



Hydrological investigation of Shahid-Yaqoobi dam: A successful design?

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This is a hydrological investigation of a large dam named "Shahid-Yaqoobi" which is located north-east of Iran. The dam is under operation since 1996. This reservoir has neither experienced a spillover nor has it delivered water rights of the downstream farmers ever during its operation period. This problem has resulted in social crisis at the region. This study evaluates the origins of the problem in following steps:

- We duplicate hydrological studies performed prior to construction of the dam using broader set of data and original design methods used by engineers who designed the dam to check its accuracy.
- Check dam hydrologic studies and the adequacy of hydrologic data used in Kal-e-Salar river flow estimation.
- Determine the share of droughts, climatologic cycles etc. in the crisis.
- Investigating other probable causes of the problem through field visits or other information resources.
- Determine reservoir performance using the time reliability, volume reliability, resilience, vulnerability and sustainability indices in current conditions and in four different scenarios.
- Evaluate management practices after dam construction and during dam operation period. In order to facilitate this, NOAA satellite images are used to monitor the land cover changes in the kal-e-salar river basin upstream of the dam.

Also a wide range of methods are applied using a forensic approach to investigate dam design failure. In this regard, a broad range of precipitation and runoff data are gathered, statistical tests like Grubbs outlier test, Menn-Whitney homogeneity test, and other tests are performed and various comparisons are made to analyze the data.

The results show various sources of errors. It is shown that the main source of error was in the design procedure due to choice of erroneous precipitation data and unsuitable time periods for data development.

Although a recent drought in the region is a key reason for the kal-e-Salar river yield reduction, poor managerial practices done during the dam operation period is also to be blamded. Furthermore, during the dam operation upstream farmers have been illegally pumping water from the upstream part of the river.

The value of time reliability, volume reliability, resilience, vulnerability and sustainability indices for Shahid Yaqoobi dam obtained 0.1, 0.277, 0.11, 0.97 and 0.0003 respectively which confirms the dam reservoir design failure.

Keywords: Shahid-Yaqoobi dam, Hydrological Investigation, reservoir performance indices.