



## 1. Project Data

<b>Project ID</b> P152698	<b>Project Name</b> National Hydrology Project	
<b>Country</b> India	<b>Practice Area(Lead)</b> Water	
<b>L/C/TF Number(s)</b> IBRD-87250	<b>Closing Date (Original)</b> 31-Mar-2025	<b>Total Project Cost (USD)</b> 134,257,370.96
<b>Bank Approval Date</b> 15-Mar-2017	<b>Closing Date (Actual)</b> 31-Mar-2025	
	<b>IBRD/IDA (USD)</b>	<b>Grants (USD)</b>
Original Commitment	175,000,000.00	0.00
Revised Commitment	134,257,370.96	0.00
Actual	134,257,370.96	0.00

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## 2. Project Objectives and Components

### a. Objectives

The Project Development Objective (PDO) of India's National Hydrology Project (NHP) as articulated in the Financing Agreement (FA, page ) was identical to the one stated in the Project Appraisal Document (PAD, paragraph 21) and aimed to:

***"Improve the extent, quality and accessibility of water resources information and to strengthen the capacity of targeted water resources management institutions in India."***



**Parsing the PDO.** The PDO will be parsed based on the following two Objectives:

1. To improve extent, quality, and accessibility of water resources information in India.
2. To strengthen the capacity of targeted water resources management institutions in India.

**b. Were the project objectives/key associated outcome targets revised during implementation?**

No

**c. Will a split evaluation be undertaken?**

No

**d. Components**

The PDO was supported by the following four components:

**1. Water Resources Monitoring Systems (appraisal estimate: US\$150 million of which US\$75m from IBRD, actual cost: US\$141.50 million of which US\$74.90 million from IBRD).** This component focused on expanding and modernizing hydrological and meteorological monitoring networks. Financing aimed to support the establishment and upgrading of data acquisition systems for meteorology, streamflow, groundwater, water quality, and water storage from manual to real-time. These networks would include automated, real-time sensors, a telemetry system for data transmission (through satellite or cellular based technology), and laboratory equipment. Supervisory Control and Data Acquisition (SCADA) systems were planned for installation at key infrastructure locations including dams, reservoirs, canals, and groundwater systems, enabling real-time monitoring and remote operation of gates and flows during normal and emergency conditions such as floods. The component also supported the establishment or upgrading of hydro-informatics centers and water quality labs at state and national levels as data hubs with information technology (IT) infrastructure, software, servers including cloud services, and facilities for digitizing historical hydrological records.

**2. Water Resources Information Systems (WRIS) (appraisal estimate: US\$50.00 million of which US\$25.00 from IBRD, actual cost: US\$42.90 million of which US\$22.70 million from IBRD).** This component enhanced both national and regional WRIS platforms by integrating and standardizing water data across various agencies and departments, comprehensive and timely information on water available to planners, managers, and the public. The India-WRIS, hosted by the National Water Informatics Center (NWIC), was to be strengthened through improved inter-operability with real-time data systems, remote sensing inputs, and national-level datasets from institutions such as the Indian Meteorological Department (IMD) and the Survey of India (SOI).<sup>5</sup> State and basin platforms were planned to enable seamless data exchange among riparian states and central agencies, supporting sectors like disaster management, agriculture, and rural water supply. An information-sharing protocol was to be established to define open-access versus restricted data, ensuring secure and transparent dissemination of information.

**3. Water Resources Operations and Planning Systems (appraisal estimate: US\$66 million of which US\$33.00 from IBRD, actual cost: US\$19.20 million of which US\$10.20 million from IBRD).** This component supported the development of modeling tools for real time flood forecasting, reservoir operations, irrigation management, river basin water accounting, and coastal and groundwater management. These tools were to be developed in coordination with the Central Water Commission (CWC)



and integrated hydrological and meteorological data with remote sensing and seasonal forecasts to improve planning and preparedness under national programs such as Pradhan Mantri Krishi Sinchayee Yojana and the National Groundwater Management Improvement Program (NGMIP). Applications would include optimizing reservoir operations, aligning irrigation water deliveries with crop requirements, and guiding decision making on groundwater depletion, sedimentation and water quality.

**4. Institutional Capacity Enhancement (appraisal estimate: US\$83.56 million of which US\$41.56 from IBRD, actual cost: US\$49.90 million of which US\$26.40 million from IBRD).** This component strengthened institutions through new centers of excellence, including flood forecasting at CWC and a Groundwater Modeling Center at the Central Ground Water Board (CGWB). Planned professional development activities included training in disciplines such as hydrology, modeling, and basin planning. The project aimed to emphasize capacity building for permanent staff of IAs by promoting interagency knowledge exchange through communities of practice and outreach. Public awareness activities and hackathons were also planned to promote water literacy and innovation. This component also supported the project management structures at national, river basin, and state levels through the establishment of a Project Management Unit (PMU), as well as finance operational costs such as staffing, travel, office space, and communication activities.

**e. Comments on Project Cost, Financing, Borrower Contribution, and Dates**

**Project Cost.** The total project cost at appraisal was estimated at US\$350.00 million (PAD, Table 1). The actual cost based on the numbers reported in the ICR Data Sheet (page ii) was US\$279.26 million. The difference stemmed from a cancellation of a total of US\$30.00 million from the IBRD loan, expiration of US\$10.74 million from the IBRD loan, and lower counterpart funding (see below for details).

