

## **Project Completion Report India Hydrology Project-II Central Water Commission**

Central Water Commission is a premier Technical Organization of India in the field of Water Resources since its inception in 1945. The Commission is entrusted with the general responsibilities of initiating, coordinating and furthering in consultation of the State Governments concerned, schemes for control, conservation and utilization of water resources throughout the country, for purpose of Flood Control, Irrigation, Navigation, Drinking Water Supply and Water Power Development.

Systematic collection of Hydro-meteorological data from all river basins in India was basic need for planning and managing water resources of India. CWC started these observations since 1958-59. The observed data are being published in the form of Water Year Books and disseminated to users as per existing hydro-meteorological data dissemination policy from time to time. Though, the observation sites were generally located with a view to estimate the basin resources, their density was found inadequate for various needs without complementary data from the State network.

During 9th Plan, telemetry system at 55 stations was installed in Chambal and Upper Mahanadi basins for real time data collection and transmission to forecast formulation centers under World Bank aided DSARP scheme.

Before the start of Hydrology Project, the Hydro-meteorological data was maintained in hard register only and no systematic computerization of data, real time observation of H.O. data etc were done. There was a need to optimize the network of surface water data observation stations as a whole covering both CWC and State network, which was taken up under Hydrology Project.

Amongst the institutional capability CWC was maintaining Central Training Unit at CWPRS campus, Pune for training to its officers in water resources sector before the start of Hydrology Project.

All above activities of Hydrological Information System(HIS) enhanced many fold after the implementation of Hydrology Project in phased manner.

The progress made during Hydrology Project I & II is as given below.

### **1. Hydrology Project Phase-I:**

Hydrology Project –I with World Bank (IDA) credit assistance of 90.1 million Special Drawing Rights (US\$ 142.0 million) was started in September, 1995. Besides, under the bilateral India-Dutch agreement, the Government of Netherlands had provided a grant-in-aid assistance of 29.9 million Dutch guilders (US\$ 17.4 million) in the form of Technical Assistance as consultancy services and overseas training to all participating states and Central agencies.

The broad objective of Hydrology Project Phase-I was to establish a functional Hydrological Information System (HIS) and to improve institutional capacity of 9 States viz. Andhra Pradesh, Chhattisgarh, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, and Tamil Nadu and 6 Central Agencies viz. CWC, CGWB, IMD, NIH, CWPRS and MOWR.

The CWC component in the project was initially Rs.595.36 million which was further revised to 716 million. The project started in September, 1995 and closed on December, 2003.

The major achievement made by CWC under HP-I is as given below.

- i. New stations opened:**  
30 H.O. Stations, 17 Rain Gauge station 2 WQ Level II labs, 1 WQ Level II+ lab, 5 Regional Data Centres, one National Surface Water Data Centre was established.
- ii. Stations upgraded:**  
254 HO Stations, 186 Rain Gauge Stations, 70 WQ Level -I labs, 8 WQ Level II Labs, 1 WQ Level -II lab upgraded to Level-II+ lab and replaced 89 SRG.
- iii. Construction of buildings:**  
Site/quarter/store/shed-191 nos., WQ Labs Level-I/Level-II/Level-II+- 100 nos, office buildings -13 nos and NWA buildings were constructed.
- iv. New offices opened:**  
3 Sub Divisional Offices and 1 Divisional office were opened.
- v. Developed Hydrological Information System (HIS) for Central and State Agencies.**
- vi. Development & installation of WISDOM software at 28 stations**
- vii. Development of SWDES:**  
SWDES made operational in 48 Sub Divisions and 87% of historical data of 254 sites was computerised.
- viii. Development of HYMOS Software:**  
HYMOS made functional at 13 Divisional data processing centers.
- ix. Central Training Unit, Pune was upgraded to National Water Academy.**
- x. Training :**

Total 3112 officials of Central and State Agencies were trained in water resources sector.

**xi. Financial Target & achievements:**

The CWC component of HP-I was 71.61 Crore and expenditure was Rs.70.92 Crore.

