

**MINUTES OF THE 30TH MEETING
OF THE NIH WORKING GROUP**

**HELD DURING
8 – 9 APRIL, 2009
AT
NIH, ROORKEE**



आपो हि स्था मयोभुवः

**NATIONAL INSTITUTE OF HYDROLOGY
ROORKEE-247667**

**MINUTES OF THE 30TH MEETING OF THE NIH WORKING
GROUP HELD DURING APRIL 8 – 9, 2009
AT NIH, ROORKEE**

The 30th meeting of the NIH Working Group was held in the Society Room of the National Institute of Hydrology, Roorkee during April 8 – 9, 2008 under the chairmanship of Shri R.D. Singh, Director, NIH. The list of the participants of the meeting is given in Appendix-I.

ITEM NO. 30.1 OPENING REMARKS BY THE CHAIRMAN

The Chairman, Working Group welcomed the Working Group members and the Scientists of the Institute at the Working Group meeting. The Chairman gave a brief background of the various technical and research activities taken up by the Institute during the previous six months. He informed that Climate Change studies have been assigned a very high priority in the recent past and Ministry of Water Resources, Govt. of India has taken up a National Water Mission in this regard. The details about these aspects are available on the website of MoWR. The Institute has been entrusted a big role in carrying out the studies on Climate Change. He also informed that the Technical Advisory Committee (TAC) of the Institute has recommended that NIH should come out with a Vision Document for carrying out various research activities in future. In compliance of the recommendations of the TAC meeting, a brain storming session was organized by the Institute during 16-17 March, 2009 and details of the Vision document would be explained by Dr. Bhishm Kumar, Scientist 'F' and Member Secretary, TAC. The Chairman also explained that the Institute is playing an important role in carrying out the various activities of the World Bank funded HP-II. The Institute is a nodal agency for development and implementation of DSS (P) for integrated water resources development and management. The activities of development and implementation of DSS (P) are in progress. The Chairman also apprised the members that the Institute has also taken up some Purpose Driven Studies under the HP-II. A number of training programs and workshops have also been organized by NIH. Thereafter, the Chairman requested Dr. Bhishm Kumar, Scientist 'F' to explain about the Vision document of the Institute. Dr. Bhishm Kumar presented the details of the Vision 2020 of NIH and its various thrust areas. Thereafter, the Chairman requested the Working Group members to give their observations, suggestions and remarks about the Vision and thrust areas as well as other scientific aspects for carrying out research work by NIH.

Dr. R D Verma appreciated the work being carried out by NIH and hoped that NIH would carry out better research work in future. He stressed that the climate change is a very important area of research and presently NIH does not have a separate division on Climate

Change. He opined that establishment of a separate division at NIH would improve the working and capacity building activities on climate change at NIH. He also expressed that earlier arid zone hydrology was one of the themes of research studies at NIH and studies on arid zone hydrology should continue at NIH. Dr. Verma informed that he being the Member of the American Geophysical Union has brought along with him four papers on Climate Change. He provided the papers to the Chairman, Working Group for reference.

Dr. B P Singh expressed that NIH is doing very good research work in the area of Hydrology and he appreciated that NIH has come out with the Vision and thrust areas. He suggested that efforts should be made to study how the available water in hydrological cycle can reach the users. He also mentioned that Climate Change is also a very important area of research and studies should be carried out for studying the effects of climate change on water resources so that the water planners can take into consideration the impact of Climate Change into account for planning, development and management of water resources.

Dr. S V Navada stated that new technologies are available for collection of data and modeling of hydrological processes specifically for isotopic measurements and NIH should have advanced isotopic data collection instruments and hydrological modeling packages.

Dr. K V Jayakumar stated that NIH has been doing commendable research work and there is a need for taking up of the capacity building and training activities for hydrological analysis and water resources management.

Prof. P K Garg emphasized that though NIH is carrying out appreciable research work in the area of Flood and Drought Management, yet there is a need for taking up studies for management of disasters resulting from landslides and glaciers. He also suggested that there is a need for carrying out studies for underground mapping of pipes and other features related to water.

Dr. S. P. Agarwal stated that the data of soil moisture is an important hydrological variable and radar data may be used for obtaining data on soil moisture. He also stressed that people want solutions of hydrological problems also there is a need to make people aware of new technological developments. He advised that NIH should carry out the studies on flood inundation and flood hazard modeling.

Shri K B Parmar opined that flood and drought management are very important areas of hydrology and water resources management. He desired that studies on real time flood forecasting should be taken up by NIH.

Shri R M Bhardwaj stated that there is a wide variability in the estimates of water resources of India and there is a need for accurate estimation of water resources. He also emphasized that with increase of population per capita availability of water would be reducing and demand for water is going to increase and therefore technology should be developed for recycle and reuse of water.

Dr. R Vishwanatham opined that there is a need for carrying out studies for reducing reservoir sedimentation. He stressed that NIH has carried out some work on sedimentation of reservoirs and the results obtained by NIH should be used in practice.

Shri V Tamilarasan expressed his happiness on the Vision Document and thrust areas. He felt that availability of data for carrying out the hydrological studies is one of the main problems. He stressed the need for sharing of data and development of common formats for processing, analysis, retrieval and sharing of data.

Shri M R Chakraborty opined that floods and droughts are important areas of research and dam safety and water resources management projects coming for clearance to CWC require the knowledge and procedures on these aspects. He also stated that DSS (P) would also be quite useful for integrated water resources development and management. He stressed that water quality management is also an important area of research as quality of water is deteriorating due to point and non-point pollution.

Shri N Y Apte felt that in addition to the thrust areas identified by NIH, the social aspects as well as social benefits resulting from the studies should also be studied. Dr. V V S Gurunadha Rao stated that there is a need for carrying out studies on climate change. He also made a presentation on impact of climate change on water resources. The presentation made by Dr. V V S Gurunadha Rao was appreciated by the members of the Working Group meeting.

In response to the various suggestions / observations / comments of the Working Group members, the Chairman, Working Group informed that due to manpower constraints, the Division on Climate Change is not functional at NIH. But, a Climate Change Cell has been set up. He also informed that Climate Change Cells have also been set up at CWC, CGWB and Brahmaputra Board and roles of these cells have also been defined. He further explained that after the man power improves in future, then only a Division on Climate Change could be set up at NIH. The studies related to problems of arid zone are being carried out under the theme of Drought Management Studies. About the procurement of instruments on isotopic data collection, the suitability of the isotopic data collection instruments would be studied and the instruments would be procured as per the requirement of the Institute. With regard to the capacity building, the Chairman informed that NIH is organizing the training courses / seminars / symposia / national and international conferences. During the previous year, 17 such activities have been carried out. The Chairman informed that studies on Floods and Drought Management are being carried out by the Institute and studies on flooding due to landslides and glaciers would also to be taken up by the Institute based on the availability of manpower at the Institute. He also informed that a study on soil moisture assessment is being carried out in collaboration with IIRS, Dehradun and a presentation on the results of the study would be made during the meeting.

While responding to carrying out studies on flood forecasting, the Chairman informed that NIH is not an operational organization but the Institute would be carrying out the studies on

applications and development of flood forecasting models. He also informed that the website of the Institute is being upgraded and the information regarding important studies carried out by the Institute will be placed on the website.

The Chairman also informed that the Institute has carried out a number of studies on reservoir sedimentation and the issues raised by the Working Group Members would be further studied under the thrust area of sustainable water resources management. He also stated that regarding sharing of data, guidelines are being prepared by the Ministry of Water Resources.

ITEM NO. 30.2 CONFIRMATION OF THE MINUTES OF THE 29TH MEETING OF THE WORKING GROUP

Shri Rakesh Kumar, Scientist F and Convener informed that the 29th meeting of the Working Group was held during 30 September – 01 October, 2008 and the minutes of the meeting were circulated to all the members and invitees vide letter no. RCMU/WG-29/NIH-08 dated 20th October 2008. No comments have been received on the circulated minutes. The members did not offer any comments. The minutes were confirmed.

ITEM NO. 30.3 PRESENTATION & DISCUSSIONS ON THE PROGRESS OF THE WORK PROGRAMME OF THE FIVE DIVISIONS FOR THE YEAR 2008-09 INCLUDING THE ACTIONS TAKEN ON THE DECISIONS OF THE LAST MEETING AND

ITEM NO. 30.4 PRESENTATION AND FINALIZATION OF THE NEW WORK PROGRAMME OF THE FIVE DIVISIONS FOR THE YEAR 2009-10

During the meeting the status of current year's (2008 – 09) work programme as well as the new proposed work programme were discussed division-wise. The Chairman urged the Heads of the Divisions to make the presentations and advised that the progress of each study should be presented with the details of objectives, progress made, results and outcome. He also desired that the research work carried out during the recent six months should be explained in detail.