**Financing.** The project was financed through an IBRD loan worth US\$175.00 million. The actual amount disbursed was US\$134.26 million. A loan cancellation of US\$15.00 million was processed as part of the first restructuring to account for actual and anticipated savings from exchange rate fluctuation and procurement improvements, reducing the IBRD loan amount from US\$175.00 million to US\$160.00 million. Additionally, a second loan cancellation of US\$15.00 million was processed as part of the second restructuring prior to closure to account for further cost savings from exchange rate gains and procurement efficiencies, reducing the overall IBRD loan amount to US\$145.00 million (ICR, paragraphs 10 and 11). According to the ICR (footnote#9) US\$10.74 million of the IBRD loan expired and were not disbursed.

**Borrower Contribution.** The borrower was expected to contribute US\$175.00 million of counterpart funding. The actual amount disbursed was US\$145.00 million.

**Dates.** The project was approved on March 15, 2017 and became effective two months later on May 5, 2017. The project closed on its expected closing date on March 31, 2025. The project was restructured twice, both of which Level 2 restructuring as follows:

1. On August 31, 2021, when the amount disbursed was US\$36.08 million, in order to process a partial cancellation of US\$15.00 million of the IBRD loan, revise components and results, adjust disbursement estimates, and reallocate funds between disbursement categories.



2. On March 27, 2025, when the amount disbursed was US\$118.84 million, in order to process a partial cancellation of US\$15.00 million of the IBRD loan, revise disbursement estimates, and reallocate funds between disbursement categories.

### 3. Relevance of Objectives

#### Rationale

**Context at Appraisal.** India continues to be subject to climate extremes with 68% of its land area drought-prone and 12% vulnerable to floods. Rainfall and river flows were highly seasonal and unevenly distributed. Climate change was expected to worsen such impacts with estimates indicating potential losses of up to three percent of projected GDP. Rising economic activity and population growth were projected to double water demand by 2050, with significant increases projected in the industrial and domestic sectors. This growing pressure on water systems underscored the urgent need for well-informed and coordinated water resources planning and management. This project (NHP) aimed to strengthen flood forecasting, reservoir operations, and basin planning while complementing parallel World Bank-supported initiatives such as Dam Rehabilitation and Improvement Project (DRIP, P170873) and National Groundwater Management Improvement Program (NGMIP; P158119). Together, these aimed to improve institutional capacity and advance integrated water governance at national and state levels.

**Previous World Bank (WB) Experience.** The WB has engaged the irrigation and agriculture sectors in India through several projects. Of relevance to the NHP were the Dam Rehabilitation and Improvement Project (DRIP, P170873) and National Groundwater Management Improvement Program (NGMIP; P158119). Also, through WB support, India advanced Water Resource Management through Hydrology Projects Phase 1 (HP-I; 1995-2003) and Phase 2 (HP-II; 2006-2014). Overall, the WB housed relevant expertise, knowledge, and on the ground experience to design and oversee the implementation of NHP.

**Consistency with WB Strategies.** At appraisal, the PDO was in line with WB Country Partnership Strategy for India (CPS, FY2013–FY2017). Specifically, the NHP would contribute directly to the CPS objective of managing disaster risks by scaling up advanced flood management systems for early warning and improved reservoir operation, as well as enhancing river basin planning that would help identify both flood and drought risks and mitigation measures.

At completion, the PDO continued to be in line with the WB Country Partnership Framework for India (CPF, FY2018–FY2022, which was extended to FY2025 through a Performance and Learning Review in 2023). Specifically, the NHP contributed to CPF Focus Area 3: Enhancing Resilience through strengthening institutions that need reliable meteorological and hydrological data for disaster risk management, improving water security, and supporting climate-resilient infrastructure and planning systems. Also, investments in hydrometeorological data systems, water resources modeling, and decision support platforms supported cross-cutting CPF priorities on digital technologies for service delivery, enhancing transparency, and improving federal-state coordination in service provision. In a further communication, the project team explained that relevance of objectives was further emphasized "by the inclusion of improved water resources management under two outcome areas in the new India CPF (FY2026-FY2031)"

**Consistency with the Government Strategies/Priorities.** At appraisal, the PDO was in line with India's 12th Five-Year Plan (2012–2017), which called for Integrated Water Resources Management



(IWRM), improved data access, and nonstructural approaches to flood management and aquifer mapping. The project also supported the National Hydrometeorological Data Dissemination Policy (2013), which promoted open access to unclassified data, and contributed to the goals of the Digital India Initiative that sought to electronically connect government departments and citizens for effective governance.

At completion, the PDO continued to be in line with the government priorities reflected under India's government priorities under the 12th and 13th Five-Year Plans. The NHP supported flagship programs such as Digital India and Jal Shakti Abhiyan. The project also expanded monitoring networks, digitizing hydrological records, and strengthening institutional capacity through targeted training.

**Summary of Relevance of PDO Assessment.** The PDO statement was clear, focused and pitched at higher level of ambition given the extensive coverage of the project across 48 implementing agencies. That said, the PDO ensured an adequate balance of ambition and pragmatism as NHP sought to promote state-of-the-art hydrometeorological systems combined with institutional strengthening nationwide. At completion, the PDO continued to be in line with the WB CPF and with the Government priorities as noted above. In a further communication, the project team explained that the "PDO's foundational focus was on improving water resources information and institutional capacity rather than full basin planning within one cycle."

