

## **Chapter – 6**

# **INFRASTRUCTURE**

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Besides excellent information and communication facilities and sensitive support base, the Institute has well-equipped laboratories with the state-of-art monitoring and analytical instruments powered by a top-of-the-line team of scientists and supporting scientific and technical staff. Sophisticated and well equipped laboratories are one of the major necessity for research and development. Water Quality, Remote Sensing and GIS, Nuclear Techniques, Hydrological Investigations and Instrumentation, Soil Characterization etc. are some of the investigations which are used in various research studies. They provide a superbly-equipped, dynamic and broad based research environment. Keeping this in view, the following six laboratories have been established at the Institute:

### **1. Nuclear Hydrology Laboratory**

The Nuclear Hydrology laboratory is well equipped with the instruments such as Normal Level Liquid Scintillation Spectrometer, Ultra Low Level Liquid Scintillation Spectrometer (Quantulus), Multichannel Gamma Ray Spectrometer, Geolog Rate Meter, Neutron Moisture and Density Probe, Ultrasonic Depth Indicator, Tritium Enrichment Units, facilities for tritium and carbon dating of ground water, CO<sub>2</sub> sample preparation lines, CO<sub>2</sub> absorption line, Soil Moisture Extraction Units and Liquid Nitrogen Plant etc. In addition, the laboratory has Continuous Flow Stable Isotope Ratio Mass Spectrometer (CFIRMS) with Elemental Analyser (EA) for measuring D, <sup>13</sup>C, <sup>15</sup>N, <sup>18</sup>O, <sup>34</sup>S & <sup>37</sup>Cl in water and solids and Dual Inlet Isotope Ratio Mass Spectrometer for measuring D and <sup>18</sup>O in waters. These instruments are being used for the field investigations and laboratory analysis for the study of soil moisture movement and estimation of recharge to groundwater, surface water and ground water interaction, lakes studies, groundwater dating and identification of recharge sources and zones of deeper aquifers and springs.

The facilities of the laboratory were extended to Regional Centres and other Divisions of the Institute for completing their studies. The facilities of the laboratory were also extended for the analysis of water and sediment samples received from various other departments/agencies like, BARC, Mumbai, Indian Institute of Technology, Mumbai, Indian Institute of Technology, Roorkee, PRL, Ahmedabad, NGRI, Hyderabad, Nuclear Research Laboratori, IARI, Delhi, Anna University, Chennai and CWRDM, Kozhikode etc.

*Water Samples Analyzed :* More than 7900 water samples (precipitation, rivers, springs, air moisture and groundwater) were collected/received under various hydrological studies being carried out by the Division, other Divisions, Regional Centres and were got analysed for deuterium (D) and Oxygen-18 (D) and C-13 on DIIRMS and CFIRMS at the Nuclear Hydrology Laboratory.

More than 850 samples were collected, 385 got distilled and then enriched for environmental H-3 dating. Out of these samples, 288 could be analyzed for environmental tritium.

*New developments in Nuclear Hydrology Laboratory facilities:* The equipment available for environmental tritium and carbon-14 analyses is more than 15 years old while the workload for the analyses of groundwater samples has been increased. Therefore, one Ultra Low Level Liquid Scintillation Spectrometer has been purchased during the current year. After the installation of this instrument, the capability of the Nuclear Hydrology Laboratory for groundwater dating will almost be doubled.

The Multi-channel Gamma Ray Spectrometer which was purchased more than 15 years back stopped working and found unserviceable. Therefore, a new MCA is being purchased for facilitating the measurements of CS-137 in soils and sediments for studying soil erosion from watersheds and sedimentation in water bodies.

## **2. Remote Sensing Applications & GIS Laboratory**

The application of remote sensing and Geographic Information System (GIS) play a rapidly increasing role in the field of hydrology and water resources development. Space is the ideal vantage point from which to make primary observations from which plethora of useful information can be derived for input for the various hydrological studies. There is now a wealth of information available from a wide variety of satellites, each using different parts of the electromagnetic spectrum as their means of making their measurements.