Thus during HP-I, an Integrated HIS providing reliable, comprehensive and timely hydrological and meteorological data relating to 56 parameters was established. This consists of 916 river gauge stations 7912 observation wells and 436 hydro-meteorological stations for collecting data on qualitative and quantitative aspects of both surface water and ground water was established. 380 data centers and 31 data storage centers equipped with specialized hardware and software has been established for data processing, storage and reliable data communication. Sufficient manpower has been trained for HIS operations and user support. In addition to current data some of the states have successfully computerized valuable historic data relating to rainfall and river discharge.

**2. Hydrology Project Phase-II:**

The Hydrology Project-II was a follow up on Hydrology Project-I. The project was cleared by the CCEA in October, 2005. The agreement for the project between the Govt. of India and the World Bank was signed on 19th January, 2006 and approved by the GOI in the month of May, 2006.

The overall project development objective was to extend and promote the sustained and effective use of Hydrological Information System by all potential users concerned with Water Resources Planning and Management thereby contributing to improved productivity and cost effectiveness of water related investments. 4 new states (Himachal Pradesh, Punjab Goa & Pondicherry) & 2 new Central Agencies (CPCB, BBMB) have also been included in the phase-II of the project. The Government of India had received a Loan (Ln. No 4749-IN) from the International Bank for Reconstruction and Development in single currency equivalent to US Dollars 105.00 million (approx) towards the cost of Hydrology Project Phase-II

The original completion period of HP-II was June, 2012. The project completion period was extended upto May, 2014 by the World Bank.

The major achievement by CWC under HP-II is as given below.

**2.1 Component A: Institutional Strengthening**

Under this component, it was proposed to consolidate the gain made under HP-I by way of strengthening of capacities through training, up gradation/ replacement of hardware/ software acquired during HP-I, maintenance of website, data dissemination and knowledge sharing – workshops / seminars tours etc. Upgradation of the Data Storage Centre Software (WISDOM) was also envisaged to obviate the issues related to hardware, software and licence issues.

The progress made under this component by CWC is as given below.

◆ **Strengthening of NWA, Pune:**

Constructed two Lecture halls, one computer lab and extended Krishna Hostel at NWA, CWC, Pune. Upgraded Godavari Hostel by installing TV, AC etc in each room at NWA, CWC, Pune.

◆ **Training:**

NWA, CWC conducted 57 training programmes related with water resources sector and trained 1342 officers from Central as well as State official involved under Hydrology Project. 19 CWC officials participated in 9 International Training courses at UNESCO, IHE, Delft, The Netherlands in the field of water resources sector.

◆ **Online Surface Water Information System (eSWIS):**

Development of Online Surface Water Information System (eSWIS) to upgrade the functionality of the existing SWDES, HYMOS and WISDOM Software (HIS) developed under HP-I by replacing obsolete components, improving system architecture and adding new components for web based hydro meteorological data entry, primary validation, secondary validation and dissemination of data including dissemination of flood forecasts. The new HIS will consist of following components:-

- I. A Web based Data Entry system (eSWDES)
- II. Provision of secondary validation and reporting tools for hydrometric data.
- III. Hydro Meteorological Database Backend database for secure encrypted storage of hydrometric data.
- IV. Hydro Meteorological Database Application.
- V. Web Hosting and management of web application i.e. eSWIS.

The two modules of the software i.e. eSWDES & eFF have been developed and is being used in CWC. The training on eSWIS application will be given to all IAs in future.

◆ **Real Time Water Quality Monitoring System (RTWQMS):**

CWC has Installed RTWQMS at three sites namely Agra (Jawahar Bridge) on river Yamuna, Lucknow on river Gomti and Moradabad on river Ramganga for monitoring of pH, Conductivity, Temperature, Dissolved Oxygen, Bio-chemical Oxygen demand (BOD) & Chemical Oxygen Demand (COD). The real time water quality data is available for above sites from 18<sup>th</sup> July, 2013 on web site <http://cwc.rtwqms.com>.