Therefore, Relevance of Objectives is rated Substantial.

## Rating

Substantial

## 4. Achievement of Objectives (Efficacy)

### OBJECTIVE 1

#### Objective

To improve extent, quality, and accessibility of water resources information in India.

#### Rationale

**Theory of Change (ToC).** To achieve the outcome of improving the extent, quality, and accessibility of water resources information in India, the project supported the establishment/modernization of water resources monitoring systems and hydro-informatics centers, and strengthen national and sub-national water information centers with web-enabled water resources information systems. The successful implementation of these activities were expected to result in the following outputs: increase in the number of monitoring systems and hydro-informatics centers established/modernized, and an increase in the number of web-enabled water resources information systems strengthened. These outputs were expected to directly contribute to the stated outcome of improving the extent, quality, and accessibility of water resources information in India. The stated activities were relevant and directly connected to the outputs and outcome in a plausible causal chain. It was expected that the successful implementation of the project activities would contribute to the achievement of



the stated outcome. This would also contribute to the long-term outcome of improved water resources management at the basin level in India.

The achievement of this objective was underpinned by the following critical assumptions: 1. A capable local supply market; 2. Continuous uninterrupted data provision; and 3. Institutionalized use of developed data systems for decision making by end users. These assumptions were logical and realistic.

### **Outputs/Intermediate Results**

- 25 water data centers were functioning satisfactorily exceeding the target of 20, no baseline provided (target exceeded). These data centers were equipped with infrastructure and manpower for data processing and integration with centralized system.
- 119,746 water resources monitoring stations along with historical data standardized and integrated with the national platform exceeding the target of 70,000, no baseline provided (target exceeded). The ICR (Annex 1) explained that this included monitoring stations historical, newly funded under NHP and non NHP resources. All the stations with temporal data would be considered and may include all water related parameters such as meteorology, river, reservoir, canal, groundwater and water quality. The project specifically supported the installation of 1,600 surface water stations exceeding the target of 1,560, 8,550 groundwater stations exceeding the target of 4,690, and 2,440 meteorology stations exceeding the target of 1,380 (targets exceeded).
- 1,037k page views to access the information at WRIS were recorded exceeding the target of 900k and a baseline of 400k (target exceeded).
- 64% of WRIS users were satisfied with the services exceeding the target of 50% (target exceeded).
- 15 new water quality labs were completed and 26 mobile water quality vans were commissioned (no targets provided).
- Notable achievements not captured directly by the Results Framework (RF) included: real-time monitoring of water availability in 600 major/medium reservoirs and storage capacity assessment through bathymetric surveys accounting for over 50% of nationwide reservoir storage capacity, real time monitoring of irrigation water supply in eight states, a national Evapotranspiration (ET)-based benchmarking tool for 2,500 irrigation systems, and flood forecasting systems in 10 major basins, and establishing State Water Informatic Centers (SWICs) in 22 states, SWICs play a key role in integrating sub-national WRIS platforms with the national system.

### **Outcomes**

The ICR (paragraph 12) explained that "PDO indicator baselines were set to zero with end targets adjusted to incremental numbers after subtracting the initial baseline numbers."

- 12,540 water resources monitoring stations were operated by implementing agencies providing validated data online exceeding the end target of 7,630 (target exceeded). This indicator measures the incremental number of stations providing accurate data. Online data will be at the centralized data center at the state or central levels. This included Real-time data acquisition system (RTDAS) funded by NHP for both new and systems continued with O&M.
- 50 Information products were produced under the project and made available to the relevant stakeholders exceeding the end target of 45 (target exceeded). At the national level, products included Real time reservoir information system; Moisture status; and Satellite based surface water



body assessment system. At the state level flood forecasting system in BBMB was revamped at HECRTS.

**Summary of Efficacy Assessment.** This objective was expected to be achieved through phased activities of monitoring network expansion (extent), telemetry and data validation (quality), and online dissemination via public platforms (accessibility). The reported evidence in the ICR and noted above suggest that the extent and quality of water resources information was advanced through the number of water resources monitoring stations providing validated, real-time data online (12, 540 stations exceeding the target of 7,630). Also, a total of 50 information products were produced and made available to relevant stakeholders, exceeding the target of 45. The project exceeded all its targets for its intermediate outcome indicators (IRIs) as well as for its two PDO outcome indicators. The evidence reported in the ICR is assessed to be valid and points to the success of the project in achieving its objective.

Therefore, the efficacy of the project in achieving this objective is rated High based on the over achievement of all targets for IRIs and PDO outcome indicators.

**Rating**  
High

## **OBJECTIVE 2**

### **Objective**

To strengthen the capacity of targeted water resources management institutions in India.

### **Rationale**

**Theory of Change (ToC).** The achievement of this outcome benefits from the project activities supported under Objective 1. To achieve this outcome, the project supported building institutional capacity for knowledge-based water resource management. This aimed to achieve the following output: strengthened products and institutions for improved operation, planning and management of surface and groundwater resources. The successful implementation of the project activities were expected to directly contribute to achieving the outcome of strengthening the capacity of targeted water resources management institutions in India. The stated activities were relevant and directly connected to the output and outcome in a plausible causal chain. The successful outcome if the project would also contribute to the long-term outcome of improved water resources management at the basin level in India.

