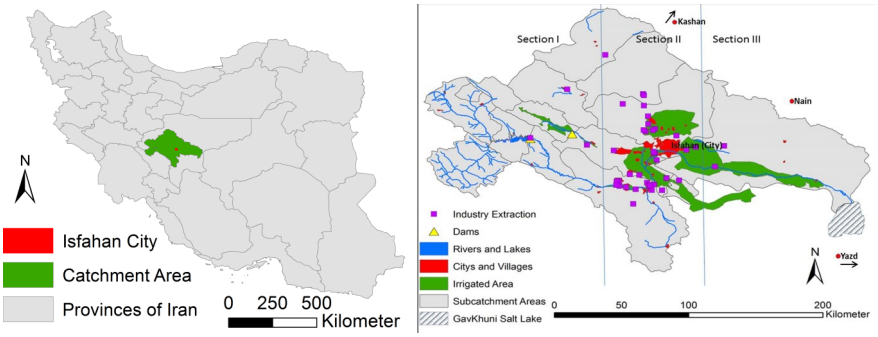
MIKE BY DHI CASE STORY

INTEGRATED WATER RESOURCE MANAGEMENT IN ISFAHAN: THE ZAYANDEH RUD CATCHMENT

Water management solution for an semiarid to arid environment

The catchment of the Zayandeh Rud river is located in central Iran in a semiarid to arid environment. The river provides the major water source for one of the most important agriculture areas in Iran, for a growing industry sector and for around 4.5 Million citizens. The growing population and the increasing agricultural- and industrial water use are in contrast to decreasing water availability which is also related to climate change. The catchment has been affected by two drought periods within the last 15 years and because of the increasing gab between water availability and water demand, groundwater resources have been overused. This leads to strongly falling groundwater levels, a widely change of groundwater flow conditions and even a dry river bed in parts of the main river.

MODELLING OF WATER RESOURCES IN CATCHMENT SCALE



Location of the catchment area in Iran (left), river sections and water users at the river (right)

The catchment area stretches across two provinces, covering a total area of 26,000 km^2. The Zayandeh Rud river originates in the province Chaharmahal-va-Bakhtiary in the area of the Zagros Mountains. On its 405 km course the Zayandeh Rud runs through extremely different climatic and natural conditions spreading from humid over semi arid to arid environment at the estuary, the salt lake Gavkhuni.

In order to achieve controlled management of the water resources, a dam with an average inflow of 40 m^3/s was built by a French-Iranian consortium in 1972. For the purpose of covering the increasing water demand, three tunnels were built in 1954 and later in 1985, through which water is being rerouted from the neighbouring province toward the Zayandeh Rud dam. But neither fully control of the Zayandeh Rud dam outflow, nor the additional water transfer from neighboring provinces are capable to solve the water shortage in Isfahan completely.

SUMMARY

CLIENT

- Federal Ministry of Education and Research

FN: 02WM1180

CHALLENGE

- Modelling of water resource systems in an semiarid to arid environment
- Management of water demand and supply
- Quantification of water balances and major water streams
- Providing concepts and solutions for an Integrated Water Resource Management process

SOLUTION

- Development of an Integrated Water Management tool by coupling water management software (MIKE BASIN), the groundwater model (FEFLOW) and the soil water assessment tool (SWAT).
- Development of an IWRM process by involving all relevant stakeholders in the catchment area

VALUE

- Visualization of water supply and demand situation as a base for the IWRM Process with stakeholders
- Decision support for water management

LOCATION/COUNTRY

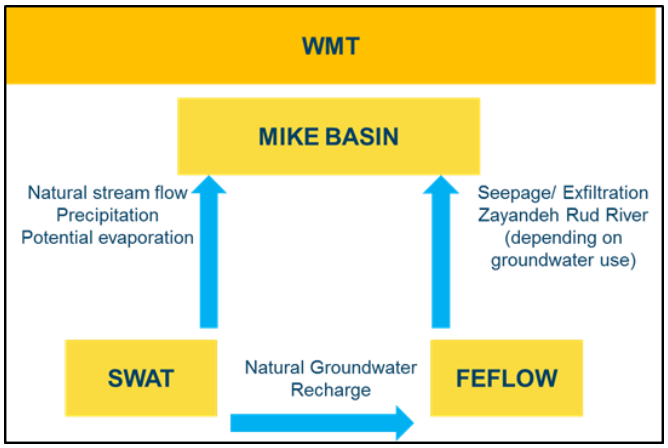
- Isfahan province, Iran

SOFTWARE USED

- MIKE BASIN
- FEFLOW
- SWAT

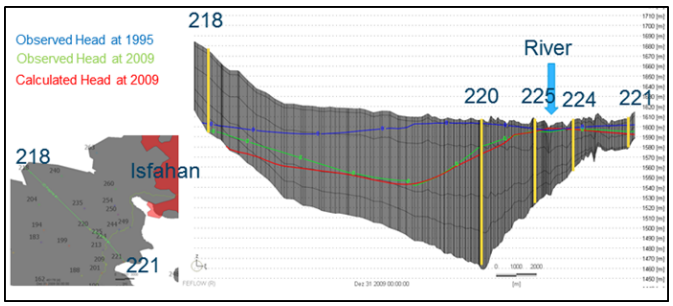
WATER MANAGEMENT TOOL AS A BASIS FOR IWRM

The Water Management Tool consists of three specialized software simulators. SWAT provides natural stream flow and climatically data for MIKE BASIN and natural groundwater recharge for FEFLOW. The groundwater model FEFLOW provides the exchange between surface water and groundwater along the river for MIKE BASIN, which calculates the water demand and its possible supply for all water users.



Structure of the Water Management Tool (WMT), covering the three interacting software tools MIKE BASIN, FEFLOW and SWAT

In addition to data support of MIKE BASIN, the groundwater model FEFLOW is able to model the dynamic groundwater levels in the entire alluvial aquifer in the catchment. Extraction, natural and artificial recharge by irrigation return flow are considered. Also the model can visualize the decrease of groundwater level, which is locally more than 25 m during the last 15 years.



Cross section views through sub catchment 4206 (Najafabad) with observed heads at 1995 and 2009 and calculated heads in 2009; 50 times vertical exaggeration

CAPACITY BUILDING AS PART OF THE IWRM PROCESS

Highly complex coupled modelling of an inhomogeneous catchment system is also an important tool to visualize the problem and to show potentials for counter activity measures. These measures need to find acceptance by local stakeholders and society to finally end up in a change of water use.

In order to guarantee that the IWRM process finally leads to a sustainable water use, even under changing climatic conditions, capacity building by professional training courses for local water experts and managers should be performed frequently.

Local experts should accompany this process as knowledge multiplier spreading the core message among a wide range of water related end users.

Nearly dry river bed of the Zayandeh Rud River in the City of Isfahan - A result of an excessive overuse of water resources

DHI-WASY supports this process with professional software solutions (MIKE BASIN and FEFLOW), international experienced consultants and training courses for a wide range of water related topics.

IWRM PROCESS AS KEY FOR AN SUSTAINABLE WATER MANAGEMENT

The visualization of the water supply and demand situation in time and space provides an excellent base for the ongoing IWRM process. At the end of the first phase, all involved stakeholders confirmed the essential necessity of an sustainable water use in the region and the advantages of the water management tool, even if changes of the actual water supply situation might cause a reduction of their personal water access.

ACKNOWLEGEMENTS

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Federal Ministry of Education and Research

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