The division-wise progress of each study of the following Divisions was taken up for discussions:

On April 8th, 2009

1. **Environmental Hydrology Division**
2. **Hydrological Investigations Division**
3. **Ground Water Hydrology Division**

On April 9th, 2009

4. **Surface Water Hydrology Division**
5. **Water Resources Systems Division**

The details of division-wise presentations and discussions are given as follows.

ENVIRONMENTAL HYDROLOGY DIVISION

Dr. V.K. Choubey, Sc. F & Head (EHD), presented overview of technical activities & progress of the Division made during last six months. Thereafter, he requested the concerned Co-investigators to present the detailed progress of the studies made during past six months. The minutes of each study are given below:

1. ASSESSMENT OF GROUND WATER QUALITY IN CLASS - I CITIES IN INDIA (CPCB SPONSORED PROJECT)

Dr V K Choubey requested Dr M K Sharma to present the progress of the project study. Dr Sharma presented the research proposal in brief. He informed that out of 25 class I cities, current year 12 class I cities will be covered and pre-monsoon sampling of six cities viz; Guwahati, Shillong, Agartala, Aizawl, Kohima and Itanagar have been completed. Thirty samples from open wells, ring wells, bore wells and handpumps from each of these cities covering residential, industrial, petroleum storage, landfill sites have been collected and are being analysed for various water quality constituents viz; major cations and anions, metal ions, pesticides and bacteriological parameters. Dr Sharma further informed that the sampling from the remaining six cities will be carried out in the month of April and May 2009. Dr S K Jain enquired the need of irrigation quality of ground water in case of cities (urban areas). Dr Sharma replied that the ground water is well being used for gardening purpose in the cities that is why irrigation quality is also being taken care of. Dr V V S Gurunadharao suggested to

increase the number of samples. Dr R M Bhardwaj informed that the objective of project study is just to create base line water quality data for each class I Cities of India and is to be completed within the scheduled time framework and only thirty number of samples are being collected from each cities.

2. HYDROLOGICAL STUDIES FOR RESTORATION OF THE RENUKA LAKE, DISTRICT SIRMAUR (HP)

Dr V K Choubey requested Shri Omkar Singh, to present the progress of study. Dr. R.D. Verma appreciated the study of the Renuka lake. He suggested to adopt biological means for conservation and restoration of the lake. Dr. S.V. Nevada enquired about isotope analysis of the lake water samples collected to study the isotopic characteristics of the lake. Shri Omkar Singh informed that water samples have been analysed in the Isotope laboratory and being interpreted. Dr. V.V.S. Gurunadharao wanted to know about phosphate induced eutrophication in the lake and he suggested that this lake is a phosphate limiting lake. Shri Omkar Singh noted the valuable suggestions for including in the report and informed that final report is under preparation.

3. MODELLING OF PESTICIDE TRANSPORT IN GROUND WATER – A CASE STUDY OF METROPOLITAN CITY – VADODARA

Dr M K Sharma presented the progress of the study and elaborated the results of the sampling carried out in December 2008 and batch experiment for adsorption of lindane on soil for optimizing condition for the column study for different operating variables. Dr R D Verma appreciated the work carried out. Dr V V S Gurunadharao suggested to refer the work carried out by NGRI in Vadodara region and agreed to provide a copy of report on the related work carried out by NGRI for reference purpose. Dr Sharma noted the suggestion and further informed that State authority Ground Water Resources Development Corporation Ltd. (GWRDC), Gandhinagar, Gujarat has provided the ground water data for carrying out the modeling. Dr A K Keshari, IIT, Delhi has been contacted for providing the technical guidance. Dr Keshari has agreed to be involved for carrying out the modeling study. The Chairman approved the propose change in the study group.

4. EVALUATION OF WATER QUALITY OF RIVERS JOINING TEHRI RESERVOIR AND DOWNSTREAM OF THE RESERVOIR

Dr V K Choubey informed that this study has been referred by MOWR. Dr M K Sharma presented the objectives and progress of the study and elaborated the results of the sampling carried out in December 2008. He informed that the results could not be appropriately

interpreted on the basis of one month monitoring data. The chairman suggested to carry out the sampling on bimonthly basis to get the clear picture about variation in water quality of the rivers joining the Tehri reservoir and downstream of the reservoir.

5. IMPACT OF SEWAGE EFFLUENT ON DRINKING WATER SOURCES OF SHIMLA CITY AND SUGGESTING AMELIORATIVE MEASURES

Dr. V.K. Choubey informed that this study being funded by NIH under the PDS component of the HP-II. He informed that as per follow up actions with the I&PH Department (Govt. of H.P), a field visit is proposed in the study area during April/May, 2009 for preliminary investigations and selection of monitoring sites for hydro-meteorological and water quality parameters. The Working Group members noted the progress of various on going studies and recommended for taking up the new studies during the year 2009-10 by Environmental Hydrology Division. The programme of studies for the year 2009-10 of Environmental Hydrology Division is given as Annexure – I.

HYDROLOGICAL INVESTIGATIONS DIVISION

Dr Bhishm Kumar, Sc F and Head of the H. I. Division presented the brief details of various studies being carried out under the H. I. Division along with number of research papers published/accepted for publication/communicated and analytical work carried out at the Nuclear Hydrology Laboratory. The progress of studies was presented by the respective P.I. of the study. The details are given as under:

1. SURFACE WATER AND GROUNDWATER INTERACTION AT SELECTED LOCATIONS ALONG RIVER YAMUNA IN NCT, DELHI

Dr. Sudhir Kumar presented the progress of the study. He informed that earlier ten piezometers were installed along the river Yamuna in June 2007 (5 each on both sides of the river) and eight more piezometers were installed in August 2008. One more cross-section of existing hand pumps near village Jhangola, was used for collecting samples. Therefore, now water samples are being collected from twenty six existing wells (18 piezometers, 6 shallow hand pumps, 1-shallow tube well, 1-Renney well) located along 3 cross sections across the Yamuna River along with water sample from the river Yamuna. Water levels in piezometers are measured at 15 days interval on both the sides of the River Yamuna while rainwater samples are collected, whenever it occurs, since July/August 2007. The isotopic composition of $\delta^{18}\text{O}$ in rain varies from -0.41‰ to -9.31‰ . Isotopic analysis of the groundwater and

river water samples collected till February 2009 have been completed, The analysis indicates that Yamuna is recharging groundwater on Delhi side (Palla sector) mostly during flood season. Dr. Kumar indicated the velocity of groundwater flow at different locations (location of piezometers) and informed that the river water takes normally 3 years to reach at the pumping location (particularly at Renney well). Groundwater velocity in the floodplain has been confirmed through salt dilution experiments carried out during February 2009. He further informed that due to floods in Yamuna River in August 2008, the floodplain on the Delhi side of the River by upto 3 meters. The flood water that has recharged the shallow aquifer will make the groundwater available for the next couple of years. The average contribution from floodplain to the pumped water has been estimated to be 39% and 50% for the water years 2007-08 and 2008-09 respectively. However, the exact contribution of the river Yamuna will be estimated after getting more data from the newly installed piezometers.

Chairman asked that the pumping of river water during the lean flow period was required to be evaluated as the river has more than the required discharge during the monsoon season. Dr. Sudhir Kumar informed that the seasonal contribution of the river was evaluated during the year 2007-08 that varies from 7% to 40%. The same will be evaluated for the year 2008-09 and details will be provided in the report of the study. But, it appears that the river water that enters in the flood plains during the monsoon season continues to be pumped during the other seasons keeping in view the long time travel. Dr. B.P. Singh suggested to carry out the mathematical modelling of recharge in the floodplain. Dr. Bhishm Kumar informed that the modeling exercise will be taken up in the IInd phase of the study (2009 - 12).