The achievement of this objective was underpinned by the following critical assumption: 1. Trained force retention and successful adoption of standardized products; and 2. Institutionalized use of developed data systems for decision making by end users. These assumptions were logical and realistic.

### **Outputs/Intermediate Results**

- 17 water resources applications were developed exceeding the end target of 15 (target exceeded). This indicator measures the number of applications developed for various systems. The ICR (annex 1) explained that "a system might refer to a river basin or irrigation systems or similar areas. The application that was customized by agencies for their use might include river basin water budget,



water availability; irrigation performance monitoring systems working on a regular basis; and basin wise sediment transport modeling."

- 10 advanced flood forecasting systems were developed for river basins exceeding the end target of 7 (target exceeded). This indicator measured number of river basins equipped with advanced flood forecasting systems including Extended Hydrological Predictions, Flood Early Warning Systems and Integrated Reservoir Operations.
- 2,340 targeted professionals received structured training exceeding the target of 2,000 (target exceeded).
- 22 State Water Informatics Centers were established (no target provided).
- 107 major Water Management Studies and 28 Purpose Driven Studies were completed (no target provided).
- 53 SCADA systems, with 24 integrated in the Water Information Management System were commissioned under the project (no target provided).
- 684 national, 57 international, and 445 internal capacity building activities were executed across trainings and workshops (no target provided)
- 400 reservoirs accounting for about half of India's total gross storage had their capacity assessed via bathymetric\* surveys (no target provided). \*The science of measuring water depth and mapping underwater terrain.
- The project introduced Introduction Continuously Operating Reference Stations (CORS) and GEOID models and increased use of Light Detection and Ranging (LiDAR) for improved 3-D surveys across the country (essential for accurate elevation models and flood inundation mapping and forecasting).
- Notable achievements not directly captured by the RF included: 1. The creation of a national digital water backbone through real-time hydrological monitoring, WRIS platforms, and advanced tools developed by central technical agencies; 2. In agriculture and irrigation, decision-support systems and automation improved yields, reduced costs, and increased irrigation efficiency in states such as Andhra Pradesh, West Bengal, and Madhya Pradesh; 3. Disaster risk management also benefitted from real-time forecasting and flood preparation across India; and 4. Environmental and ecosystem management advanced through integrated coastal assessment in Goa and spring mapping in Hilly regions, including Uttarakhand, Sikkim, and Meghalaya.

## Outcomes

- By project completion, 22 water Resources Institutions achieved benchmark performance levels exceeding the end target of 15 (target exceeded). Water resources institutions would refer to central- and state-level water resources departments including irrigation, groundwater, water resources department training centers, and concerned societies. Benchmark performance level meant a score of 50% or more on predefined benchmark standards which included: (a) Institutional setup (50%) with required setup for developing analytical products and core staff in place; (b) Arrangements to collaborate in WRIS and provide services (50%) including reports on flood forecasting, river basin assessment, collaboration and information exchange with other institutes, ease of accessibility to tools and applications developed under the project.

**Summary of Efficacy Assessment.** The project supported the deployment of real-time data systems, advanced analytics platforms, and decision support tools, complemented by extensive training and capacity-building efforts. The project also supported equipping relevant agencies with the tools, systems, and skills needed for modern, data-driven water management. This contributed to strengthening institutional



performance and readiness across India's water sector. As a result, agencies shifted from reactive to proactive management practices, with improved reservoir operations during extreme events, enhanced interdepartmental coordination, timely access to digital data, increased quantity and quality of data and increased public trust through greater transparency. These results were evidenced by the over achievement of the end targets of four IRIs and the PDO outcome indicator as noted above. Further, the ICR (paragraph 21) noted that "agencies not only adopted modern tools but embedded them into routine workflows, supported by policy and organizational reforms in several states."

Therefore, the efficacy of the project in achieving this objective is rated High based on the over achievement of all targets for IRIs and the PDO outcome indicators.

**Rating**  
High

## **OVERALL EFFICACY**

### **Rationale**

**Overall Efficacy is rated High.** For both Objectives, the project over achieved its end targets for all three PDO outcome indicators. The project successfully catalyzed the digital transformation of India's hydrological data systems, institutionalized new models for state-level informatics centers, and delivered operational tools used in flood forecasting, reservoir operations, and groundwater planning. The achieved results reflected a transformative improvements in India's water data infrastructure and institutional readiness. This was expected to enable a shift toward more transparent, evidence-based, and climate-resilient water governance.

### **Overall Efficacy Rating**

High

## **5. Efficiency**

### **Economic and Financial Analysis (EFA)**

#### ***Ex-ante***

- An incremental benefit-cost analysis (BCA) estimated the economic internal rate of return of the project at 34.8%. The net present value (NPV) was estimated at US\$834 million at a discount rate of 12%.
- The EFA analysis used a modified version of the sectoral approach and combined historical data and expert opinion to estimate economic benefits. It captured two main potential benefits of the NHP, which were (a) the benefits of reduced damages from flooding and (b) the benefits of better (dynamic and modeling-based) reservoir management, which was expected to result in greater hydropower generation,



enhanced canal water releases for irrigation, increased drinking water supplies, and improved water supply for industrial production.