The space borne multi-spectral data enable generating timely, reliable and cost effective information on various natural resources, namely surface water, ground water, land use/cover, soil, forest cover and various environmental hazards, viz waterlogging, salinity and alkalinity, soil erosion by water etc. For many hydrological applications, remote sensing data alone are not sufficient and need to be merged with data from other sources. GIS technology provides suitable alternative for efficient management and analysis of large and complex databases. Multitude of spatially related data concerning topography, geomorphology climatology etc. along with satellite derived information can be appropriately integrated in GIS environment.

For carrying out studies and research on various aspects of hydrology and water resources using remote sensing and GIS techniques, institute is having Remote sensing and GIS Laboratory. The softwares and peripherals available in the laboratories are as follows.

*Software:* Arc Info, ERDAS IMAGINE, ILWIS, ENVI, R2V:Raster to Vector conversion software

*Peripherals:* A0 WIDECOME IMAGE SCANNER, A0 CALCOM DIGITIZER, LASER COLOUR PRINTER

### **3. Soil and Ground Water Laboratory**

The Soil-Water Laboratory has capabilities for laboratory and field measurement of various soil hydrological, physical and optical properties such as particle size for textural analysis, permeability, porosity, infiltration, soil density, soil moisture at different suction for determination of the soil moisture characteristics curves, saturated hydraulic conductivity, sorptivity and matrix flux potential of soils, in-situ soil moisture, soil salinity, measurement of trace elements, leaf area index, foliage and other canopy measurements in command area etc. using various advanced instrument. Major instruments available in the lab include Pressure Plate Apparatus, Mastersizer E System, Guelph In-situ Permeameter, TDR Soil Moisture Probe, ICW Lab Permeameter, Multi Volume Pycnometer, Infrared Soil Moisture Balance, Digital pH & Conductivity meter, Constant Head Permeameter, Falling Head Permeameter, Electromagnetic Sieve Shaker, Hydrometer Kit, Tensiometers, Double Ring Infiltrimeters, Plant Canopy Analyser and UV Visible Spectrophotometer.

In addition to routine analysis work, the laboratory is providing services in the field for collecting samples, conducting in-situ measurement of various parameters and for field surveys relating to the studies taken up by various divisions including the sponsored/consultancy projects.

During the year 2008-09, the laboratory facilities were used in the following studies:

- (i) Integrated Hydrological Study for Sustainable Development of two Hilly Watersheds in Uttarakhand.
- (ii) Hydrological studies in a forested watershed, Uttarakhand.
- (iii) Use of remote sensing in soil moisture and water balance estimation – a case study of Solani catchment.
- (iv) Monitoring and modeling of stream flow for the Gangotri glacier.
- (v) Impact Assessment of Land use on the Hydrologic Regime in the selected micro-watersheds in Lesser Himalayas, Uttarakhand using Isotopes.
- (v) Modelling of pesticides transport in ground water – a case study of metropolitan city Vadodara.



### **Determination of saturated hydraulic conductivity using Guelph Permeater**

#### **4. Water Quality Laboratory**

The Water Quality Laboratory is well-equipped with state-of-the-art-equipment to identify and quantify physical, chemical and bacteriological parameters in various water bodies like rivers, lakes, reservoirs, wells, aquifers, canals etc. The laboratory has facilities and capabilities to determine about 100 water quality constituents including major and minor ions, trace elements, pesticides, Polynuclear Aromatic Hydrocarbons, organic compounds and bacteriological parameters. During the year 2008-09, samples collected by the division for different studies were analyzed. In addition, water samples of outside agencies (including public and private) were also analyzed.