◆ **Video-conferencing:**

CWC has Installed Video-conferencing facilities at Delhi, Pune, Gandhinagar, Hyderabad, Lucknow, and Bhubaneswar & Coimbatore since October, 2011. Lectures on subject matters for training at NWA are being delivered using Video-conferencing.

◆ **Strengthening of Water Quality Laboratories:**

One Atomic Absorption Spectrophotometer for analysis of trace and toxic metals at National River Water Quality Laboratory, CWC, New Delhi has been installed.

◆ **Modernization of Hydrological Observation Stations:**

Acoustic Doppler Current Profilers (ADCP) for discharge measurement on large rivers at 15 locations namely Varanasi, Rishikesh, Shahzadpur, Allahabad (Chhatnag) and Mirzapur on river Ganga, Billingundulu on River Cauvery, Wadenpalli on River Krishna, Garudeshwar, Barmanghat, Hoshangabad&Handia on River Narmada, Bhomoraguri, Pandu&Pancharatna on river Brahmaputra and A.P.Ghat on river Barak have been provided.

◆ **Procurement of Software**

Two set of Arc GIS (Arc Info, Arc 3-D Analyst, Arc Spatial) software for various application in water sector have been procured.

◆ **Procurement of Computers and other hardware.**

During the project, 30 Nos. new Computer, 3 Nos. Projector, 1 Audio Equipment and 2 Photocopiers have been procured. 97 Nos. computers have been also upgraded in data centres.

◆ **Procurement of Inspection vehicle.**

Four inspection vehicles have been procured against survey reported of condemned vehicle.

## **2.2 Component B: Vertical Extension**

### **2.2.1 Development of Hydrological Design Aids for Surface Water(HDA-SW):**

The hydrological analysis in the formulation of various water resources projects by different state agencies are not uniform and even today some of these projects are being formulated using empirical formulas which are no longer in use . The hydrologic analysis is carried out in a limited way without exploring various alternatives under the various data scenario condition. Therefore, development of HDA(SW) including standardization of Methodologies/protocols for making use of state of art technology for rational design and analysis and carry out integrated water resources analysis including study of hydrology of the complete water system i.e. "Hydrological Design Aids (Surface Water"(HDA-SW ) at a cost of

Rs. 8.00 crore was taken up by CWC through consultancy. HDA has the following three major components:

- a. Assessment of Water Resources Potential - Availability/yield Assessment (HDA-Y);
- b. Estimation of Design Flood(HDA-F); and
- c. Sediment Rate Estimation(HDA-S)

The software is under development .Till date following reports have been submitted by the consultant and accepted:

- a. State of the Art Report(SAR) in October, 2010
- b. Inception Reports of three modules (HDA-1, HDA-2 and HDA-3) in March, 2011
- c. Draft Final Report of HDA-2 ( now designated as HDA-F)- February, 2014
- d. Draft Final Report of HDA-3 ( now designated as HDA-S) - February, 2014
- e. Draft Final Report of HDA-1 ( now designated as HDA-Y) - May, 2014 (Yet to be submitted )

The consultant has not developed the software fully till May,2014 and is still under development.

### **2.2.2 Purpose Driven Studies (PDS):**

18 proposals received from the States Andhra Pradesh, Maharashtra, Orissa, Madhya Pradesh, Gujarat, Kerala, Tamilnadu, Himachal Pradesh as well as from NIH and Bhakra Beas Management Board (BBMB) were examined and cleared by HISMG (Tech.) and concurrence of World Bank on these proposals was received in June, 2008. Subsequently, two proposals were received from the State of Chhattisgarh and one from the State of Karnataka which were also examined and cleared by HISMG (Tech) in September, 2009.

### **2.3 Financial Target & Achievement:**

The project was cleared by the CCEA in October, 2005. The agreement for the project between the Govt. of India and the World Bank was signed on 19th January, 2006 and approved by the GOI in the month of May, 2006. Estimated cost of the CWC component of HP-II based on Revised Cost Table 2013 is Rs. 26.72 crore against initial PIP cost of Rs. 24.90 crore. The total expected expenditure on CWC component of Hydrology Project-II is Rs.18.75Crore.