- Sensitivity analysis found that if there were cost overruns, or the main outcomes were underachieved, the project would still be viable: a 20% percent increase in costs and a 20% reduction in benefits would only reduce the economic internal rate of return to 27%.

**Ex-post**

- The *ex-post* analysis largely followed the same methodology developed at appraisal to ensure consistency and comparability. At completion, the Internal Rate of Return (IRR) of the project was estimated at 27.6% compared to 34.8% at appraisal. The Net Present Value (NPV) was estimated at US\$374 million (in 2016 prices) at a discount rate of 12% and the corresponding Benefit-Cost Ratio (BCR) at project completion was estimated to be 2.54. The ICR (paragraph 25) attributed the lower IRR at completion compared to the one at appraisal due to more conservative assumptions used in the *ex-post* analysis.
- Sensitivity analysis confirmed robust returns as even with a 50% decline in benefits the IRR was 16% and the NPV remains positive indicating continued economic viability.

**Implementation and Administrative Efficiency.** The project closed on its expected closing date set at appraisal. The project experienced challenges in Financial Management (FM) and administrative processes. FM challenges related to staffing, and procurement challenges resulted in disbursement delays, averaging 75 days. Also, there were delays in fund release from the center to Implementing Agencies (IAs). The ICR (paragraph 26) noted that overtime implementation efficiency improved. While the COVID-19 pandemic caused disruptions, almost all project activities were fully completed by the original loan closing date. The successful implementation of a large, technically complex, and geographically dispersed program involving 48 IAs reflected commendable efficiency in resource use.

**Summary of Efficiency Assessment.** While the IRR at completion was lower than the one estimated at appraisal (27.6% compared to 34.8%), it was still significantly above the discount rate at 12%. Also, at completion the project had a favorable Benefit-Cost Ratio (BCR) at 2.54 (no BCR was estimated at appraisal). Lastly, all project activities were completed by the original loan closing date without cost overruns despite that NHP was a large, technically complex, and geographically dispersed program with 48 IAs. This strongly suggests that the project was efficient in resource use.

Therefore, the Efficiency of the project is rated Substantial.

**Efficiency Rating**

Substantial

a. If available, enter the Economic Rate of Return (ERR) and/or Financial Rate of Return (FRR) at appraisal and the re-estimated value at evaluation:

Rate Available?	Point value (%)	*Coverage/Scope (%)
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Appraisal	✓	34.80	0 <input checked="" type="checkbox"/> Not Applicable
ICR Estimate	✓	27.60	0 <input type="checkbox"/> Not Applicable

\* Refers to percent of total project cost for which ERR/FRR was calculated.

## 6. Outcome

Relevance of Objectives was rated Substantial. Overall Efficacy was rated High. For both Objectives, the project over achieved its end targets for all three PDO outcome indicators. The project successfully catalyzed the digital transformation of India’s hydrological data systems, institutionalized new models for state-level informatics centers, and delivered operational tools now used in flood forecasting, reservoir operations, and groundwater planning. Efficiency was rated Substantial. While the IRR at completion was lower than the one estimated at appraisal (27.6% compared to 34.8%), it was still significantly above the discount rate at 12%.

Based on the assigned ratings for the three outcome criteria (i.e. Relevance of Objectives, Efficacy, and Efficiency), the Outcome of the project is rated Satisfactory.

### a. Outcome Rating

Satisfactory

## 7. Risk to Development Outcome

The following risks could potentially impact the Development Outcome:

**1. Institutional risk.** This risk relates to the institutional ownership of the project achievements. The project achieved strong institutional ownership, particularly at the central level, and successfully embedded data systems, dashboards, and hydrology tools into national platforms such as Water Information Management System (database management system) and India WRIS (for data dissemination through a web enabled GIS platform). Several states have institutionalized hydrology functions and continue to use the systems developed under the project, with evidence of scale-up through other programs.

**2. Financial risk.** This risk relates to the availability of adequate levels of budgetary allocations to sustain the project achievements. The project established strong institutional mechanisms and digital platforms, but their continuity will require continued funding, particularly for Real-time data acquisition system (RTDAS) operations and contract staff at State Water Informatics Centers and hydro-informatics centers. While most agencies have government staff and budget provisions, reliance on outsourced IT teams and pending approvals in some states pose risks of disruption. Existing O&M contracts are expected to cover the next 3–5 years, and several states have already committed resources to expand these systems, but long-term sustainability will depend on governments fully internalizing O&M within their budget cycles.

**3. Technical risk.** This risk relates to the ability of the local expertise to keep the data systems established under the project operational. NHP’s digital infrastructure requires regular upgrades to remain effective.



Some platforms still face challenges in interoperability, cybersecurity, and integration with newer technologies such as AI-driven forecasting and remote sensing. The National Water Informatics Center (NWIC) has developed data-sharing protocols and is developing a national digital governance framework. Further efforts are needed to institutionalize a comprehensive digital sustainability strategy such as clear guidance on procurement, data standards, and vendor management. Sustaining data sharing and transparency will also require consistent institutional incentives and oversight. Without continued central coordination by NWIC, risks of data fragmentation and lapses in data quality may re-emerge.

