MINUTES OF THE 32ND MEETING OF THE WORKING GROUP OF NIH HELD DURING MARCH 4-5, 2010 AT NATIONAL INSTITUTE OF HYDROLOGY ROORKEE.

The 32nd meeting of the Working Group of NIH was held in the Society room of the National Institute of Hydrology, Roorkee during March 4-5, 2010 under the Chairmanship of Shri R. D. Singh, Director, NIH. The list of the members and invitees participated in the meeting is given in **Annexure-I**.

ITEM NO. 32.1: OPENING REMARKS BY THE CHAIRMAN

The Chairman, WG welcomed the Working Group members and the Scientists of the Institute present in the meeting. The Chairman gave a brief of the various ongoing technical and research activities of the Institute. He informed that the Ministry of Water Resources, Govt. of India under the 'National Water Mission' has entrusted a big responsibility to the Institute for R & D studies related to Climate Change impact on water resources, and has identified NIH as the Nodal organization to that effect. The Chairman, WG explained the important role being played by the Institute in carrying out the various activities of the World Bank funded HP-II. The activities include: development and implementation of DSS (P) for integrated water resources development and management, undertaking and carrying out Purpose Driven Studies (PDS), organizing a number of training programs, etc. He further informed that the Governing Body of the Institute has recently approved the consultancy rules for the Institute and it has come into effect from February, 2010. The scientists of the Institute in future will be able to receive some financial benefits from the consultancy projects to be undertaken. The Chairman also expressed that the Working Group meeting generally convene during the beginning of a financial year has the importance based on the fact that in this meeting, the members have to guide the Institute in finalizing the work programme for the next year and to take stock and evaluate the progress of scientific activities undertaken during the previous year i.e., for the year 2009 -10. Thereafter, the Chairman requested the Working Group members to give their general observations, suggestions and remarks on the scientific activities of the Institute.

After the self introduction of the members and invitees, Chairman asked Dr. N. C. Ghosh, Member-Secretary, WG to take up the agenda items in sequence.

ITEM NO. 32.2: CONFIRMATION OF THE MINUTES OF THE 31st MEETING OF THE WORKING GROUP.

The minutes of the meeting of 31st Working Group held during 17-18 September, 2009 were circulated vide letter No. NIH/GWH/WG/09 dated 14th October 2009. The suggestions giving emphasis on some areas for research received from Sri K. P. Singh, RO, IRI, Roorkee vide letter no. 565/H-2/R-58

dated 27.10.2009 was placed before the members. Members observed that those were suggestions to undertake new studies on specific areas but not comments on the minutes. As no comments were received from any other members, *the minutes were confirmed*

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ITEM NO. 32.3: ACTION TAKEN ON THE DECISIONS/ RECOMMENDATIONS OF THE PREVIOUS WORKING GROUP MEETING

Dr. N. C. Ghosh, Member-Secretary, WG gave a brief account of the actions taken on the recommendations/decisions of the 31st working group meeting.

ITEM NO. 32.4: PRESENTATION AND DISCUSSION ON THE STATUS AND PROGRESS OF THE WORK PROGRAMME OF THE FIVE DIVISIONS FOR THE YEAR 2009-'10,

AND,

PRESENTATION AND FINALIZATION OF THE WORK PROGRAMME OF THE FIVE DIVISIONS FOR THE YEAR 2010-11.

In view of the some of the scientists' involvement in an urgent World Bank meeting on 4th March at New Delhi, the order of presentation of the work programme was taken up in the following sequences:

On 4th March,

i) Environmental Hydrology Division,
ii) Hydrologic Investigation Division,
iii) Surface Water Hydrology Division.

On 5th March,

iv) Ground Water Hydrology Division
v) Water Resources System Division.

Member Secretary gave a brief account of the previous year work programme (2009-'10) including number of studies concluded and being concluded during the year, and also the proposed work programme for the year 2010-11under three categories: (i) internally funding projects, (ii) sponsored projects, and (iii) purpose driven projects under HP-II. It was informed that out of 33 studies (18-internally funded; 9-sponsored; and 6 purpose driven) of the year 2009-'10, 10 studies have/are being concluded by the March, 2010, and remaining, 23 projects shall go as continuing studies during the year 2010-'11. Along with those 23 continuing studies, different divisions have proposed to undertake 15 more new studies under the work programme of the year 2010-'11. The studies proposed under the work programme of the year 2010-'11 thus worked out to be 38 (24-internally funded, 7-sponsored, and 7-PDS under HP-II).

