The Red Dead Canal project: an adaptation option to climate change in Jordan

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\textbf{ABSTRACT}

In arid and semiarid regions such as Jordan, climate change impacts on the balance between available resources and demands are expected to be severe. Climate change is expected to reduce resources and increase demands which will inevitably result in enlarging the gap between supply and demand. Adaptation to these impacts can be achieved either by reducing demands via implementing demand management practices or by developing and utilizing undeveloped resources, or by both. This paper investigates the impacts of the proposed red dead canal (RDC) project on bridging the gap between supply and demand in Amman and Zarqa cities within Amman Zarqa Basin (AZB) and in the Jordan Valley. The water evaluation and planning system (WEAP) is implemented for the Jordan Valley and AZB for this purpose. WEAP allocates water to competing demands based on the physical system characteristics as well as user-defined criteria, so that coverage at all competing demand sites is equal. The physical system characteristics include water availability, water demands, and transmission line capacity. The user-defined criteria include demand priority and supply preference. The Jordan Valley and AZB are represented as a network of supplies and demands connected by transmission lines in the WEAP environment. AZB and the Jordan Valley are connected via Zarqa River, where As Samra wastewater treatment plant effluent that treats the wastewater generated in Amman and Zarqa is discharged to the river, which flows to King Talal Dam and then released to the Jordan Valley, and used for irrigation after mixing with King Abdulla Canal water. Inputs to the model were taken from MWI real time records and measurements and other sources such as the Department of Statistics. The WEAP model was run for three scenarios namely: Business As Usual (BAU) scenario, climate change (CC) scenario, and RDC scenario. In the BAU scenario, water demands and resource trends grow as expected or planned. In the CC scenario, climate change impacts on the resources; run-off and groundwater recharge and on the demands in the valley are imposed. Run-off and groundwater recharge are assumed to decline according to a certain formula, and irrigation demand is assumed to increase by 0.10%. In the RDC scenario, the RDC project which will provide about 550 MCM of desalinated water per year...
is assumed to be implemented by the year 2022. The results showed that without implementing the RDC project, the gap between supply and demand for Amman and Zarqa for domestic use as well as in the Jordan Valley for irrigation use will continue to grow until the year 2050 for both the BAU and the CC scenarios. However, by implementing the RDC, the domestic demand in both cities will be satisfied starting from the year 2022 till the year 2050. Furthermore, the deficit in the agricultural demand in the JV for the year 2050 will drop from about 195 MCM for the CC scenario to about 85 MCM for the RDC scenario as a result of the increased treated wastewater flow to the valley from AZB. The results also showed that groundwater resources that supply Amman and Zarqa from inside the basin as well as from outside the basin can be saved as a result of giving the supply preference to the RDC project.

*Keywords:* Water resources management; WEAP; Climate change; Jordan Valley; Amman Zarqa basin