

HYDROLOGY PROJECT  
PHASE II

OF

PUNJAB STATE

WATER RESOURCES ORGANISATION  
IRRIGATION DEPARTMENT  
PUNJAB GOVERNMENT  
CHANDIGARH

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# **HYDROLOGY PROJECT – II**

## **Punjab State**

### **General**

1. Punjab is predominantly an agriculture State and is proud to be grainery State of India. It has geographical area of about 50362 Km<sup>2</sup> and population of about 24.3 million in the year 2001. Its surface water resources are being fully utilised and to meet growing demand of water for irrigation & diverse purposes, the ground water is being exploited extensively. It is facing the problem of 'falling ground water level' in about 80 percent of the State. It has generally a hot and arid climate. The annual normal rainfall is around 532 mm in the plains and 890 mm in the sub-mountainous regions near lower Shiwaliks in the East. Rain is primarily provided by the South-West monsoon during the months of June-Sept.
2. The existing system for the hydrological observations & data management is described in Section A and the proposed improvements are summarized in Section B.

### **Section A**

#### **Existing Systems for the Hydrological Observations and Data Management**

##### **Surface Water**

3. Organization All hydrological data collection and management activities in Punjab including discharge measurements upstream of Hydro Electric Dams at sites (Bhakra Dam, Pong Dam and Ranjit Sagar Dam) falling in the area of other basin States namely J & K and Himachal Pradesh are being controlled by Discharge Division, Mohali, under the Chief Engineer/Canals Irrigation Works, Punjab and Bhakra Beas Management Board. The Planning and Design Studies Directorate, Irrigation Works, Punjab under Chief Engineer/WR is monitoring the discharge of various rivulets flowing in Kandi Areas at Shiwalik foothills for the preparation of Feasibility Reports for the construction of low dams in the Kandi Area.
4. River Gauging At present there are 80 discharge sites being monitored. Out of these, 58 sites fall under the jurisdiction of the Chief Engineer, Canals and the remaining 22 sites are under the control of Bhakra Beas Management Board. The records of these discharge sites are available since early seventies. Out of these 58 sites, 33 are Gauge Discharge, 20 Discharge and 5 Gauge sites. There are also 3 additional seasonal discharge sites in the Kandi

Areas of Ropar, Nawan-Shahar and Hoshiarpur districts monitored by P&D Studies Directorate under CE / WR.

5. Laboratory Facilities There are no laboratory facilities for measuring the water quality and the sediment load in the Discharge Division. Some seasonal sediment load measurements in rainy season are taken selectively for the construction of low dams in the Kandi area by Planning and Design Studies Directorate.
6. Data Processing and Management The observed data is compiled and stored in the Discharge Division, Mohali and P&D Studies Directorate on monthly basis manually. A copy of the compiled data is sent to C.E/ Canals, Irrigation Works, Punjab, Chandigarh and to MOWR.
7. Other Annual budget for the year 2003-04 for O & M of the Discharge Division is Rs. 3.9 million and for salary & overhead of the staff is Rs. 20.8 million. The current discharge measurement system is very crude and does not measure higher discharges. The collected data is presently used for flood forecasting, irrigation and drainage planning. The staff needs proper training and the sites need to be upgraded. Automation of the data collection, compilation and management system is also necessary.

### **Ground Water**

8. Organization Groundwater observation network of Punjab is currently monitored by four agencies, namely, Water Resources & Environment Directorate, Punjab, Planning & Design Studies Directorate, (both under CE/WR), Ground Water Cell of Department of Agriculture (DOA), and Central Ground Water Board (CGWB). Each agency has its own administrative set-up. Amongst them the Water Resources & Environment Directorate (WRED) has been designated as the Nodal Agency for Hydrology Project Phase-II and to act as Database Administrator in respect of groundwater by the State Government.
9. Groundwater Monitoring Network WRED observes groundwater level from a network comprising of 162 dug wells & 224 piezometer tubes (175 shallow and 49 deep), GW Cell of DOA observes from 456 open dug wells & 133 piezometers, CGWB observes from 326 open dug wells & 87 piezometers and the Planning and Design Studies Directorate observes from 199 dug wells & 20 piezometers mainly in the Kandi Area. There are about 1.125 million of private shallow tube-wells owned by farmers and the number is increasing day by day resulting in over withdrawal and lowering of groundwater level.
10. Laboratory Facilities Eight Governmental & semi-Governmental institutions, including the WRED, have the water quality testing facilities. But most of the water testing is done as per their own needs and some of these are also providing testing services to farmers and industries. Punjab Pollution Control Board and Public Health Department at Patiala have laboratories of

Level II+ and II respectively. Punjab Agricultural University at Ludhiana has also some advanced instruments.