2. NATIONAL PROGRAMME ON ISOTOPE FINGERPRINTING OF WATERS OF INDIA (IWIN)

Dr. M. S. Rao presented the progress of the study. He informed that during the period from August, 2008 to 31st March, 09 total 753 samples (air moisture, groundwater, precipitation and river) have been collected from NIH IWIN Centres (Roorkee and Sagar) and the same were analyzed. He further informed that isotopic composition of air-moisture during the monsoon season is $\delta^{18}\text{O} = -13\text{‰}$ with $D_{\text{excess}} = 70\text{‰}$ whereas, in the post monsoon this changes to $\delta^{18}\text{O} = -5\text{‰}$ with $D_{\text{excess}} = 30\text{‰}$. This change in D_{excess} can be effectively used in monitoring the arrival and withdrawal date of monsoon vapors. During the monsoon period, the peaks RH and D_{excess} correlates well in time but on temperature data they appear 2 months after reaching of summer maximum temperature. The hourly data on isotope in air-moisture indicate isotopic variation in air moisture over day & night due to vertical atmospheric dynamics. With regards to surface-water groundwater interaction, it was reported that the Upper Ganga Canal at Roorkee recharges the shallow aquifers over a distance ~2km across

the canal beyond which the local precipitation dominates. While investigating of methodological details, it was observed that separation of moisture is complete and rapid using liquid nitrogen condensers whereas the condensation methods normally using ice as condensing medium cause incomplete retrieval of moisture and thus can lead to erroneous results.

In response to the query made by Dr. Navada on altitude dependent changes in isotopes in air moisture at Roorkee station, Dr. Rao informed that such variations are normally observed for altitude variation over several 10s of meters whereas within 20 meters of altitude variation such changes are not observed and the supporting results were shown in the last Working Group meeting. Dr. Apte asked whether it is possible to distinguish the source of moisture to the Bay of Bengal or Arabian Sea. Dr. Rao informed that it is possible and also informed that Dr. Anendya Sarkar from IIT Kharagpur has published a paper on similar lines. Dr. V.V.S. Gurunadha Rao suggested for looking at vapor pressure in order to correlate it with isotopic data on air-moisture. Dr. Rao noted the suggestion.

3. IMPACT ASSESSMENT OF LANDUSE ON THE HYDROLOGIC REGIME IN THE SELECTED MICRO-WATERSHED IN LESSER HIMALAYAS, UTTARAKHAND

Dr. S. P. Rai presented the progress of the study. He informed that two watersheds, namely Bansigad and Arnigad near Musoorie, have been selected for hydrological studies. The Arnigad micro-watershed covers an area of 2.85 km² and is covered with dense Oak forest and its altitude varies between 1640 m and 2220 m. While the Bansigad micro-watershed covers an area of 1.9 km² and lies between altitudes 1600m to 2060 m. He further informed that the landuse type in this watershed is degraded oak and pine mixed forest and agriculture. Dr. Rai informed that a hydro-meteorological observatory has been installed in each watershed. Also, a compound Notch along with an automatic water level recorder has been constructed at the outlets of both the watersheds for monitoring the discharge data continuously. Suspended sediment data and TDS are also being collected on daily basis. The data collected for different hydrological variables during June, 2008 to December, 2009 were presented along with trends in variation. The preliminary results indicate that the runoff coefficient is higher in the degraded watershed in comparison to the forested watershed. The pattern of discharge w.r.t. rainfall was presented for both the watersheds. Analyses of the sediment data indicates high rate of erosion from the degraded watershed as compared to the forested watershed.

Dr. Rai informed that water samples are being collected from both V notch sites on daily basis for $\delta^{18}\text{O}$ and δD and ^3H analyses. About 250 samples have been analysed out of 500

collected so far during the past six months. The interpretation of the isotopic data and the isotopic analyses of remaining samples are in progress.

Dr. V. Tamilarasan enquired about the method followed for the determination of sediment yield. Dr. Rai informed that gravimetric method is being used for this purpose. Dr. B. P. Singh enquired about the criterion of dense and degraded forest cover. Dr. Rai informed that canopy cover density has been taken into consideration for categorizing the watershed. Dr. Parmer enquired about the procedure of determining the TDS. Dr. Rai informed that after filtering the sample, the remaining water was evaporated in oven at 60°C and difference of weight gives the TDS per litre. Dr. S.P. Agrawal pointed out that sediment yield looks lower in comparison to average sediment yield reported in other cases, particularly in Uttarakhand. Dr. S. P. Rai explained some difficulties in taking the samples during the time rainout process or immediately after the rain due to which our estimate may be lower. Therefore, the points raised by Dr. S. P. Agrawal will be considered for further cross check during the coming monsoon season.

4. ESTIMATION OF IRRIGATION RETURN FLOW IN SELECTED CANAL COMMAND AREAS IN UTTARAKHAND AND UTTAR PRADESH

Dr M. S. Rao informed that the proposal of this study was presented in the meeting of INCID on 22nd Jan., 2008, at CWC, New Delhi. Formally the project was approved in the meeting with the suggestion that estimation of regeneration of river/canal water should be included in the proposal along with the water quality. In the mean time WALMI Lucknow showed its willingness to be one of the partners of this project. As earlier IRI, Uttarakhand was the partner of this project which later on disassociated therefore, the revised proposal after including the WALMI, Lucknow as partner of the study and incorporating the suggested modifications was submitted again to the INCID. But on recent enquiry, it was told that approval of the project at the level of MoWR will take some more time. Dr. Rao informed that this project will be taken up only after its approval from INCID.

5. GROUNDWATER MANAGEMENT IN OVER- EXPLOITED BLOCKS OF CHITRADURGA AND TUMKUR DISTRICTS OF KARNATAKA

The study was presented by Dr. Sudhir Kumar. He informed that this study has been approved as a purpose driven study under the Hydrology Project II and yet to start. He further informed that the present study involves a comprehensive multi-institutional, multi-disciplinary and multi-locational study approach. The Groundwater Department of Karnataka State would provide crucial inputs pertaining to hydro-geology, hydrology, land use etc. Conjunctive use of surface/ groundwater, artificial recharge/ draft regulation and institutional

interventions would be crucial decision variables. After a detailed understanding of hydrogeology, hydrology and land use practices, conceptual and real-life models (specific and general) would be developed within Simulation-Optimization framework to arrive at policy guidelines for managing and regulating the groundwater resources by state agencies. The services of experts in groundwater management and modelling will be hired to achieve the output as per the objectives and to finalize the policy guidelines for optimal groundwater management. The project will seek to build strong linkages between stake holders and regulating agencies through capacity building strategies for effective groundwater governance and harmonized groundwater use. He informed that the programme of work for the next six months along with the budget to utilize during the current financial year was presented during the last Working Group meeting. However, significant progress could not be achieved so far due to some administrative reasons.

6. GROUNDWATER DYNAMICS OF BIST-DOAB AREA, PUNJAB USING ISOTOPES

Dr. M. S. Rao informed that this study has started in Nov. 2009 with objectives to identify recharge zones, recharge sources and flow pattern of groundwater in BIST Doab. In a field work carried out during the month of January 09, total 90 groundwater and 10 surface water samples were collected and analyzed for isotopic systematics. From the preliminary investigations it was inferred that the groundwater in the Bist Doab is formed mainly due to mixing of Satluj River water and local precipitation. For the detailed investigation, sampling stations will be established in 2009-10 to collect river water, groundwater and rainwater samples at regular intervals. For monitoring of groundwater hydrograph in multiple aquifers, data loggers will be installed at 2 -3 locations. However, due to some administrative problems significant progress could not be made under this project.

7. IDENTIFICATION OF SOURCE OF SEEPAGE AND LOCATION OF SEEPAGE IN TEHRI DAM USING ISOTOPIC TECHNIQUE

Dr. S.P. Rai informed that a request was received from the Tehri Hydro Power Corporation, Tehri (THDC) in order to identify the source of leakage/seepage in the first stage and then the location of seepage in the reservoir. Later on, it was decided that THDC will collect the water samples as per the advice of NIH and also provide the required hydrological data to NIH. He presented the progress of the study. He also pointed out that there are two locations of seepage in the reservoir that are contributing seepage in drainage galleries AGR-3 and AIGR. He further informed that isotopic and discharge data reveal 5 to 7 days time lag between the water entry from the reservoir and its appearance from the seepage points in the drainage galleries. Dr. Rai also presented the variation of reservoir level with seepage discharge that

indicates that reservoir is the source of seepage in AGR-3 and AIGR galleries. But he showed that the isotopic evidences reveals reservoir as the major source of seepage only in five cases (D5, D6, D7, D10 and D11) while the isotopic signature of seepage from the sixth location (D9) do not match with the reservoir. He further showed that D9 bears the signature of groundwater which indicate that seepage through D9 is due to recharge from precipitation. The Working Group members noted the progress of the study. Dr. Rai also pointed out the elevation range of the seepage points in reservoir in both cases i.e., seepage locations of D5, D6, D7 and , D10, D11 groups in reservoir.