During the meeting the status of the previous year (2009-10) work program as well as the proposed programme for the year 2010-2011 were discussed division-wise in detail. The Chairman requested the Heads of the Division to make the presentation, and also advised that while presenting the progress, each P.I should stick to the objectives of the study and progress made and results obtained in last six months for the previous year studies, and the objectives, methodology, milestones, and work elements for the work programme of the year 2010-11 in respect of both continuing and new studies.

Division-wise work programme for the year 2010-'11 as recommended by the Working Group is given below.

The details of the division-wise presentation and suggestions/ comments emerged from the discussion are given in the **Annexure-II.**

WORK PROGRAMME OF THE FIVE DIVISIONS FOR THE YEAR 2010-2011

ENVIRONMENTAL HYDROLOGY DIVISION

A. Internally Funded Studies

Reference Code	Title of the Project/Study	Study Team	Duration/ Status	Funding
NIH/EHD/NIH/07-10	Modelling of Pesticide Transport in Ground Water – a case study of Metropolitan City – Vadodara	M.K. Sharma (PI) V.K. Choubey A.K. Keshari, IIT-D	3 years *(10/ 07 – 9/10)* ***Continuing study***	NIH
NIH/EHD/NIH/09-12	Environmental Flow Requirement of a River	Dilip G. Durbude (PI) V.K. Choubey Omkar Singh M.K. Sharma	3 years (9/09 – 8/12) ***Continuing study***	NIH
NIH/EHD/INT/10-11	Impact of Kumbha Mela 2010 on water quality of surface water and ground water resources in and around Hardwar City	V.K. Choubey (PI) M.K. Sharma Omkar Singh D.G. Durbude	1 year *(4/10-3/11)* ***New Study***	NIH
NIH/EHD/INT/10-11	Spatial Variability of Ground Water Quality in Jammu and Kashmir Provinces, J&K (India)	Omkar Singh (PI) V.K. Choubey D.G. Durbude M.K. Sharma	1 year *(4/10-3/11)* ***New Study***	NIH

B. Sponsored Studies

NIH/EHD/CPCB/10-11	Assessment of Ground Water Quality in 25 Class I Cities of India – Phase II (Chandigarh, Panjim, Gandhinagar, Shrinagar, Ranchi, Thiruvananthapuram, Imphal, Pondicherry, Kavaratti, Daman, Silvassa, Ratlam, Bilaspur)	V K Choubey (PI) M K Sharma	*1 year* *(4/10-3/11)* ***New Study***	CPCB

C. Purpose Driven Studies Under HP-II

NIH/EHD/HP-II/09-12	Impact of sewage effluent on drinking water sources of Shimla city and suggesting ameliorative measures	V.K. Choubey (PI) R.P. Pandey Omkar Singh M.K. Sharma I&FC Dept., Shimla NICD, New Delhi	3 years *(4/09 -03/12)* ***Continuing study***	HP-II

HYDROLOGICAL INVESTIGATIONS DIVISION

A. Internally Funded Studies

Reference Code	Project	Project Team	Duration/ Status	Funding
NIH/HID/INT/09-12	SW and GW Interaction at Selected Locations Along River Yamuna in NCT, Delhi: Phase-II	Sudhir Kumar (PI) M. S. Rao P. K. Garg	3 years *(4/09 – 3/12)* ***Continuing study***	NIH
NIH/HID/INT/10-12	Identification of Recharge Zones of Some Selected Springs of Uttarakhand Using Isotopes	S. D. Khobragade (PI) Bhishm Kumar Sudheer Kumar S. P. Rai Pankaj Garg	*2 years* *(04/10-03/12)* ***New study***	NIH

B. Sponsored Studies

NIH/HID/DST /07-12	National programme on isotope fingerprinting of waters of India (IWIN)	M.S. Rao (PI) B. Kumar, Sudhir Kumar S.P. Rai S.K. Verma Pankaj Garg	5 years *(7/07 –6/12)* ***Continuing study***	DST

NIH/HID/FRI/ 08-13	Impact Assessment of Landuse on the Hydrologic Regime in the selected Micro-watersheds in Lesser Himalayas, Uttarakahand	S.P. Rai (PI) Bhishm Kumar J.V. Tyagi	5 years (4/08 – 3/13) ***Continuing study***	FRI
NIH/HID/DJB /10-11	Assessment of Groundwater Resources & Development Potential of Yamuna Flood Plain, NCT, Delhi	Sudhir Kumar (PI) Vijay Kumar AK Keshari, IIT Delhi S. Shekhar, Delhi Univ. YB Kaushik, CGWB PS Datta, ICAR Executive Engineer, CWC AK Gupta, Delhi Jal Board	1 year (02/10-01/11) ***New Study***	Delhi Jal Board