### **2.4 Lesson learnt:**

Hydrology Project has been implemented mainly in Peninsular India. There is need to expand the project in remaining parts of India alsoto cover all hydrological basins of India for better management of water resources. The Project should be initiated in the early phase of starting of Hydrology Project to achieve the target within stipulated time frame. The processes of tender preparation/award also got delayed due to delay in obtaining clearances from different authorities. Capacity building as per project could not achieve because International Training Courses as stipulated in the project plan could not materialised.

### **2.5 Future Plan and Needs:**

India is under water stress since the early 2000's, and its main challenge is to produce more food with less water; other important issues concern Water Quality, reservoir sedimentation, climate and land use change impacts on water resources availability, etc. Therefore, it is need to development of Integrated Water Resources Management (IWRM). Some of the activities that can be taken up under the next phase of the Project are given as below:

#### **A. Consolidation and expansion of HIS**

- Extend HIS to all non-HP States of India including the procurement and installation of equipment, software and data sets, development of HIS infrastructure and Regional Data Centres.
- Upgrading and expansion of existing HIS networks, advanced monitoring equipment.
- Upgrading of existing HIS monitoring stations with Real-time Data Acquisition (RTDAS) systems; develop mobile-based applications for addressing flood forecasting and flood risks.
- Installation of additional RT-WQMS stations in important surface water bodies for the assessment of water quality in polluted river stretches;
- Rehabilitation and upgrading of WQ laboratories established under HP-I (15 to 20 years old).
- Introduce web-based data processing (including mobile applications) throughout India through e-SWIS and enhance the capabilities and functionalities of software as per requirement.
- Improvement/Strengthening of India-WRIS portal to provide web services to other portals

#### **B. Water Resources Development, Management and Planning**

- Objective: Move from data to information to application; integration of tools developed in HP-I and HP-II in design, planning and operational practices throughout the country and scaling-up the utilization of HIS data for IWRM and planning.
- Introduce Web-Based Hydrological Design Aids (HDA) to all State SW agencies in order to improve current design practices of water resources infrastructure; expansion of tools in the HDA toolbox, e.g. with hydrological models.
- Carry out reservoir sedimentation studies, reservoir bathymetric surveys and river sediment load monitoring.
- Impact of climate change on water resources.
- Census of Major & Medium Water Resources Projects and establishment of an assets management service.
- Preparation reference Evapo-transpiration Atlas for country.
- Development of Aquatic life assessment in major rivers of India
- Development of android based application for hydrological observation site management and data updation.
- Improvement in Glacial Lake Monitoring and forecasting of unusual weather effects.

#### **C. Real-time Decision Support Systems**

- Introduction of flood plain mapping, flood inundation modeling, flood risk zoning and flood vulnerability mapping
- Introduction of dam break analysis, flood modeling and flood forecasting
- Explore the feasibility of using Meteosat/INSAT satellite based estimation of precipitation (based on Cold Cloud Temperatures) and actual evapo-transpiration, in conjunction with

real-time field measurements of rainfall and other hydro-meteorological parameters, as input to flood forecasting and drought monitoring & management systems.

#### **D. Institutional Strengthening and Institution Building**

- Provision of field equipment, GPS, GIS data sets, toposheets, Data Centres (buildings and hardware/ software), vehicles and office infrastructure.
- Establishment of Hydrological Observation Training institute, including current meter calibration facilities and Centre of Expertise in hydrometric monitoring equipment to advise all monitoring agencies on appropriate choice of equipment, its specification, and appropriate management and maintenance
- Training programs at various HIS levels, domestic study tours and international study tours, cross learning from participating States, introduction of HAD & e-SWIS, etc.
- Promote data sharing and dissemination, joint data validation and data utilization for design, planning and management purposes;
- Sustainability HIS requires to cover all of India in the HIS, improve inter-agency coordination mechanisms, central data storage, standardization of equipment, AMCs, and O&M training