Dr. Gurunath Rao suggested that TDS can also be considered to distinguish the source of leakage i.e., reservoir or the groundwater. Dr. Rai informed that the EC has been measured for the reservoir and seepage water, hence it will be cross checked whether it works or not in the present case. Dr. B. P. Singh enquired that how seepage from D9 is considered as ground water? Dr. Rai informed that isotopic signature of seepage from D9 location is in close correlation with hand pump (groundwater) water, while it does not match with the isotopic signature of reservoir water from any depth.

8. INTEGRATED HYDROLOGICAL INVESTIGATIONS OF ROPAR LAKE, PUNJAB

Dr. Bhisim Kumar informed that it is a new study being proposed by the Division. He further informed that earlier it was planned to take up a study on Pushkar Lake in Rajasthan and accordingly it was included in the agenda notes which were circulated to the Working Group members. However, during the study on groundwater dynamics in the Bist-Doab region, it was informed by the CGWB that the water to the region was being supplied by the canals coming from the Ropar lake and the discharge and running days of the canal has decreased in recent years which may be the cause of groundwater scarcity in this region besides the more withdrawal of groundwater for irrigation. So it was decided to take up study on the Ropar lake which is Ramsar site and needs to be studied for the various problems being faced by it. Results of the two studies would be helpful in understanding and managing the hydrological problems in the area. Dr. Verma informed that the study of Pushkar Lake is also a very important one therefore, whenever the study of Pushkar Lake is taken up, Prof. Rohit Goyal and Prof. A. B. Gupta of MNIT, Jaipur should be consulted as they have done work on the lake. . Dr. Bhisim Kumar informed that the study of Pushkar Lake would be taken up after the completion the study of Ropar Lake.

Shri. S. D. Khobragade presented the study on Ropar Lake. He informed that the Ropar Wetland is a manmade lake constructed on river Sutlej for diversion of water into Sirhind canal. It is located at about 45 Kms. in the north-west of Chandigarh at 30°57'-31006' N

latitude and 76°25'-76°36' E longitude at an elevation of 275 m amsl. It is a shallow wetland with a maximum depth of 6 m and has water spread area of 8 sq. km. He further informed that the wetland is extremely important ecologically, economically and socially. The water of the lake is being used for irrigation and industrial use and the water being supplied through the canal is subsequently being used for drinking also. It is an important destination for tourism and recreation. It has a high ecological value as 119 species of birds and 20 species of fishes have been reported in this wetland area. It was declared as wetland of national importance in 1992 by Ministry of Environment & Forests, Govt. of India and was included in the Ramsar List of Wetlands of International Importance in 2002. However, the lake is facing many environmental threats. Important threats include siltation, encroachment, eutrophication and pollution etc. He further informed that very little conservation work has been implemented on the lake which included plantation in 30 ha, 12000 ft. fencing and soil conservation works in 121 ha out of 4700 ha area which require treatment. He said that no scientific investigations have been carried out so far to evolve the conservation and sustainable development of the lake. He informed that the objectives of the study would include the evaluation of water balance parameters, sedimentation rate and expected useful life, water quality and pollution aspects, water quality modeling of the lake and to suggest the suitable measures for the proper conservation and sustainable development of the lake.

Dr. Gurunadha Rao enquired about the various aspects which would be considered under the water quality modeling. Sh. Khobragade informed that modelling of eutrophication of the lake would be attempted. Dr. Jayakumar informed that a study on Asthmudi Lake in Kerala, which is also a Ramsar site, has been completed by the CWRDM and the report is likely to be completed within 15 days. He said that the report would be sent to NIH for reference.

The Working Group members noted the progress of various on going studies and recommended for taking up the new studies during the year 2009-10 by H.I. Division

The programme of studies for the year 2009-10 of the H.I. Division is given as Annexure - II.

GROUND WATER HYDROLOGY DIVISION

Dr. N. C. Ghosh, Scientist 'F' & Head, Ground Water Hydrology Division presented the general overview of the activities of the division. He also briefly reported about the other scientific and administrative works carried out by the division during the year 2008-2009 and

the scientific papers published /sent for publication by the scientists. Study-wise suggestions and discussions emerged are given below:

1. MITIGATION AND REMEDIATION OF GROUND WATER ARSENIC MENACE IN INDIA

Dr. N. C. Ghosh informed about the background for taking-up this study. He indicated that a vision document is being prepared involving experts from the respective topics related to mitigation and remediation of ground water arsenic menace in India. Mr. M. R. Chakraborty enquired if the geological formation is responsible for arsenic menace. Dr. Ghosh explained about various hypotheses in this regard. Dr. R. D. Verma pointed out that impact of arsenic on human health is very serious. He suggested to investigate proper adsorption phenomenon in order to find out an economic solution for arsenic problem. Dr. V. V. S. Gurunadha Rao opined that optimum pumping scheme should be suggested for arsenic affected areas. Dr. G. C. Mishra indicated that in a previous study carried out by NIH, several peaks were observed due to dewatering, which implies localized nature of the problem due to source of arsenic in the geological strata. He suggested to take soil samples upto water table for analysing their arsenic content, accordingly in-situ remediation measures can be planned. Dr. Mishra further suggested to check the efficiency of equipment by checking the arsenic content before and after filtering. It was informed by Dr. Ghosh that two more chapters are yet to receive and the document would require a series of review and editing and hence may come out by May, 2009.

2. QUANTIFICATION OF IMPACT OF RAINWATER HARVESTING ON GROUNDWATER AVAILABILITY IN ARAVALLI HILLS

Dr. Anupma Sharma explained about background and objectives of the study, data monitoring and field investigations being carried-out in Savana macro-watershed, tracer studies being undertaken and current progress of the study. She also presented the qualitative influence of the impact of water harvesting structures on the availability of groundwater in Gangeshwar watershed. Dr. Anupma Sharma also informed that "Wells for India" is supporting in data monitoring and field investigations for this study. Dr. V. V. S. Gurunadha Rao enquired about the spread area of anicut and opined that this study will also be useful in the context of climate change due to extreme rainfall events. Mr. K. B. Parmar suggested that integrated water balance study may be taken-up. Dr. Tamilarasan observed that drainage density of the study area is very high and suggested to quantify the impact of rainwater harvesting structures. Dr. G. C. Mishra indicated that due to high evaporation, soil moisture deficiency will be high. Therefore, it needs to be ascertained how much water is actually getting recharged to groundwater system. Dr. Mishra further suggested to find the rise in

water table through Hantush solution. Chairman suggested to conduct groundwater modeling study in order to find the impact of rainwater harvesting structures on groundwater availability in the study area.

3. IMPACT OF CLIMATE CHANGE ON DYNAMIC GROUNDWATER RECHARGE IN A DROUGHT PRONE AREA

Mr. C. P. Kumar presented brief background about climate change and its likely impact on groundwater resources. He also explained about the study area (Sonar basin, Madhya Pradesh) and proposed methodology (using Visual HELP and Modflow) to find the impact of climate change on groundwater recharge. Dr. B. P. Singh indicated that the study should be conducted in an area where change in climate has been observed. Chairman clarified that outputs of the Global Circulation Model are downscaled to the basin scale and accordingly used in the climate change studies. Dr. G. C. Mishra suggested that runoff should be computed in the study area alongwith use of a distributed model. Mr. C. P. Kumar informed that due to simplistic approach and ease of use, Visual HELP has been proposed to be used in this study. Mr. Kumar further informed that the same methodology has been used by other researchers during last few years. Mr. Rakesh Kumar suggested exploring the possibility of using MIKE-SHE software package.

4. WATER TABLE EVOLUTION DUE TO SUBSURFACE DRAINAGE WITH ARBITRARY RECHARGE USING A NUMERICAL MODEL

The proposed study could not be discussed because Dr. S. K. Singh, the proposer of the study was absent in the meeting.

The work programme finalized for the division for the year 2009 - 10 is given as Annexure - III.