**4. Environmental risk.** This risk relates to impact of climate variability of the effectiveness of the management systems established under the project. Growing climate variability and extreme weather events place additional pressure on the systems established under NHP. Despite enhanced forecasting and Decision Support System (DSS) tools, the increasing complexity of water-related risks will necessitate enhancement of models, analytics, and multi-hazard warning systems in the future. Without regular technical upgrades and closer integration with disaster management authorities, the relevance and reliability of forecasting systems may decline. This consideration should accordingly inform the design of any future government projects in the sector.

## 8. Assessment of Bank Performance

### a. Quality-at-Entry

- **Strategic relevance and approach.** The PDO was in line with the Government priorities at the National and State levels. Water resources challenges faced by India continue to be considerable and need to be addressed by adopting an integrated approach that considers all water uses and all water sources on a hydrologic/river basin basis.
- **Technical and financial aspects.** The project design reflected a complex and ambitious PDO. The NHP was a large, technically complex, and geographically dispersed program that included 48 IAs. The NHP aimed to establish an enabling framework for surface water and groundwater management by strengthening information and DSS for water resources planning and management. The design reflected relevant activities to achieve the envisioned outcomes. The design was pragmatic and allowed staggered entry and retroactive financing to accommodate capacity variations among participating IAs. The PAD reflected an adequate EFA that justified the project investments.
- **Social and gender aspects.** While not directly tracked, the project's contribution to risk reduction and improved access to public information supported the World Bank's mission of ending extreme poverty and boosting shared prosperity. The project contributed to gender inclusion through training and access to public information tools. Women participated in various technical training programs delivered under the project, and the open-access design of India WRIS and State WRIS platforms ensured that women stakeholders could access water information products without institutional barriers.
- **Environmental and fiduciary aspects.** The project design focused on soft solutions as opposed to hard infrastructure, no social impacts and no significant and/or irreversible adverse environmental impacts were anticipated from the investments to be financed. Fiduciary aspects (financial management and procurement) experienced challenges during implementation including delays in fund release, lengthy approvals, and limited state-level capacity.



- **Implementation arrangements.** Inadequate staffing was a recurring constraint at both state and central levels. Also, state PMUs faced turnover and limited delegation and NPMU was slow to recruit key experts. While the Technical and Management Consultancy (TAMC) was a major investment of about US\$19.6 million (6% of project cost), it played a pivotal role in enabling implementation across the 48 IAs. It provided extensive technical support through specialists in Hydromet, SCADA, water quality, water resources, MIS, communication, procurement, and finance, guiding the development of analytical products and applications.
- **Risk assessment.** At project appraisal, the overall risk rating for the project was Substantial. Five main risk areas were identified including risks related to sector strategies and policies, technical design, institutional capacity, fiduciary, and coordination. While risk identification was thorough and adequately addressed via targeted mitigation measures, unanticipated risks materialized during implementation. These included the Government of India's public financial management reform agenda, and persistent procurement delays. Also, the risk related to the outbreak of COVID-19 was unforeseen.
- **M&E arrangements.** A results-based M&E system was set up before the start of project implementation. The system was built on experience from the implementation of HP-I and HP-II projects. An M&E cell was established in the NPMU and M&E focal points were appointed in each central, river basin, and state PMU. The M&E design was adequate and allowed tracking PDO progress through indicators covering institutional, technical, and operational aspects. However, some aspects were not comprehensively captured such as decision-making based on real-time data by participating agencies (see section 9 a for details).

**Summary of Quality-at-Entry (QAE) Assessment.** The project design reflected a strategically relevant PDO, yet the PDO was complex and ambitious. The design reflected relevant activities to achieve the envisioned outcomes. It was also pragmatic and allowed staggered entry and retroactive financing to accommodate capacity variations among participating IAs. The design reflected adequate social, gender and environmental aspects. However, fiduciary aspects might have benefited from more attention as fiduciary proved to be more challenging than anticipated. Implementation arrangements benefited from investing in the TAMC which enabled implementation across the 48 IAs. While risk identification was thorough and adequately addressed via targeted mitigation measures, unanticipated risks materialized during implementation. M&E arrangements and design were both adequate. Overall, QAE is rated Satisfactory.

## **Quality-at-Entry Rating**

Satisfactory

### **b. Quality of supervision**

- The project experienced implementation challenges with the outbreak of COVID-19 in early 2020. This disrupted supply chains, fieldwork, mobility, and contract execution, particularly affecting Hydromet activities and equipment commissioning (ICR, paragraph 44).
- The World Bank conducted 17 implementation support missions through the project duration. During the COVID-19 restrictions, reviews, training, evaluations and procurement were shifted to digital platforms. The Task Team Leader (TTL) remained unchanged during the project, facilitating a sustained and consistent relationship with the client.



- The Bank team addressed implementation delays through introducing the concept of lapsable funds for nonperforming IAs with NPMU-guided reallocation to better performing IAs should time-specific targets not be met. The Task Team included expertise across hydrology, water resources planning, procurement, financial management, environmental and social safeguards, and M&E, allowing for holistic implementation support. The Bank team also played a catalytic role in improving procurement outcomes. Early technical support and standardization of bidding documents helped expand the pool of qualified vendors.
- The Bank facilitated more than 40 workshops, technical exchanges with leading global organizations and experts, and peer-to-peer learning events that supported cross-state collaboration and innovation. Additionally the Bank maintained close coordination with the NPMU and the National Ministry Responsible for Water Resources Management, Irrigation and Rural Water Supply and Sanitation (MoJS) to provide technical advice across components.