11. Data Processing Facilities The ground water level records are available since 1970s. The water level recording is taken, processed and validated manually by the collecting agencies.
12. Other Annual salary and overhead of staff of WRED is Rs. 28.23 millions and annual works budget is Rs.6.76 million (for the year 2003-04). The current groundwater monitoring system is inadequate, crude and lacks desired level of accuracy. The staff needs proper training and the sites need to be rationalized and upgraded. The collected data is presently used for water level monitoring, water balance studies and environmental degradation management. But due to lack of sufficient network and advanced monitoring facilities for determining Ground water resource estimation & hydraulic characteristics of the aquifers, the reliability is not very high. Automation of the data collection and management system is also necessary.

### **Hydrometeorology**

13. Organization Punjab, like other Indian States, has many agencies that maintain network of rain gauge stations and climate stations, namely Irrigation Department, Director of Land Records (DLR), Indian Air Force (IAF) and Punjab Agricultural University (PAU) apart from Indian Meteorological Department (IMD).
14. Meteorological Network The total network comprises 173 SRG, of which 130 SRG are monitored and maintained by Irrigation Deptt. and 43 by DLR. Presently, more than half of the rain gauges are in dilapidated or non-functional conditions. Out of the 138 blocks of the States, 36 blocks have no rain gauge stations at all. Though, the rainfall data is being recorded since 1960s, the reliability of the data is low. There are also 18 Full Climate Stations (FCS) in the State owned and operated by IMD (9), PAU (5), and IAF (4). Out of these, 6 FCS owned by IMD are not functional and record of 4 IAF stations is not available due to security reasons.

## **Section B**

### **Proposed Improvements and enhancement to the Existing Hydrological and Meteorological Data Collection System**

#### **Surface Water Hydrology**

15. **Upgrading of Data Collection Infrastructure** The proposed upgrading of infrastructure of the Discharge Division, Mohali under CE/Canals would include the modernization of all the 58 gauge sites. Out of these 58 sites, about 20 sites are having wide rivers & flat banks, according to which provisions have been made for civil works/equipments. For continuous water level measurement, provision has been made at 33 sites. At 30 sites, where level changes are high, provisions of stilling well with float sensor (shaft encoder & logger type) has been made and 3 sites on banks of rivers have been provided with Bubbler type sensor with housing.
16. **Measuring Equipment** For the velocity measurement, provision for procurement of 30 numbers of package A current meter (Propeller Type), 20 numbers of Standard type current meters and 15 numbers of Pygmy type current meters have been made. Provision of bridge outfit package at 38 sites and boat outfit package for 20 sites have been made for discharge measurements. The provision for procurement of 12 numbers Echo Sounders has also been made.

#### **Groundwater Hydrology**

17. **Upgrading of Data Collection Infrastructure** The proposed GW observation network of the Water Resources and Environment Directorate (WRED), will be upgraded by installing a total of 700 piezometric wells (up to 60 m depth) including replacing of 175 no. of existing 2" diameter PVC pipe piezometers with 4" dia MS pipe piezometers, About 100 piezometric wells will be installed with digital water level recorder.
18. **Deep Piezometric Wells** In addition to shallow piezometric wells, 50 deep Piezometric wells (up to 100 m depth) are proposed to be installed for ground water observation net work for monitoring water table at deeper depths and estimation of ground water potential.
19. **Upgrading Laboratory Facilities** WRED is monitoring quality of the groundwater at shallow and deep aquifers. The monitoring so far, however, has been for the agriculture use only. With the increasing ill-effects of intensification of agro-chemical fertilizer uses on health of human beings, the monitoring of ground water quality need to be expanded to cover various additional parameters (metal and toxic elements). The present laboratories of Irrigation Department i.e. in WRED at Chandigarh is proposed to be upgraded to Level III and existing laboratories of Irrigation & Power Research Institute at

Amritsar & Punjab Agriculture Department at Bathinda are also proposed to be upgraded to Level II.

### **Hydro-meteorological observation network**

20. The Project will support a total 100 No. Rain Gauge Stations for upgrading and replacement of existing SRG & installation of new stations (including 10 new ARG stations) which will also represent 36 blocks where no SRG exists presently. The FCS for the state are not proposed but it was agreed by IMD that IMD will propose 4 FCS and 44 ARG for real time data network in their proposal.