SURFACE WATER HYDROLOGY DIVISION

Shri Rakesh Kumar, Scientist F and Head of the Surface Water Hydrology Division presented brief details of various studies being carried out under the Surface Water Hydrology Division along with number of research papers published/accepted for publication/communicated as well as other research and technical activities carried out by the Division. The progress of individual studies was presented by the respective P.I. of the study. The details are given as under:

1. DEVELOPMENT OF DROUGHT VULNERABILITY INDICES FOR PREPAREDNESS AND MITIGATION

Dr. R.P. Pandey presented details of the project and explained the methodology used for assessment of drought vulnerability and for derivation of integrated drought vulnerability indices for preparedness and mitigation. He informed that the study was taken up for five sites representing different climatic zones, physio-graphical heterogeneity, cropping systems and socio-economic conditions, etc. The relevant data/information/maps etc. have been obtained from various sources. Inventories of drought events and physiographic conditions for different study sites were prepared. During previous year the Sonar basin observed delayed onset of monsoon and it has affected the cropping pattern to large extent. To study the effect of delayed monsoon the survey was conducted in Patharia, Batiagarh and Damoh blocks of Damoh district falling in lower catchment area and Kesli block of Sagar district falling in upper catchment of Sonar river basin. Generally region experiences onset of monsoon in second week of June but this year monsoon was delayed by 3-4 weeks. In Sagar district monsoon started in last week of June and in Damoh district monsoon started in 2nd week of July. In Damoh district monsoon effectively started from 14th July in almost all blocks and the cultivation could be started in 3rd week of July. Similarly, investigations were conducted for other sites too. Drought conditions also prevailing in Mahaboobnagar, district of A.P. during the year 2006 and 2007 and the crops were significantly affected both in kharif and Rabi seasons. However, in other sites namely, Balangir, Nanded, and Bijapur normal rainfall occurred and no drought conditions were observed in above three sites during past two years. Hydro-meteorological data were analysed and Standard Precipitation Index(SPI), Effective Drought Index (EDI), Decile Index and percent deviation from normal were applied for identification of droughts. Also relationship of evapotranspiration/precipitation (EP/Pa) with SPI, EDI, % normal Pa, Decile Index were developed to examine the applicability of above indices at different sites. The classification of the indices was revised for their suitability at the sites of NIH. Further, fine tuning of the proposed methodology and report writing are in progress.

2. INTEGRATED WATER RESOURCES MANAGEMENT OF SUB-BASIN TO COPE-UP WITH DROUGHTS

Dr. R.P. Pandey presented details of the study. He informed the various objectives and methodology of the study. The study will be carried out for the Tons sub basins lying in Madhya Pradesh. The visit for the study area was taken up for preliminary investigations and data collection during December 2008. Concerned agencies like CWC and IMD have been contacted for obtaining the discharge and meteorological data. Toposheets and other

information is being obtained from various sources. The Chairman suggested that this study is very important to cope with drought problems for integrated water resources management of any basin.

3. IMPACT OF CLIMATE CHANGE ON THE FLOW CHARACTERISTICS OF BEAS RIVER AT PANDOH DAM SITE

The study was presented by Dr. A.K. Lohani. He informed that the present study is taken up under the action plan chalked out by Ministry of Water Resources under the National Action Plan for Climate Change. Prime Minister's Council on Climate Change, during its first meeting decided that MoWR should initiate studies for major rivers whose waters come from snow melt. In the action plan prepared by MoWR, it was decided that the NIH should carry out such studies in the Indus, Ganga and Brahmaputra basins. Further, Dr Lohani presented the objectives of the study and the progress of the work carried out from April, 2008 to March, 2009. He informed that the analysis has been completed and the draft report is ready. He further mentioned that Chairman advised to carry flow duration analysis with the base line flow data as well as flow data generated for the different climatic scenarios in order to study the impact of climate change on dependable flows. Dr S.K. Jain, Scientist 'F' enquired about the difference between the present study and the Purpose Driven Study (PDS) proposed under HP-II in which Dr Sanjay Kumar Jain is PI. Dr Lohani informed that the present study is carried out as per the requirement of Ministry of Water Resources and it has some limited scope and objectives. Further, Chairman informed that the present study is having some specific objective and the results of this study will be used in another study related to reservoir operation under climate change scenario. Further, Dr. Sanjay Kumar Jain Scientist E1 informed that the results of this study will be the part of the PDS as it covers one of the objectives of the PDS study.

4. IMPACT OF CLIMATIC CHANGE ON THE FLOW CHARACTERISTICS OF A SUB-BASIN OF GANGA BASIN (BHAGIRATHI BASIN UP TO TEHRI DAM)

Dr. Sanjay Kumar presented the study on "Impact of Climatic Change on the Flow Characteristic of a sub-basin of Ganga Basin (Bhagirathi Basin up to Tehri Dam)". He gave the brief background and explained the methodology adopted in the study. He informed that Snow Cover Area (SCA) of the study area is calculated using satellite data (MODIS) in different elevation zones (twelve zones). The capabilities of the SNOWMOD model and the details of the hydro-meteorological data used in the model were presented. Dr. Sanjay Kumar explained the effect of the temperature change on the runoff characteristic of the Bhagirathi river at Tehri and presented the simulated runoff using the SNOWMOD model and explained

the findings of the study. Mr. Apte suggested to refer the studies on climatic change conducted by IITM Pune.

5. MONITORING AND MODELING OF STREAMFLOW FOR THE GANGOTRI GLACIER

Dr. Manohar Arora presented the progress of the ongoing study. He intimated the working group that the data collected earlier have been analysed and the report has been submitted to the DST. All the objectives laid down in the project were achieved. Since the last year the investigations in the Gangotri glacier are being carried out by the Institute funds. He presented the hydrological and hydro - meteorological data for the ablation season 2008. The installation of an AWS at the observatory at the Bhojwasa site will be taken up during this season. The techniques for discharge measurements being followed elsewhere in other headwaters of Himalayan basin were also explained.

6. MODELLING OF SUSPENDED SEDIMENT CONCENTRATION USING ARTIFICIAL NEURAL NETWORKS

Shri A. R. Senthil Kumar presented the objectives, brief methodology, development of ANN models and results of the study. He explained the results achieved during recent six months. He also explained the methodology adopted in estimating the status of the reservoir storage for the next 100 years using Artificial Neural Networks (ANN). Shri B. K. Parmar, Superintending Engineer, CDO, Gujarat suggested to put the sediment load in tons/hectare/year. Shri Senthil kumar replied that it would be incorporated while preparing the final report of the study.

7. INTEGRATED HYDROLOGICAL STUDY FOR SUSTAINABLE DEVELOPMENT OF TWO HILLY WATERSHEDS IN UTTARANCHAL

Dr. Avinash Agarwal presented the progress of the project. He informed about the previous progress of the project in relation with the old instrumentation, data status, analysis of spring flow, flow duration curves, spring rainfall analysis, delineation of recharge zone infiltration and rainfall characteristics and water balance. Further he informed that the instruments required in the second phase of the project have been procured and installed at the watershed sites. He added that the shape file for watersheds for drainage characteristics, land use, soil texture, springs, tanks and instruments sites have been prepared using Arcview and the sediment sampling on both the watersheds is continuing. He also informed that the soil texture for Anjanisain watershed is not available and will be taken from National Soil Survey Atlas. He informed that the work on modelling is in progress.

8. HYDROLOGICAL STUDIES IN A FORESTED WATERSHED IN UTTARAKHAND

Dr. J.V. Tyagi presented the progress of the project. He explained the background, objectives, progress and the results of the study. It was informed that the project is being carried out in collaboration with Forest Training Academy (FTA), Govt. of Uttarakhand in a Sal forested watershed of about 17 ha in Nainital District. Among a number of factors that affect the natural regeneration of Sal, a majority of the factors remain more or less uniform over a small area as of the present study. However, the soil moisture, soil erosion, and light intensity vary spatially depending on the canopy density, and the variation of these factors could be attributed to differential regeneration under various canopies. Therefore, the main objectives of the project were to study the variation of soil-hydrological and environmental parameters viz. soil moisture storage, light intensity and soil erosion under various micro-environments due to overhead canopy and their effect in terms of the variation in natural regeneration of Sal. Besides the progress made during current year, the preliminary results of study, based on the so far available data of 4 1/2 years, were presented. It was further informed that the natural regeneration in Sal species is affected by the 'dying back phenomenon' which results in a very slow progress towards establishment of the seedlings. Therefore, a long-term data on regeneration, soil moisture storage and light intensity is needed to account for 'dying back phenomenon' and to develop suitable relationships among various parameters and the regeneration.

