NMCG Empowered to Clean River Ganga and Its Tributaries with PRAYAG using ArcGIS

Client
National Mission for Clean Ganga (NMCG), Ministry of Jal Shakti

Industry
Water Resources

Organization Profile
The Namami Gange program was launched in 2014-15 to integrate previous and currently ongoing initiatives in a holistic manner with a basin approach. It was approved as a Central Sector Scheme in 2015 and includes a diverse set of interventions such as pollution abatement measures to tackle different sources of pollution such as municipal sewage, industrial effluents, municipal solid waste, non-point sources of pollution, and interventions for improving ecological flows, biodiversity conservation, afforestation, improving amenities and sanitation at riverbanks, capacity building, research & monitoring, public awareness. To speed up and scale up the interventions required for Ganga Rejuvenation through the Namami Gange mission, the Government decided to bring in a long-term perspective with a proper institutional framework, and the National Mission for Clean Ganga (NMCG) was notified as an Authority under The Environment Protection Act on 7th October 2016 empowering it with regulatory powers along with administrative strengthening and delegating higher financial and administrative powers.

Website
www.nmcg.nic.in

Project
GIS-based Water Quality Management System

Highlights
- ArcGIS provides powerful tools for visualizing complex geospatial data.
- ArcGIS supports real-time data integration, enabling monitoring of key parameters of the Ganga River in realtime.
- ArcGIS facilitates increased collaboration and communication among stakeholders.

Project Summary
Namami Gange is running PRAYAG (Platform for Real-time Analysis of Yamuna, Ganga & their Tributaries) for Monitoring, review, and accountability measures. PRAYAG is a collaborative Platform to access Information, Data Maps, Apps & Dashboards for Ganga Basin. The significance of PRAYAG had brought a paradigm shift in the visualization of all crucial spatial and non-spatial information of Ganga basin to adopt accurate & transparent decisions.

The various interventions under Namami Gange have resulted in significant improvements in the water quality of river Ganga. As a result of multi-sectoral interventions, the comparison of median data of water quality parameters viz. Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD) and Fecal Coliforms (FC) of years 2014 and 2023 (Jan to Sept), DO median has improved at 32 locations, BOD median has improved at 43 locations and the FC median has improved at 25 locations respectively. The stretch of River Ganga from origin up till Haridwar has reached Class A, i.e. highest standard of water quality. Based on the water quality assessment by CPCB in 5 Ganga main stem states in 2023 (January to September), the observed water quality indicates that the median value of Dissolved Oxygen which is an indicator of river health has been found to be above the minimum acceptable limits notified for primary bathing water quality criteria and satisfactory to support the ecosystem of river for almost entire stretch of River Ganga. The median value of Biochemical Oxygen Demand (BOD) has been found less than the maximum acceptable limits of 3mg/L except a marginal exceedance (BOD: 3.2 to 4.5 mg/L) in 2 locations.

The GIS-based Web Centric Water Quality dashboard helps in visualizing the status of River Ganga Water Quality by means of "Monitoring Station wise Water quality Indicator" dashboard. It shows the water quality as reported through monitoring stations at various locations along the river Ganga. This dashboard, as its first phase; is an attempt to create a web-centric GIS-based scientific Water Quality Application by using 7 years' data (2014 to 2021) with 4 parameters DO, BOD, FC, and pH. The data from seven years were processed in a percentile-based method (90, 50 and 10 Percentile) and compliance criteria applied for individual parameters separately. The data can be filtered on the basis of States, Districts, Monitoring Stations, Station Codes, Years, etc. The portal allows users to extrapolate and make sense of trends to better identify decisions in "Nirmal Ganga".

Challenges
Before adopting Esri's technology for water quality monitoring by the National Mission for Clean Ganga (NMCG), several challenges were encountered in decision-making. These challenges include:

Data Integration: Consolidating diverse datasets from various sources and formats to create a unified and comprehensive water quality database can be a significant challenge.

Spatial Variability: Water quality parameters can vary spatially, and capturing this variability accurately requires sophisticated spatial analysis tools to ensure reliable monitoring results.

Real-time Monitoring: Implementing real-time monitoring systems for water quality can be complex, requiring robust infrastructure and technologies to collect, process, and analyze data in near real-time.

