irrigation 1
Springs
Natural-Baseflow 1.8
Base Flow
Transmission loss: 1.0
WWTP-Effluent 6.8
WWTP
Spring-Production 5.4
Pumped GW (Municipal) 1.3
Untreated-WW-1 0
Gain 0
WWTP-Inflow 7.1
Public Import 9
Water Supply Network
Supply 13
Consumption
Municipal
Touristic
Industrial
Collected WW 7.5
Sewage Network
Direct Import 0
Physical Losses 2.7
Untreated-WW-2 1.4
WW-Leakage 0.4
Unintentional Recharge
Unintentional-Recharge 4.5