9. RUNOFF AND SEDIMENT MODELING IN A PART OF THE BRAHMAPUTRA RIVER BASIN IN INDIA

Mrs Archana Sarkar presented the background, objectives, methodology and progress of the study. Mrs Sarkar informed that the study area includes three gauging sites on one northern tributary. She informed that ANN models for stage-discharge and sediment-discharge at three selected gauging sites namely, Choulduaghat, Pandu and Panchratna have been developed and validated with observed data. The correlations are more than 90%. Rating curves using conventional technique have also been developed for the three sites. She further informed that the meteorological data for Subansiri River basin (biggest tributary of Brahmaputra in India) has been procured and during the coming year rainfall-runoff modeling as well as sediment yield modelling would be taken up.

10. SNOW MELT RUNOFF MODELING USING FUZZY LOGIC

Dr A.K. Lohani presented the objectives of the proposed study entitled "Snow Melt Runoff Modeling Using Fuzzy Logic". He informed that during the snowmelt modeling of Beas

catchment using SNOWMOD model, it was felt that a fuzzy rule based model can be applied for the computation of snow melt runoff. Further he highlighted the methodology of the conventional snow melt modeling approach and its limitations. The Chairman advised to highlight the advantages of the fuzzy rule based system. Dr Lohani informed that the intelligent computing tools such as fuzzy logic can approximate virtually any (measurable) function up to an arbitrary degree of accuracy. The advantage of intelligent computing is that one need not have a well defined physical relationship for converting an input to an output. With fuzzy logic it is possible to describe available knowledge directly in linguistic terms and according rules. Quantitative and qualitative features can be combined directly in a fuzzy model. This leads to a modeling process, which is often simpler, more easily manageable and closer to the human way of thinking compared with conventional approaches. Dr Lohani informed that the fuzzy rule based approach would be applied to simulate snow melt runoff in the proposed study. An attempt will be made to use the same input data in the fuzzy model as used by the conventional snow melt model. Furthermore, fuzzy models will also be developed with the input vector comprising of temperature, snow cover area, rainfall and other available meteorological variables.

11. ENVIRONMENTAL FLOW REQUIREMENT FOR RIVER GANGA AT LOHARI NAGPALA POWER PROJECT SITE

Dr. Manohar Arora presented the results of the study completed on the "Environmental Flow Requirement of River Ganga at Lohari Nag Pala Power Project". He explained that the study was undertaken on the request by NTPC and in the limited time the study was concluded using the two approaches. He further reiterated that there are other methods available which can also be looked into and the study can be dealt in a fresh way for another two years. Dr Bhardwaj enquired about the data requirement and its frequency. Dr Arora explained that in the hydrologic method daily flow data is needed for the analysis. Dr R D Verma enquired how the portion on ecology was dealt since there is no expertise available at the Institute. Dr Arora replied that NTPC had outsourced the ecological work to an expert and the report was prepared by the concerned expert. However, final agreement on flow release was made considering the recommendations from the study carried out by NIH and the experts' opinion.

12. SNOW MELT RUNOFF MODELLING IN SUTLEJ BASIN

Shri A. R. Senthil Kumar presented the objectives, methodology and results to be achieved in the study. He also explained that SRM, SNOWMOD and ANN models would be used to simulate the snow melt runoff and comparison among the models would be carried out. He listed out the requirement of data for the study and proposed to procure satellite imageries for

10 scenes. Dr. Jayakumar suggested to compare the results of the conceptual models with soft computing techniques such as ANN, Fuzzy logic and Genetic Algorithm.

13. DATA BOOK-HYDRO-METEOROLOGICAL OBSERVATORY

Shri Digambar Singh presented the objectives and methodology of the studies. He also briefed that hydro meteorological data are observed daily and a data book containing the statistics of the observations would be prepared. Shri Apte, IMD, New Delhi enquired about the period of the data to be presented in the data book since NIH has got 25 years of data for NIH observatory. Shri Manohar Arora replied that such type of data books are already available up to 2000 in the Institute.

Working Group noted the progress of ongoing studies and recommended for taking up the new studies. The programme of the studies for the year 2009 – 10 of the Surface Water Hydrology Division is given in annexure – IV.

WATER RESOURCES SYSTEMS DIVISION

Dr. S.K. Jain, Scientist F and Head Water Resource Systems Division appraised the Working Group members about the various studies being carried by the WRS division. He also informed about other scientific and administrative works being carried out by the division. The various PIs presented the progress of the studies. The details of discussions are given below:

1. DEVELOPING DECISION SUPPORT SYSTEM (PLANNING) FOR INTEGRATED WATER RESOURCES DEVELOPMENT AND MANAGEMENT

Dr S K Jain presented the progress of the study. He informed that this study has five components (i) Surface water resources planning, (ii) Integrated operation of reservoirs, (iii) Conjunctive use of surface water and ground water resources, (iv) Drought management, and (v) Water quality management in a river basin. He also informed that DHI Denmark have been appointed as the consultants to develop the DSS. The consultant have initiated work and are currently visiting various states for familiarization, review of data availability and to identify the focus basin.

2. HYDROLOGIC STUDIES FOR KEN-BETWA LINK PROJECT

Dr S K Jain briefed about the Ken-Betwa link. Dr. Vijay Kumar presented the progress of this consultancy work. He informed that the work was done in two phases. The final report of Phase-I was submitted long back. The Phase-II study has also been completed and a final report was prepared and submitted to NWDA. As per requirement of NWDA, both the reports (Phase-I and Phase-II) were combined into one final report and this final report has been submitted to NWDA. It was also informed that a Chapter on 'Hydrology and Water Assessment' was prepared and same has been included in the DPR prepared by NWDA. Mr Parmar (SE, WRD, Gujarat) enquired about the diversion flood. Dr S K Jain explained that the estimation of diversion flood is for the construction phase of the dams.

3. IMPACTS OF DAMS AND DIVERSIONS ON HYDROLOGY

The progress of the study was presented by Mr D.S. Rathore. It was informed that in the study various GIS layers, namely basin, sub basin, river, dams, physiography etc. were prepared from atlas with plates in the scale of 1:2 M. A data base of the salient features of the dams was also prepared in database software, namely MS Access. This database was joined with the attribute table of the point map of dams in ArcGIS software. With this operation, the salient features are available in the GIS for query operations. Using the GIS, summery statistics of the storage for basin, state etc. can be prepared. Geographic coordinates of 1812 medium and major dams were entered in the database. In the data base, salient features of 614 dams and diversions have been included. Out of these, locations of 414 dams and diversions were available.

Evaporation estimation for five reservoirs was also done. Estimation was done on monthly basin using water level data for the reservoirs and evaporation rates (mean monthly). Annually, evaporation was nearly 6- 8% of the live storage for four reservoirs and nearly 23% for Jayakawadi. A review of the hydrological and morphological impact of the dams was also presented. The study is complete and the final report is under preparation.

4. DEVELOPMENT OF EMPIRICAL METHODS FOR ASSESSMENT OF THE RESERVOIR SEDIMENTATION

Dr. Sanjay K. Jain presented the objectives and scope of the proposed study. He informed that the data of a number reservoir have been collected and analyses have been made. Dr, Jain informed that depth, capacity of 87 reservoirs have been collected. Data of 69 reservoirs were found complete. On the basis of analysis, reservoirs have been classified into four types. For each type of reservoir, design curves have been plotted. In this way, coefficients for design

for Indian reservoir have been obtained. Dr. Sharad K. Jain further elaborated the work carried out. Member from APERL said that the study will be useful for reservoir sedimentation assessment. Chairman opined that the results of the study can be used to estimate revised capacity of the reservoirs.

5. USE OF REMOTE SENSING IN SOIL MOISTURE AND WATER BALANCE ESTIMATION – A CASE STUDY OF THE SOLANI CATCHMENT

Dr. Sanjay K. Jain presented the objectives and progress made so far. He informed that IIRS, Dehradun is also collaborating in this study. Chairman suggested that assessment of soil moisture using satellite data is one of the objectives of the study therefore it should be given adequate attention. Dr. S P Agarwal informed that microwave remote sensing data will also be used for assessment of soil moisture. Dr. Tamilarasan suggested taking data of RISAT for this purpose. Mr. Chakrovarty from CWC appreciated the work carried out.

Dr. Sharad K. Jain stated that the duration of this study was up to March 2009 and sought extension of the study for another term of three years in collaboration with IIRS. The Working Group agreed for extension of the study and Dr Agrawal of IIRS also expressed willingness to continue collaboration with NIH for this work. WG asked the division to prepare an interim report of the work carried out so far.