Data Accuracy and Precision: Ensuring the accuracy and precision of collected data is crucial. Challenges may arise from the reliability of monitoring equipment, calibration procedures, and the need for standardized measurement protocols.

Capacity Building: Adequate training and skill development are essential for personnel involved in water quality monitoring decision-making using the dashboard & app.

Organizational Collaboration: Coordinating efforts and data sharing among various stakeholders, including government agencies, NGOs, and local communities, is crucial for a holistic approach to water quality management.

Infrastructure and Connectivity: Remote or inaccessible areas may lack the necessary infrastructure and connectivity for seamless data transmission, posing challenges in integrating data from these regions into a centralized monitoring system.

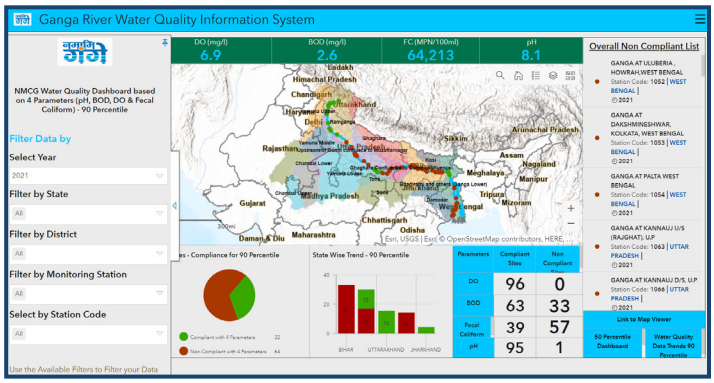
Policy and Regulatory Framework: Aligning water quality monitoring practices with existing policies and regulations can be challenging. Ensuring that the monitoring system adheres to regulatory standards is essential for meaningful data interpretation. Esri's technology can enhance the efficiency and effectiveness of water quality monitoring efforts by NMCG, providing a robust platform for data visualization, analysis, and informed decision-making.

Solution & Benefits

Esri is known for its Geographic Information System (GIS) solutions, which can be applied to various domains, including environmental management. In the context of NMCG, GIS technology could potentially be utilized for spatial analysis, data visualization, and decision support to address challenges related to the Ganga River rejuvenation.

The GIS system allows NMCG to assess the current state of the Ganga River, identify pollution sources, and plan effective conservation strategies. It helps in:

Data Visualization: ArcGIS provides powerful tools for visualizing complex geospatial data. NMCG can use these capabilities to create interactive maps, dashboards, and other visualizations that make it easier to communicate information and insights to stakeholders.



Ganga River Water System Quality Information

Real-time Monitoring: ArcGIS supports real-time data integration, enabling NMCG to monitor key parameters of the Ganga River in real-time. This can help in the early detection of pollution events, enabling prompt response measures.

Collaboration and Communication: ArcGIS Online facilitates collaboration among different stakeholders by providing a cloud-based platform for sharing maps, data, and analyses. This can enhance communication and coordination among NMCG, government agencies, and other partners involved in Ganga River conservation.

Mobile Data Collection: With ArcGIS mobile applications, field teams can collect and update data in the field using mobile devices. This can streamline data collection processes for monitoring water quality, biodiversity, and other environmental factors along the Ganga River.

Decision Support: The analytical capabilities of ArcGIS assist NMCG in making informed decisions. By integrating various datasets, the system can help identify priority areas for intervention, assess the impact of different conservation measures, and optimize resource allocation.

Scalability: ArcGIS solutions can scale to accommodate the varying needs of NMCG. Whether it's a small-scale pilot project or a large-scale regional initiative, the flexibility of ArcGIS can support the scaling of geospatial applications.

Compliance and Reporting: ArcGIS can assist NMCG in meeting regulatory requirements and reporting standards by providing a platform for managing and analyzing environmental data, which is crucial for compliance monitoring and reporting.

> "Esri's Manual & Real Time water Quality Information dashboard, which is embedded in "PRAYAG" had brought a paradigm shift in the visualization of all crucial spatial and non-spatial water quality related information of Ganga basin to adopt accurate and transparent decisions in Namami Gange flagship program."
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> **– Mr. Peeyush Gupta, Real Time Information Specialist, National Mission for Clean Ganga, Ministry of Jal Shakti**