The major equipment are: (i) Ion Chromatograph, (ii) Atomic Absorption Spectrometer, (iii) Total Organic Carbon Analyzer, (iv) Gas Chromatograph, (v) Flow Injection Analyzer, (vi) UV-VIS Spectrophotometer, (vii) Ion Analyzer, (viii) Mercury Analyzer, (ix) Flame Photometer, (x) Portable Environmental Laboratory, (xi) Digesdahl Digestion Apparatus, (xii) COD Reactor, and (xiii) Water Purification System, (xiv) Research microscope, etc.

#### **5. Snow & Glacier Laboratory and Hydrometeorological Observatory**

The Meteorological observatory at NIH campus has been operational since 1985. The instruments operational are: (i) ordinary rain gauge, (ii) autographic rain gauge (siphon) (iii) max and min thermometer, (iv) dry and wet bulb thermometer, (v) thermograph, (vi) hydrograph, (vii) anemometer, (viii) pan evaporimeter. The readings of various meteorological parameters are taken from the instruments on daily basis at 08:30 am. The data collected at NIH campus

have been supplied to various research organizations, state government departments and research scholars on their requests.

National Institute of hydrology has been carrying out hydrological studies since 1999 on Gangotri Glacier, which is one of the biggest glaciers of Himalayas. The field investigation for the year 2008-2009 started in the last week of April 2008. The monitoring of Gangotri Glacier was carried out with the help of conventional meteorological instruments. In order to make accurate streamflow observations, the cross section of the river channel was determined at the gauging site and observations were made continuously. A graduated staff gauge was installed in the stilling well at the right bank of the river for observations of water level fluctuations. Manual observations were made for water level during the day and night time. For the continuous observation an automatic water level recorder was also installed. For measurement of discharge, velocity-area method was used to estimate flow in the river. Wooden floats were used to compute the velocity of flow and time travelled by the floats was determined with the help of stopwatch. For accuracy in velocity, the readings were repeated at least three times and an average value was adopted for further computations. For suspended sediment studies water samples were scooped directly from the channel at the sampling site in a pre cleaned polyethylene bottle (500 ml) twice a day (0830 and 1730 hours). The samples were collected from the stream at about mid-depth, filtered at the site using Whatman-40 ash less filter paper and packed properly. The sets of samples were transported to the laboratory of the Institute for further analysis.

## **6. Hydrological Instrumentation Laboratory**

Hydrological Instrumentation Laboratory caters to the instrumentation needs of the Institute. It provides infrastructure for routine servicing of hydrological instruments. The laboratory has necessary state-of-art instruments for hydrological and hydro-meteorological monitoring under specific projects.

### *Capabilities :*

- Indigenous development of hydrologic instruments
- Hydro-meteorological monitoring
- Geophysical investigations
- Capacity building programmes

### *Equipment / Facilities:*

- Terrameter (SAS 4000 ABEM)
- EM 34-3 & 34-3XL Conductivity Meter (Geonics)
- Automated Weather Station
- Weighing Snow Gauge
- Weighing Rain Gauge
- Automatic Water Level Recorder
- Tipping Bucket Rain Gauges with Event Logger
- Water Current Meter with Digital Readout
- Soil Moisture Sensors with Digital Readout

## **Library**

Realizing the crucial role of up-to-date information services for conducting high level R & D activities, the Institute since its inception has been in the continuous process of building and updating a good technical library with latest publications in the area of hydrology and water resources.

It has been its endeavour to add modern hydrologic literature to its library. In the year 2008-09, 113 new books, 300 bound periodicals and 53 technical reports have been added to the collection of the library. The total collection of the library has reached upto 20,251 publications, comprising 10867 books, 2925 bound periodicals, 5076 technical reports, 306 Indian and foreign standards, 1036 technical papers / reprints and 41 microfiches. The library is currently subscribing 28 Indian and 23 foreign periodicals. Out of them, online versions of 5 international periodicals are also available in addition to their print versions. Seven periodicals are in Hindi. In addition to the Institute employees, library's resources are being utilised widely by users from other organizations.