6. HYDROLOGICAL ASSESSMENT OF UNGAUGED CATCHMENTS (SMALL CATCHMENT)

Dr P K Bhunya presented the objectives and progress of the study. He informed the house about the new methods developed and the preliminary results which included a statistical table of annual peak flow data of 38 Indian catchments and three graphs showing a non-dimensional analysis of flood peaks and a comparison of synthetic methods to an observed flood hydrograph. He presented results of a new flow duration curve model using available data of 22 ungauged catchments in Mahanadi basin. Mr. Chakrovarty from CWC emphasized that the regional formulae for synthetic hydrographs were developed long ago and now RDSO is not collecting routinely data from gauging sites at bridge catchments.

Mr Rakesh Kumar informed that RDSO reports were prepared nearly 10 to 15 years ago and the present work will also utilize development in flood frequency analysis techniques. Recent and updated database for the study area will be used and representative parameters for the catchments will be obtained using advanced techniques. Any improvement obtained from advanced techniques will be highlighted. Mr. Chakrovarty emphasized to include regional flow duration curves as an objective in the study. Chairman informed that such studies had been completed earlier in sub-Himalayan catchments.

7. WEB-BASED RIVER BASIN INFORMATION SYSTEM FOR INDIA

Mrs. Deepa presented the progress of the study. She informed that a web based water resources information system is being developed. This year the information related to river basins of the country has been incorporated in the system and during the next year, the subbasin wise information including maps will be incorporated. She added that the software developed under this study can be used as a framework for integrating the hydrological information from national to sub-regional level. Such a system is useful to support decision making to address the river basin issues in a comprehensive manner. Dr Jayakumar suggested adding a disclaimer statement in the web-page.

8. INTEGRATED APPROACH FOR MODELING SNOWMELT RUNOFF AND EFFECT OF CLIMATE CHANGE IN BEAS BASIN

Dr. Sanjay K. Jain presented the background and objectives of the study and informed that the study has been started in September 2008. As a first step, a visit to Sundernagar/Pandoh was made in the first week of September 2008 and the following Data have been collected from BBMB, Sundar Nagar.

- Rainfall (1979-2007): Manali, Bhuntar, Largi, Banjar, Sainj, Janjhely, Pandoh
- Temperature (1986-2005): Manali, Bhuntar, Largi and Pandoh
- Discharge (1966-2007): Manali, Beas at Bhuntar, Parbati at Bhuntar, Thalout Tirthan Khad, Sainj Khad, Pandoh, Bhakli khad at Pandoh and Junikhad

The base maps (drainage/contour/DEM) of the study area have been prepared from Survey of India toposheets and converted into digital form. The Digital Elevation Model (DEM) has been divided into number of elevation bands. MODerate-resolution Imaging Spectroradiometer (MODIS) satellite data (weekly) for the study area has been obtained from National Snow and Ice Data Center (NSDIC). The Snow Cover Area (SCA) for the years 2000-2003 have been computed and depletion curve have been prepared. This snow cover area for different elevation bands has been computed using SCA maps and DEM. The procurement of instruments and satellite data has been initiated.

9. ASSESSMENT OF EFFECTS OF SEDIMENTATION ON THE CAPACITY/ LIFE OF BHAKRA RESERVOIR (GOBIND SAGAR) ON RIVER SATLUJ AND PONG RESERVOIR ON RIVER BEAS

Dr. Sanjay K Jain informed that the above PDS has been taken up by BBMB under the HP-2 project. They have now requested NIH for collaboration in this study. Therefore this study

has been proposed under the work program of Water Resources Systems Div. Dr. Jain informed about the objectives and work elements of the study. BBMB has already informed about the approval of chairman, BBMB for partnership of NIH in the study. The duration of the study is four years. The objectives of the proposed study are:

- Collection and development of data for the catchment and the reservoir by latest techniques.
- Analysis of existing sediment data at various locations in the catchments of river Satluj and Beas.
- Soil erosion modelling for both the catchments
- Development of mathematical model for instant study of Sedimentation to assess life of reservoirs.
- Dissemination of knowledge, findings and applications of the developed models to field Engineers through preparation of manual, leaflets & by organizing workshop & seminars.

Working Group noted the progress of ongoing studies of WRS division and recommended the new studies. The work programme of WRS division for the year 2009-10 is given as Annexure - V.

ANY OTHER ITEM WITH THE PERMISSION OF THE CHAIR

The Chairman apprised the Working Group members about the issues raised by Dr. S K Mazumder, Member of the N.I.H. Society regarding the functioning of the Institute.

Regarding the issues related to "better coordination between the Governmental organization (NIH) and the private organizations as many private sector companies are participating in the development of the Water resources and other infrastructure in the country". The members opined that this is an administrative issue and can be taken up by the Institute with the Ministry of Water Resources. Regarding the issue that "NIH should start a regular PG program in the specialized areas of hydrology and also conduct short duration training courses in different areas of the water resources", the members felt that NIH is already conducting short duration courses in the various areas of hydrology and water resources. Regarding to start a regular PG program by the Institute, it was felt that Department of Hydrology, Water Resources Development & Management, Civil Engineering Department, Earth Sciences Department of IIT, Roorkee are already conducting the M.Tech. courses. There is always a shortage of students even for these courses at some of these Departments and as such NIH does not require to begin any such course.

The meeting ended with a vote of thanks to the Chair.

Annexure-I**WORK PROGRAMME OF ENVIRONMENTAL HYDROLOGY DIVISION
FOR THE YEAR 2009-10**

S. No.	Title of the Project/Study	Principal Investigator	Duration	Funding Agency
1. NIH/EHD/NIH/07-10	Modelling of Pesticide Transport in Ground Water – a case study of Metropolitan City – Vadodara	M. K. Sharma, S.V.N. Rao	3 Years	NIH
2. NIH/EHD/NIH/08-09	Evaluation of water quality of rivers joining Tihri Reservoir and downstream of the reservoir	M K Sharma, V K Choubey	1 Year	NIH (As suggested by MOWR)
3. NIH/EHD/CPCB/08-10	Assessment of ground water quality in class – i cities in India (CPCB sponsored project)	V.K. Choubey M.K. Sharma	2 Years	CPCB
4. NIH/EHD/NIH/09-13	Impact of sewage effluent on drinking water sources of Shimla city and suggesting ameliorative measures	V.K. Choubey Omkar Singh M.K. Sharma	4 Years	HP-II

Annexure-II

WORK PROGRAMME OF HYDROLOGICAL INVESTIGATIONS DIVISION FOR THE YEAR 2009-10

Reference Code	Project	Project Team	Duration	Funding
NIH/HID/U YRB/06-08	SW and GW Interaction at Selected Locations Along River Yamuna in NCT, Delhi: Phase-II	Sudhir Kumar, M. S. Rao, P. K. Garg	4/09 – 3/12 (3 yrs)	Internal
NIH/HID/D ST/07-12	National programme on isotope fingerprinting of waters of India (IWIN)	M.S. Rao, B. Kumar, Sudhir Kumar, S.P. Rai, S.K. Verma, Pankaj Garg	7/07 –6/12 5 yrs	DST
NIH/HID/F RI/08-13	Impact Assessment of Landuse on the Hydrologic Regime in the selected Micro-watersheds in Lesser Himalayas, Uttarakhand	S.P. Rai, Bhishm Kumar, J.V. Tyagi	4/08 – 3/13 5 years	FRI
NIH/HID/H P-II/08-10	Groundwater Dynamics of Bist-Doab Area, Punjab Using Isotopes	M.S. Rao, Bhishm Kumar, Sudhir Kumar S. K. Verma, Pankaj Garg + Officials of CGWB	10/2008- 3/2012	HP-II
NIH/HID/H P-II/08-13	Groundwater Management in Over- Exploited Blocks of Chitradurga and Tumkur Districts of Karnataka	Sudhir Kumar, JV Tyagi, Vijay Kumar, B.K. Purandara, S.P. Rai, M.S. Rao	10/2008- 3/2012	HP-II
NIH/HID/I NCID/08- 11	Estimation of irrigation return flow and stream flow regeneration in parts of the selected canal command areas	M S Rao, Bhishm Kumar, S. K. Verma, Pankaj Garg	2 years from the date of approval from INCID	INCID
NIH/HID/I NCID/09- 12	Integrated Hydrological Investigations of Ropar Lake, Punjab	S.D.Khobragade, B. Kumar, N.C.Ghosh, Sudheer Kumar, S.P.Rai, M.S.Rao, S.K.Verma, Pankaj Garg, One scientist from EHD	04/09-03/12 (3 years)	Internal