**Summary of Quality of Supervision Assessment.** The World Bank successfully played a catalytic role in advancing institutional reform, digital modernization, and evidence-based water management in India. The Bank maintained a consistent focus on outcomes, capacity-building, and adaptive management which contributed to the successful achievement of the PDOs and sustainability of the project results. Therefore, the Quality of Supervision is rated Satisfactory.

Based on the ratings assigned for QAE and Bank supervision, the Overall Bank Performance is rated Satisfactory.

### **Quality of Supervision Rating**

Satisfactory

### **Overall Bank Performance Rating**

Satisfactory

## **9. M&E Design, Implementation, & Utilization**

### **a. M&E Design**

- The PAD did not include a ToC since it was not yet required by the Bank at appraisal. Nonetheless, the ICR (figure 1) included a ToC that outlined the connections between project activities, outputs and outcomes in plausible causal chains. This Review outlined a ToC for each objective based on the detailed project description in the PAD and the ToC reported in the ICR.
- The PDO was measured through three PDO outcome indicators: 1. Number of water resources monitoring stations operated by implementing agencies providing validated data online; 2. Number of information products produced under the project made available to the relevant stakeholders; and 3. Number of water resources institutions achieving benchmark performance levels. These indicators were measurable and connected to the PDO. However, indicators 1 and 2 were quantitative in nature and lacked the depth to capture behavioral change. For example, decision-making based on real-time data by agencies, was not explicitly captured in the results framework. The ICR (paragraph 45) noted that "establishing direct attribution between project interventions and



these systemic behavioral changes required additional validation through case examples and post-implementation reviews."

- The RF included six intermediate outcome indicators (IRIs) to track the progress of the project activities towards achieving the PDO. The IRIs were relevant, measurable and connected to the stated activities.
- Overall, M&E design tracked the progress towards achieving the PDO through indicators covering institutional, technical, and operational aspects. However, there were some weaknesses, most notable was that behavioral change in terms of decision-making based on real-time data by target agencies required further verification beyond the RF.

## **b. M&E Implementation**

- A central MIS was established at the NPMU level during the preparation stage, enabling the project to operate paperless. This facilitated coordination across numerous IAs and ensured a smooth transition to virtual operations during COVID-19.
- The ICR (paragraph 45) reported that "key indicators tracked progress on data acquisition, data dissemination, and institutional performance, with systems in place to provide disaggregated data across national level." Also, IAs updated their plans and progress through the platform, allowing for real time process monitoring and timely issue resolution (ICR, paragraph 46). Further, independent technical audits were commissioned to validate results, and findings, which informed updating of the implementation strategies.
- The project also benefited from the integration of real-time monitoring platforms and GIS-based tools, which enhanced transparency and supported decentralized decision-making. Also, targeted capacity-building efforts and centralized data quality assurance protocols helped improve M&E activities in low capacity states.
- Overall, M&E implementation was effective despite initial challenges at low capacity states.

## **c. M&E Utilization**

- The ICR (paragraph 47) noted that the project used M&E data informed the project management and enabled course corrections. For example, M&E data directly influenced the identification of low performing agencies, reallocation of resources through project restructuring, and adjustment of training and procurement plans.
- Utilization of project M&E data was also demonstrated through the usage of the dashboard-based visualization of real-time data by agencies for flood forecasting, reservoir management, and planning of irrigation releases.
- Additionally, M&E results contributed to national reporting and informed policy discussions on IWRM. That said, the ICR (paragraph 47) highlighted that the project could have benefited further from a more systematic documentation of implementation experiences and lessons, such as structured case examples or learning briefs, to enhance cross-state learning.

**Summary of M&E Quality Assessment.** M&E design included relevant indicators that tracked the progress towards achieving the PDO. However, there were some design weaknesses, most notable was that behavioral change in terms of decision-making based on real-time data by target agencies required further verification beyond the RF. M&E implementation was effective and generated enough data to



assess the progress of the project towards achieving the PDO. Utilization was evident in informing management decisions and informing policy discussions on IWRM. The ICR also used the project M&E data to assess the project achievements. Lastly, the ICR (paragraph 48) explained that "the project's focus on real-time monitoring and institutional benchmarking set a national precedent for results-based management in the water sector."

Overall, M&E Quality is rated Substantial despite some design shortcomings.

## M&E Quality Rating

Substantial

## 10. Other Issues

### a. Safeguards

- **Environmental Category and Safeguards.** This project was classified an environmental category 'B' (Partial Assessment) as the environmental impacts could be readily avoided, minimized and mitigated with proper management practices. The project triggered two environmental policies: Environmental Assessment (OP/BP 4.01) and Projects on International Waterways (OP/BP 7.50). The project met the criteria defined in paragraph 7(b) of OP 7.50 that no riparian notification was required as the project only provided technical assistance and localized support to project IAs and therefore did not involve any detailed design and/or engineering studies that would involve the use or pollution of water. The borrower prepared an Environmental Assessment (EA), which identified multiple enhancement opportunities in the project and proposes ways of mitigating small negative impacts. This project was not expected to have any adverse social impacts and no social safeguards were triggered.
- **Compliance with the World Bank's safeguard policies.** According to the ICR (paragraph 49) "the project had low Environmental and Social risks and complied with requisite safeguards." The online grievance redressal mechanism (GRM) was functional and only 6 out of 58 complaints pending resolution as at the last implementation support mission (March 2025).

