DHI CASE STORY

# IMPROVING WATER MANAGEMENT IN NORTH INDIA

## Using a real-time DSS to support sound water management decisions

Throughout the year, the North Indian States are often subjected to both droughts and floods. The Bhakra Beas Management Board (BBMB) in Northern India is in charge of managing both of these. They must also ensure that people living in the North Indian States have enough water to meet their irrigation needs. In order to help BBMB, we developed a Real-Time Decision Support System (RTDSS). Our RTDSS provides BBMB with the latest information available on the state of the water in its catchment and command area. This enables BBMB to improve flood management in the region, while also optimising operations to meet the region's water needs.

### TOO MUCH RAIN, NOT ENOUGH WATER

The Bhakra Beas Management Board (BBMB) manages the operations of two reservoirs in the area – Bhakra and Beas in Northern India. For three states in the region – Punjab, Rajasthan, and Haryana – the monsoon (rainy) season can cause flooding in many areas. In addition, inefficient reservoir operations mean that the massive amount of water that could be collected during the rainy season is lost. As such, this area often struggles with a shortage of water during the dry season.

Normally, the reservoirs are filled during the monsoon period, with the stored water utilised during the non-monsoon period. However, during the years when the monsoons start early, the reservoirs may fill sooner than expected, resulting in little buffer for late monsoon rainfall. If there is heavy rainfall after the reservoirs are full, the flood gates need to be opened, which causes downstream flooding. To avoid this, BBMB starts releasing water from July onwards, often wasting valuable water.

The Bhakra and Beas reservoirs have a combined catchment area of nearly 70,000 $km^2$. The Bhakra reservoir alone meets the irrigation needs of over 40,000 $km^2$. Successfully managing droughts and preventing floods can be a difficult balancing act. As such, BBMB asked us to develop a solution that would help them address this multidimensional problem. Using MIKE 11 and MIKE BASIN, we developed a Real-Time Decision Support System (RTDSS).

## SUMMARY

### CLIENT

Bhakra Beas Management Board (BBMB)

### CHALLENGE

- Inefficient reservoir operation
- Downstream flooding during the rainy season
- Loss of excess water during the monsoons (rainy seasons)
- Water shortage during dry seasons

### SOLUTION

A Real-Time Decision Support System (RTDSS) that provides up-to-date, easily understandable information on the state of water resources

### VALUE

- Increased efficiency of reservoir operations
- Optimised dam operations
- Minimisation of lost water
- Improvement in flood management

### LOCATION

Punjab, Rajasthan, and Haryana, India

## MEETING INDIA'S WATER NEEDS

The first of its kind in India, our RTDSS is an easy-to-use system featuring:

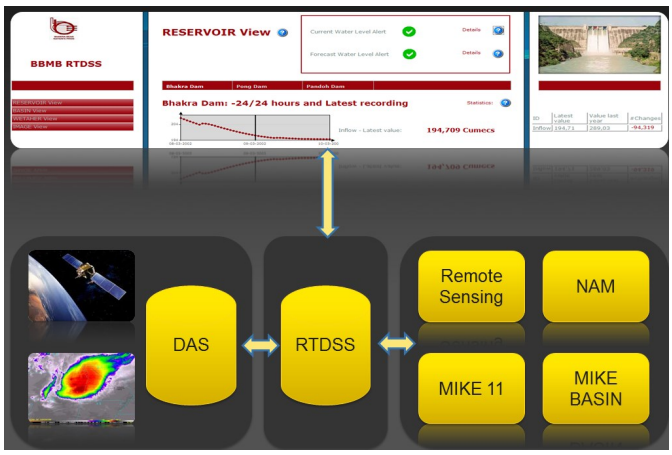
- a state-of-the-art, real-time data acquisition and advanced communication system that monitors the rivers and canals downstream of the state's contact points
- analysis and modelling tools that can predict inflows generated by rainfall up to seven days and snow melt up to three months in advance
- a Decision Support System (DSS) to help improve the reservoirs' operations, power generation and water distribution to partner states

Designed for the Beas and Satluj River Basins, our RTDSS covers the area that runs upstream from the Satluj River in Tibet to the border with Pakistan downstream. Built on our MIKE CUSTOMISED Platform, our RTDSS uses:

- MIKE 11 NAM for rainfall-runoff analysis
- MIKE 11 HD to calculate travel time and to study downstream flooding
- MIKE BASIN for the water allocation, water accounting and reservoir simulation

It gathers the information required for real-time operational management of Bhakra and Beas reservoirs from several sources, including:

- external sources, such as weather forecasts, NASA satellite images and so forth
- flow forecast models
- optimisation tools
- analysis and decision support tools



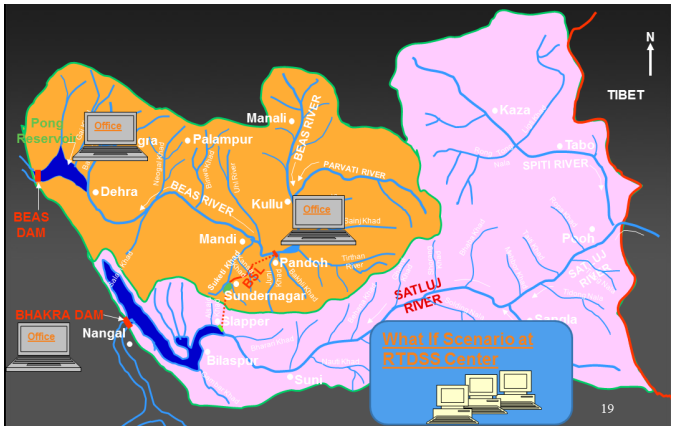

*Schematic diagram showing data flow from sensors to database, models and decision makers.*

Our RTDSS processes the data and provides decision makers with easily understandable information on the state of their water resources. In addition, our RTDSS's hydraulic flood modelling simulates time varying flood maps for a given discharge. This gives BBMB the information needed to issue flood warnings, allowing downstream authorities to prepare accordingly.

## ONE RTDSS, MULTIPLE BENEFITS

Since the rivers under BBMB's management flow through more than one state, there are multiple stakeholders concerned with how the water is used. In Punjab, Haryana and Rajasthan, for example, there are often disagreements about the amount of water they receive from the canals. To help solve this issue, our RTDSS keeps track of water allocated to each state weekly. Using automatic sensors installed in canals in the region, the RTDSS software monitors the flow of water going to each state. It also helps Punjab, Rajasthan and Haryana meet their irrigation needs by optimising reservoir operations.

Our RTDSS enables BBMB to improve flood management, leading to minimised loss of life and property for those living along the rivers. It can also help authorities optimise power generation, encouraging overall development in the region. A flexible system, our RTDSS can be implemented in other Indian states facing similar challenges.




*Map showing data analysis at RTDSS centre. The decisions taken are implemented at Pandoh and Pong Reservoirs (Beas catchment) and Bhakra Reservoir (Satluj catchment).*

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