



DHI CASE STORY

RISK MANAGEMENT SYSTEM FOR TAI LAKE BASIN

Mathematical models and DSS for enhanced management of Tai Lake Basin

The water quality of Tai Lake Basin has been deteriorating every year since the 1980s. At present, Tai Lake is one of the most polluted in PRC. This is mainly a result of organic contamination, which leads eutrophication. Due to the lack of a comprehensive water quality management system, there was no efficient way to manage this pollution problem in Tai Lake Basin. In order to reduce the threat of socio-economic losses and ecological damage due to inefficient management of pollution incidents, the Ministry of Environmental Protection (PRC) approached us to come up with a solution. We developed various mathematical models of the Tai Lake Basin. Based on these models and our Decision Support System (DSS) technology, we also created a water environment risk management system, thereby facilitating better management of the precious resource.

TAI LAKE BASIN – AN AREA OF PROMISE, NOW THREATENED WITH POLLUTION

Tai Lake Basin is located in the Yangtze Delta plain, covering three provinces (Jiangsu, Zhejiang, Anhui) and one municipality (Shanghai). It has a drainage area of 36,895km² and is composed of interlinked rivers, lakes, reservoirs and other water bodies that are spread across the region. Lake Taihu (Tai Lake), spanning a cumulative area of 2,250km² and with an average depth of 2m, is the third largest freshwater lake in PRC. Economically speaking, Tai Lake Basin has one of the highest population densities and one of the most developed economies. However, the unhindered and rapid economic growth has also led to immense pollution issues in the region, with obvious negative impacts.

NEED FOR AN APPROPRIATE WATER QUALITY RISK MANAGEMENT SYSTEM

The PRC government did not have an efficient and comprehensive water quality management system in place to monitor and deal with these pollution issues. Their capability to respond to emergency pollution incidents was also not well defined. This increased the risk of socio-economic losses and ecological damage to the surrounding regions, in case of the occurrence of such pollution incidents.

The Nanjing Institute of Environmental Sciences in the Ministry of Environmental Protection (PRC) voiced a clear need for the establishment of a mathematical model-based risk management system for the Tai Lake area. However, the modelling technology in PRC is still not mature enough for the development of such a full-fledged management system. Also, the system needed to be in place within

SUMMARY

CLIENT

Nanjing Institute of Environmental Sciences,
Ministry of Environmental Protection, PRC

CHALLENGE

- Intensive pollution of the Tai Lake, due to rapid and unhindered economic growth in the region
- Inefficient emergency response capability in the case of pollution incidents
- Increased risk of socio-economic losses and ecological damage, in case of such incidents
- Need for a comprehensive water environment risk management system in order to manage the Tai Lake Basin better

SOLUTION

- Mathematical models of Tai Lake Basin, describing the hydrologic, hydrodynamic, water quality and eutrophication processes of the river network and adjacent lake area
- Integrated water environment management system based on these mathematical models and Decision Support System (DSS) technology

VALUE

- Enhanced water management capacity of the Tai Lake Basin
- Reduced risk of pollution incidents, socio-economic losses and environmental damage

LOCATION / COUNTRY

People's Republic of China (PRC)

three to five years. This was compounded by the problem of limited funding for the project, due to which enough money was not available for investing in immature modelling services.

In light of all these issues, the client turned to us for our vast modelling expertise, our hold on modelling technology and our global knowledge and experience in the same.

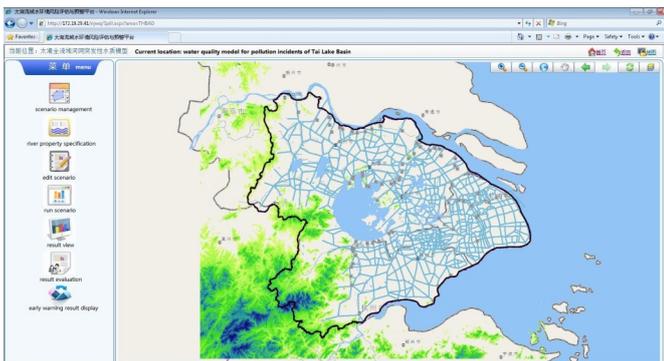


Blue-green algae gathered in Tai Lake at Wuxi, China's Jiangsu Province (11 June 2005).

ESTABLISHING A WATER QUALITY RISK MANAGEMENT SYTEM FOR TAI LAKE BASIN

To begin with, we developed mathematical models of the Tai Lake Basin. These models describe the hydrologic, hydrodynamic and water quality process of the river network and its surrounding lake area. Based on these models and our DSS technology, we also created a water environment risk management system. This system is full-featured and user friendly. It integrates a series of mathematical models. These include models concerning:

- rainfall-runoff
- hydrodynamics
- water quality
- eutrophication
- oil spill



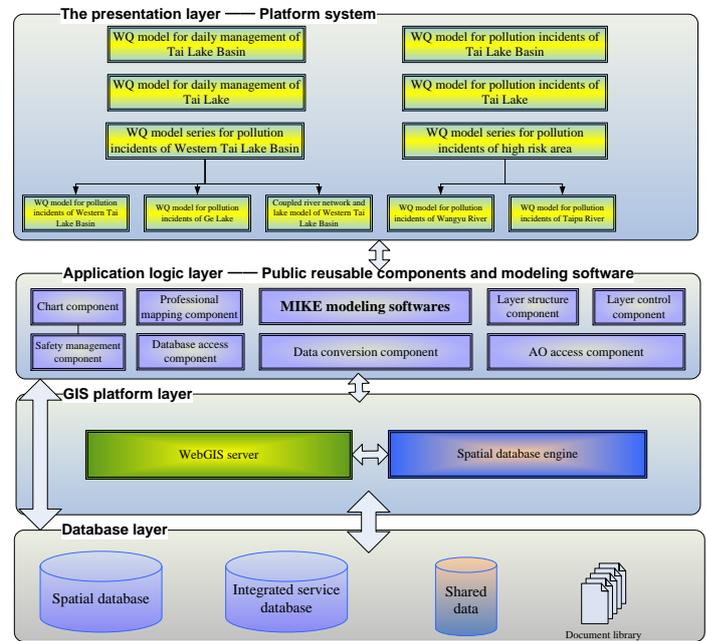
The user interface of Tai Lake Basin Water Quality Management System

Moreover, this system can be used for the management of the whole basin or some key research areas, as and when required.

We mainly used our MIKE 11 software to simulate one-dimensional river network and the water quality condition within Tai Lake Basin. Meanwhile, the MIKE 21 software was used to simulate two-dimensional Tai Lake and its surrounding lake area. We provided accumulative batch of services. These included data analysis, modelling, calibration and validation. We also developed a DSS based on the user's need. This included modules related to:

- database
- data exchange
- Geographic Information System (GIS)
- incident prediction and emergency management
- information system

Based on customer requirements, we confirmed the software and modules which needed to be purchased. Following that, we visited the site and collected the requisite data. Once the data were carefully analysed, the modelling area and method were decided. Instead of a single model, we set up a large model library, consisting of a series of MIKE 11 and MIKE 21 models. Once the models were calibrated and validated, the results were aligned to those expected. In order to meet the final target of a comprehensive water quality risk management system, we conducted intensive research and system developmental work, helping to set the much-needed system in place.



The structure of Tai Lake Basin Water Quality Management System

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