## **Communication and Telephones**

A CDOT 256 port PBX was installed at National institute of Hydrology, Roorkee in 1998. As per approval of the competent authority, the existing analog telephone exchange has been replaced by BSNL with a new digital EPABX-256 Port (Make: Coral Telecom) having advanced features. In this connection, an agreement has been signed between NIH and BSNL on 31-03-2009 initially for a period of five years. The telephone services in the Institute as well as at residence of residing Scientists in the New Teachers Hostel (under IIT Campus) have been provided with this new digital exchange. All extensions have been connected through new exchange offering Direct Inward Dialing (DID) facility.

In addition, at present 27 BSNL land line and one WLL connections are working at the offices, residences and NIH colony. Three BSNL landline connections are being used as FAX lines in the offices of Director, Sr. Administrative Officer and INCOH Secretariat. A small EPABX (1+ 4) is working with the Director's office and 11 sets of Plan (1+1) are functioning in the institute with Divisional Heads/SAO/INCOH, etc.

## **Computer Centre**

The Computer Centre is responsible for providing computing, networking, internet and email facilities to Scientists and Staff at the Institute. Computing has become an essential tool for almost all scientific research. At NIH, computers are extensively used both in scientific computation as well as in preparation and publication of scientific reports and papers. Computers of latest configuration are available in the Institute for conducting complex hydrological analyses and modeling studies. Internet and email facilities are routinely utilized for accessing scientific literature as well as for correspondence. The institute also uses computers for processing of administrative and accounting data. The centre

procures and provides maintenance to computers and related peripherals available with the Scientists and Staff.

The local area network (LAN) provides interconnectivity between the computers in different building blocks of the campus. The network comprises of switches in various blocks and UTP connections to individual machines. The LAN is connected to Internet by a 50 Mbps leased line link from BSNL. VSAT connectivity from ERNET India also exists for email communication. A centralized server receives and stores/forwards emails to respective users. A dedicated web server ([www.nih.ernet.in](http://www.nih.ernet.in)) provides a platform for hosting institute information, research publications, important announcements, tender notices etc. and some useful hydrology related information. To maintain the integrity and security of Institute's network, a firewall restricts access from outside to machines within the LAN. All the facilities existing at the Computer Centre are upgraded from time to time to meet the evolving standards of Information Technology.

### **Construction Activities**

During the year 2008-09, several renovation works of the Institute have been entrusted to CPWD, Dehradun. The completed works are as follows:

1. Renovation of Remote Sensing Laboratory
2. Renovation of Director's Chamber
3. Renovation of main building porch, entrance lobby.
4. Construction of Cement Concrete road in NIH Campus
5. Bituminous layer coating on Bituminous macadam road in staff colony

### **Workshop**

Workshop plays a significant role in developing instruments and for repair and maintenance of the various equipment. The workshop not only carries out the various works assigned by the maintenance division but also renders helps to scientists of various divisions, particularly the Hydrological Investigations Division, in developing prototypes of automated hydrologic instruments. At present the workshop has lathe machine, drill machine, cutting cum punching machine, and welding machine, besides various related smaller machines.

During the year 2008-09, the facilities of the workshop have been used for fabrication of 10 teflan caps for vials of  $^{14}\text{C}$  counting, plastic moisture traps for use in  $\text{CO}_2$  preparation line for radiocarbon dating of water, air conditioning frame, cooler stands, M.S. steel structure for rain gauges and water level recorders for installation at Solani river site, male-female fitting of brass, teflan rod of gas cylinders of  $\text{CO}_2$  and helium for gas supply in Nuclear Hydrology lab, and repair of various equipment like Ultra Low Level Liquid Scintillation spectrometer, lawn mover, hedge shair, repairing of rain gauge of mountain hydrology laboratory, and repair of Jhoola for NIH colony etc.

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