Annexure-III

WORK PROGRAMME OF GROUND WATER HYDROLOGY DIVISION FOR THE YEAR 2009-10

Study No.	Title of the study	Study team	Duration
1.NIH/GWD /NIH/07-10	Quantification of impact of rainwater harvesting on groundwater availability in Aravalli Hills.	Anupma Sharma (P.I.) N C Ghosh C P Kumar Sudhir Kumar Rajan Vatsa	3 years (04/07 – 03/10)
2. NIH/GWD/N IH/08-09/	Vision document on “Mitigation and Remediation of Ground Water Arsenic Menace in India	Coordinators: N C Ghosh (NIH) S K Srivastava (CGWB)	8 months (09/08 – 04/09)
3. NIH/GWD/N IH/09-12/	Impact of Climate Change on Dynamic Groundwater Recharge in a Drought Prone area	Dr. Surjeet Singh (P.I.) Mr. C. P. Kumar Dr. Anupma Sharma Mr. Rajan Vatsa	3 years (04/09 – 03/12)

Annexure-IV

WORK PROGRAMME OF SURFACE WATER HYDROLOGY DIVISION FOR THE YEAR 2009-10

S. No. & Reference Code	Project	Project Team	Duration	Funding Source
1. NIH/SWD/NIH/08-12	Study on integrated water resources management of sub-basin to cope with droughts	R.P. Pandey Ravi V. Galkate Surjeet Singh L.N. Thakral	4 years	NIH
2. NIH/SWD/NIH/09-11	Snow melt runoff modeling using fuzzy logic	A.K. Lohani Sanjay K. Jain Rakesh Kumar	2 years	NIH
3. NIH/SWD/NIH/08-	Monitoring and modelling of streamflow for the Gangotri Glacier	Manohar Arora Rakesh Kumar	To be continued	NIH
4. NIH/SWD/NIH/09-11	Environmental flow requirement for river ganga at lohari nagpala power project site	Manohar Arora R.D. Singh Rakesh Kumar	2 years	NIH
5. NIH/SWD/NIH/09-12	Snow melt runoff modelling in Sultej basin	A. R. Senthil kumar Manohar Arora Avinash Agarwal D. S. Rathore Digambar Singh	3 years	NIH
6. NIH/SWD/NIH/07-10	Runoff and Sediment Modelling in a part of Brahmaputra River Basin using ANN	Archana Sarkar R D Singh Nayan Sarma	3 years	NIH
7. NIH/SWD/NIH/05-10	Integrated Hydrological Study for Sustainable Development of two Hilly Watersheds in Uttaranchal	Avinash Agarwal R P Pandey S P Rai S K Singh	5 years	DST
8. NIH/SWD/NIH/07-10	Hydrological studies in a forested watershed in Uttarakhand	J.V. Tyagi Rakesh Kumar Digamber Singh	3 years	NIH & FTA
9. NIH/SWD/NIH/09-11	Data book - hydro-meteorological observatory 2001-2008	Digambar Singh A. R. Senthil kumar Manohar Arora	2 years	NIH

Annexure-V

PROPOSED WORK PROGRAMME OF WATER RESOURCES SYSTEMS DIVISION FOR THE YEAR 2009-10

S.No. & Reference Code	Project	Project Team	Duration	Funding Source
1. NIH/WRSD/ HP-II/07-12	Decision Support System (Planning) for Integrated Water Resources Development and Management	S K Jain, A K Lohani, D Chalisgaonkar, C P Kumar, M K Goel, Vijay Kumar, R P Pandey, P K Bhunya, Sanjay Kumar, A Sharma	5 Years	HP-II
2. NIH/WRSD/ NIH/09-12	Use of Remote Sensing in soil moisture and water balance – case study of Solani catchment	Sanjay K. Jain Sharad K Jain, J.V. Tyagi IIRS Dehradun	3 Years	NIH
3. NIH/WRSD/ HP-II/08-12	Integrated approach for modeling snowmelt runoff and effect of climate change in Beas basin	Sanjay K. Jain, Sharad K. Jain D.S. Rathore, Vijay Kumar R Theyyan, S P Rai	4 years	PDS under HP-II
4. NIH/WRSD/ HP-II/08-12	Hydrological Assessment of Ungauged Catchments (Small Catchment)	P K Bhunya, Rakesh Kumar, Sharad K. Jain, D S Rathore , PC Nayak, Nirranjan Panigrahy, Sanjay Kumar, Suhas Khobragade, Director (Hydrology and W.R. Planning-I), Govt. of Orissa	4 Years	PDS under HP-II
5. NIH/WRSD/ HP-II/09-13	Assessment of Effects of Sedimentation on the Capacity/ Life of Bhakra Reservoir (Gobind Sagar) on River Satluj and Pong Reservoir on River Beas	Sanjay K. Jain, D. S. Rathore, J. V. Tyagi, Sharad K. Jain, Rama D. Mehta, Director (Regulation), BBMB.	4 Years	PDS under HP-II
6. NIH/WRSD/ NIH/08-10	Web-based River Basin Information System for India	Deepa Chalisgaonkar S K Jain D S Rathore N Panigrahy	2 years	NIH

APPENDIX-I

List of Participants of the Working Group Meeting:

1. Shri R.D. Singh, Director
National Institute of Hydrology
Roorkee – **Chairman**
2. Prof. K.V. Jayakumar,
CWRDM Kozhikode
3. Dr. R. Vishwanathan,
Jt. Director A.P.E.R.L, Hyderabad-30 (AP)
4. Dr. V Tamilarasan,
Ahmedabad
5. Dr. B.P. Singh,
New Delhi – 61
6. Dr. P.K. Garg,
Civil Engg. Dept. IIT, Roorkee
7. Shri K.B. Parmar,
Supdt. Engg., CDO, Gandhinagar, Gujarat
8. Dr.G.C.Mishra
WRDM, IIT, Roorkee
9. Dr. S.V. Navada, Mumbai
10. Dr. V.V.S. Gurunadha Rao,
Sc.F, NGRI, Hyderabad
11. Dr. R.D. Verma, Retd. Prof.
MNIT, Jaipur
12. Shri R.M. Bhardwaj, Sc. C
CPCB, Delhi
13. Shri S. P. Agarwal, Scientist/Engineer “SE”,
IIRS, Dehradun
14. Shri N.Y. Apte,
DDGM (M), IMD, New Delhi
15. Shri M.R. Chakraberty,
CWC, New Delhi
16. Shri P.K. Bhargava,
Chief Engg., IRI, Roorkee
17. Shri Rakesh Kumar,
Sc. F, & Head, RCMU, NIH
Roorkee – **Convener**

List of Participants from National Institute of Hydrology, Roorkee

1. Dr. S.K. Jain, Sc.F & Head,
Water Resources Systems Division
2. Dr. Bhishm Kumar,
Sc.F & Head Hydrological Investigations Division
3. Dr. N C Ghosh,
Sc.F & Head Ground Water Hydrology Division
4. Dr. V K Choubey,
Sc.F & Head Environmental Hydrology Division
5. Shri Rakesh Kumar,
Sc.F & Head Surface Water Hydrology Division
6. Smt. Deepa Chalisgaonkar, Sc.E1
7. Shri C.P. Kumar, Sc.E1
8. Dr. Sanjay Kr. Jain, Sc.E1
9. Shri Avinash Agarwal, Sc.E1
10. Shri J.V. Tyagi, Sc.E1
11. Shri Sudhir Kumar, Sc.E1
12. Shri D.S. Rathore, Sc.E1
13. Shri A K Lohani, Sc.E1
14. Dr. Vijay Kumar, Sc.E1
15. Shri R P Pandey, Sc.E1
16. Shri Omkar Singh, Sc.E1
17. Shri S.D. Khobragade, Sc.C
18. Shri P K Bhunya, Sc.C
19. Dr. S.P. Rai, Sc.C
20. Shri A R Senthil Kumar, Sc.C
21. Dr. Anupma Sharma, Sc.C
22. Dr. M.S. Rao, Sc.C
23. Dr. N Panigrahy, Sc.C
24. Shri S K Verma, Sc. C
25. Dr. Rama Mehta, Sc.C
26. Dr. Sanjay Kumar, Sc.C
27. Dr. Surjeet Singh, Sc. C
28. Smt. Archana Sarkar, Sc.B
29. Shri Pankaj K. Garg, Sc.B
30. Shri Rajan Vatsa, Sc.B

31. Shri Manohar Arora, Sc.B
32. Dr. M.K. Sharma, Sc.B
33. Shri Digambar Singh, Sc.B