### b. Fiduciary Compliance

- **Financial Management (FM).** A Project Operations Manual was developed detailing the FM arrangements at the IA level and relied on existing agency systems. Several trainings were executed by the NPMU to orient staff, familiarize them with the NHP's FM arrangements, and enable peer to peer learning. The NPMU developed an integrated and real time MIS for expenditure accounting and reporting. The MIS simplified a manual accounting system, incorporating certain levels of internal controls at minimal cost. The NHP laid the foundation for two design innovations in Bank Investment Project Financing (IPF). First, the facility for inclusion of IAs post loan signing without the need for restructuring, and second, establishing a mechanism to suspend disbursements to non-compliant agencies, such as those failing to submit timely audit reports, without suspending disbursements for the entire project, thereby enabling continued



progress in other states. However, the project experienced FM challenges with the Government of India's public financial management reform agenda. The project successfully adapted to the new requirements which were managed through support from the TAMC. The ICR (paragraph 53) commended the "accuracy and timeliness of Interim Unaudited Financial Reports (IUFR)." In a further communication, the project team explained that, "except one, all audit report tends to carry an unqualified audit opinion." FM performance was rated Moderately Satisfactory in the final ISR.

- Procurement.** At the early implementation of the project experienced delays with high-value contracts due to lengthy approvals, and limited state-level capacity. Procurement performance benefited from NMPU-supported reforms such as standardized bidding documents, virtual trainings, streamlined protocols, and updated guidelines during COVID-19 to ensure continuity. This project was the first in India to digitally integrate its procurement plan with the World Bank's STEP system (ICR, paragraph 54). Also, several NHP approaches were replicated in Bangladesh and adopted in Sri Lanka. Procurement performance was rated Satisfactory in the final ISR.

**c. Unintended impacts (Positive or Negative)**

None.

**d. Other**

The ICR (paragraph 31) noted that "the WRIS platform, initially a technical data-sharing tool, evolved into the national backbone for multiple ministries, including Water, Agriculture, Environment, and Urban Affairs, with states such as Karnataka, Odisha, Andhra Pradesh, and Tamil Nadu committing their own resources to sustain and expand the platform. Project-developed manuals, tender templates, and training modules were adopted by nonparticipating agencies and line departments, setting new national standards for procurement, capacity building, and digital hydrology"

**11. Ratings**

Ratings	ICR	IEG	Reason for Disagreements/Comment
Outcome	Satisfactory	Satisfactory	
Bank Performance	Satisfactory	Satisfactory	
Quality of M&E	Substantial	Substantial	
Quality of ICR	---	Substantial	

**12. Lessons**



The ICR included five lessons. The following three are emphasized with some adaptation of language:

**1. In countries with a federalized governing structure, large-scale institutional transformation could benefit from a flexible, decentralized implementation model that balances strong national coordination combined with targeted technical assistance.** The project's implementation modality allowed 48 IAs to operate under a common national framework while customizing interventions to local needs. It also allowed for flexibility in implementation approaches as evidenced by the increased leveraging of SWICs to advance the establishment of SWRIS.

**2. To catalyze broader sectoral transformation, projects could adopt a system-based, cross-program approach.** The experience of NHP showed that the project's tools, standards, and technical outputs extended beyond the project itself, supporting other World Bank and government-funded initiatives such as NGMIP, DRIP, and various state-level programs. By producing technical guidelines, baseline datasets, and standard operating procedures, the project laid a foundation for ongoing and future investments in hydrology and water governance. Its contribution to sectoral coordination, data interoperability, and institutional alignment makes it a model for initiatives that aim at integrating infrastructure, digital platforms, and institutional reforms at scale.

**3. To strengthen institutions and enable reform, projects need to support sustained investment in capacity building.** NHP's structured training programs for professionals built institutional memory across IAs. Peer learning exchanges, thematic workshops, and online training tools proved particularly effective, especially in states with high turnover. Institutionalizing capacity building through national frameworks, refresher programs, and certified training courses can help sustain and scale the reform momentum. However, without continued investment, these gains risk erosion.

### 13. Assessment Recommended?

No

### 14. Comments on Quality of ICR

- **Quality of Evidence.** The evidence base in the ICR was adequate to assess the outcomes of the project.
- **Quality of Analysis.** The analysis of the project achievements was thorough and balanced.
- **Internal Consistency.** Various parts of the ICR were internally consistent and logically linked and integrated.
- **Lessons.** Lessons reflected the project experience and were based on evidence and analysis.
- **Consistency with guidelines.** The ICR used the standard structure defined in the Guidelines and used available evidence to justify the assigned ratings. However, the relevance of objectives could have benefited from further details to justify the assigned rating.
- **Conciseness.** Overall, the ICR was well written and concise, and candidly reported on most shortcomings.



**Summary of Quality of the ICR Assessment.** Overall, the ICR was well written. It included an adequate evidence base to assess the project outcomes, and candidly reported on most shortcomings and reflected relevant lessons. The discussion of the project outcomes was balanced and provided a convincing narrative that connected the project activities to the achieved outcomes. Most sections were concise and reflected relevant information.

Therefore, the Quality of the ICR is rated Substantial.

**a. Quality of ICR Rating**  
Substantial