### **Section C**

#### **Data Management and Communication Systems**

21. A Combined State Data Centre would be established in WRED for storage of surface water and ground water information. The data of SW & GW will be finalized / validated by the respective Directorates before transferring it to the State Data Centre. The standard protocol for the data entry, primary validation, secondary validation, and inter-agency validation would also be similar to the protocol established under HP-I, which has the proven success. The 'Combined State Data Centre' is proposed to be part of State Data Processing/Storage Center building proposed under this project for two Directorates (WRED and P & D Studies Dte.) and CE/WR offices.
22. The State has proposed 20 section offices, 10 sub-divisional offices, 4 Divisional offices and one State Data Processing / Storage Centre buildings in order to house the data computing & processing facilities at the various levels which the State do not have at present. The communication between the different locations with the State Data Processing Centers will be realised using a dedicated phone line to NICNET connection or by diskette transfers. The State Data Centre is proposed to be linked through NIC's satellite with different data centers.

### **Section D**

#### **Institutional Strengthening**

23. The institutional base of the proposed Hydrological Observation Divisions needs to be strengthened for data collection, validation, storage and dissemination. The State Level Project Co-ordination will be required for the development of computerized Data Banks, which may be accessible to all user departments and interested private entities.
24. The State has presently two Directorates each headed by a Director (SE level officer) at Chandigarh under the control of Chief Engineer/WR, Irrigation

Deptt., Punjab. The Director, Water Resources & Environment Directorate will be responsible for ground water observations and the Director, Planning and Design Studies Dte. will be responsible for surface water observations. The project would finance incremental staffing and other inputs to support the institutional developments; such as office buildings, transport vehicles, telecommunication and other office equipments, technical assistance services, training and incremental operating costs during the project period.

25. There would be no major organizational changes at the apex level or Directorates level. However, it is proposed that Discharge Division, Mohali, under the Chief Engineer/Canals, which observe & maintain the surface water observation records will carry out the construction activities under same administration but for data collection and related activities, it will be fully answerable to Director, Planning and Design Studies Directorate of WRO during the project period and later. The existing Surface Hydrology Division, Chandigarh under the Planning & Design Studies Directorate, Chandigarh shall be responsible for collecting and compiling of Hydrometeorological data of the whole State besides its existing works.
26. Existing Ground Water Resource Division, Chandigarh, under the Planning and Design Studies Directorate will be attached to the Water Resources & Environment Directorate. The infrastructure development work and ground water observations of the State will be distributed amongst the Ground Water Resource Division and Water Resources Investigation Division at Chandigarh.
27. The incremental staff will be required to run the improved hydrological observation set up in the state. Most of these positions can be filled up by re-deployment and re-training of the existing staff from the other divisions with less load. Apart from the bulk requirement of observers and data entry operator positions, the state's WRED will require the groundwater and chemical laboratory staff positions, such as Hydro-chemists, Senior Technical Assistants, Laboratory Assistants, data entry operators and Laboratory Attendants etc.
28. Training A tentative training program to effect the proposed physical and organizational enhancement has been given in the proposal. Most of the proposed training is to be imparted by participating central agencies such as CWC, CGWB, NIH, CWPRS, NWA and IMD. Some specialised training may be imparted by some experts from India or abroad. The specialised training courses for the specialised equipments can be carried out by the suppliers of the equipment, supplemented by domain Academic Institutes.

## **Section E**

### **Research and Development**

28. Lump sum provision has been made for Applied Research & Development studies namely “Reclamation of brackish aquifers underlying the reclaimed waterlogged saline sodic soils & transfer of innovative drainage technologies” & “Proficiency in Canal Water distribution” to be carried out by PAU, Ludhiana and “Standarisation of rain water harvesting structures & their impact studies”, “Study the presence of Selenium in ground water & its impact in Nawan Shahr Distt”, “Study the impact of industrial effluents, fertilizers & pesticides on surface & ground Water with special reference to pollution related parameters in Ludhiana” and “Study of groundwater quality variation with depth to deliniate fresh-marginal-saline interface up to 60 mts. depth in South-western part of Punjab” by Water Resources & Environment Directorate Punjab. These studies are based on the real issues experienced in the State and will be examined / finalised by Hydrological Information System Management Group (Tech), to be constituted at the level of MOWR, GOI, before being implemented.

## **Section F**

### **Project Coordination, Monitoring & Evaluation and Review**

30. Project Coordination A State Level Steering Committee headed by the Principal Secretary, Irrigation, GOP and State Level HIS Co-ordination Committee headed by Chief Engineer/WR will be established for various project activities. The Coordination Committee will also include a representative from the State Finance Department as per the requirement of World Bank. The Committees will have liaison with the central agencies and with the other agencies, which are involved in the project programs. The Committees will also have the responsibility for monitoring, evaluation and annual reviews of the Project.

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