C. Purpose Driven Studies Under HP-II

NIH/HID/HP-II/09-12	Groundwater Dynamics of Bist-Doab Area, Punjab Using Isotopes	M.S. Rao (PI) Bhishm Kumar Sudhir Kumar S.K. Verma PankajGarg+ CGWB Officials	3.5 years *(10/08-3/12)* ***Continuing study***	HP-II
NIH/HID/HP-II/09-12	Groundwater Management in Over- Exploited Blocks of Chitradurga and Tumkur Districts of Karnataka	Sudhir Kumar (PI) J.V. Tyagi Vijay Kumar B.K. Purandara S.P. Rai M.S. Rao	3.5 years *(10/08-3/12)* ***Continuing study***	HP-II

SURFACE WATER HYDROLOGY DIVISION

A. Internally Funded Studies

Reference Code	Project	Study Team	Duration/ Status	Funding
NIH/SWD/NIH/09-11	Snow Melt Runoff Modeling Using Fuzzy Logic	A.K. Lohani (PI) Sanjay K. Jain Rakesh Kumar	*2 years (4/09-3/11)* ***continuing study***	NIH
NIH/SWD/NIH/08-12	Study on integrated water resources management of sub-basin to cope with droughts	R.P. Pandey (PI) Ravi V. Galkate Surjeet Singh L.N. Thakaral	*4 years (12/08-11/12)* ***continuing study***	NIH
NIH/SWD/NIH/09-12	Snow Melt Runoff Modelling in Sultej Basin	A.R. Senthil Kumar (PI) Manohar Arora Avinash Agarwal D.S.Rathore Digambar Singh	*3 years (4/09-3/12)* ***continuing study***	NIH
NIH/SWD/NIH/08-	Monitoring and modelling of streamflow for the Gangotri Glacier	Manohar Arora (PI) Rakesh Kumar	*Long term continuing project*	NIH

NIH/SWD/NIH/09-11	Data book – hydro-meteorological observatory 2001-2008	Digambar Singh (PI) A. R. Senthil kumar Manohar Arora	*2 years* *(4/09-3/11)* ***continuing study***	NIH
NIH/SWD/NIH/09-11	Impact of climatic change on evaporation	N.K. Bhatnagar (PI) Avinash Agarwal	*2 years* *(9/09-8/11)* ***continuing study***	NIH
NIH/SWD/NIH/10-13	Snowmelt Runoff Modeling and Study of the Impact of Climate Change in part of Brahmaputra River Basin	Archana Sarkar (PI)	*3 years* *(4/10-3/13)* ***New study***	NIH
NIH/SWD/NIH/10-13	Climatic Scenarios Generation for Satluj Basin using Statistical Downscaling Techniques	Manohar Arora (PI) Rakesh Kumar	*3 years* *(4/10-3/13)* ***New study***	NIH

B. Sponsored Studies

Reference Code	Project	Study Team	Duration/ Status	Funding
NIH/SWD/NIH/05-10	Integrated Hydrological Study for Sustainable Development of two Hilly Watersheds in Uttaranchal	Avinash Agarwal (PI) R.K. Nema	*5 years* *(7/05 – 6/10)* ***Continuing study***	DST
NIH/SWD/NIH/09-11	Study on Environmental Flow from proposed Dam of Teesta Stage IV HE Project	Manohar Arora (PI) Rakesh Kumar	*1 year* *(9/09-8/11)* ***Continuing study***	NHPC

GROUND WATER HYDROLOGY DIVISION

A. Internally Funded Studies

Reference Code	Project	Project Team	Duration/ Status	Funding Source
NIH/GWD/NIH/09-12	Impact of Climate Change on Dynamic Groundwater Recharge in a Drought Prone Area	Surjeet Singh (PI) C. P. Kumar Anupma Sharma Rajan Vatsa	3 years *(04/09 – 03/12)* ***Continuing study***	NIH
NIH/GWD/NIH/10-12	Quantification of Impact of Rainwater Harvesting on Groundwater Availability in Aravalli Hills – Part II: Mathematical Modeling	Anupma Sharma (PI) N. C. Ghosh C. P. Kumar Sudhir Kumar Rajan Vatsa	2 years *(04/10 – 03/12)* ***New study***	NIH

B. Sponsored Studies

NIH/GWD/NIH/09-11	Study of Rising Ground Water Table in Jodhpur City, and to Evolve a Management Plan to Contain the Rising Trend	N. C. Ghosh (PI) C. P. Kumar Sudhir Kumar B. K. Purandara Anupma Sharma Surjeet Singh Rajan Vatsa	1.5 years *(08/09 – 02/11)* ***Continuing study***	Ground Water Dept., Govt. of Rajasthan

C. Purpose Driven Studies Under HP-II

NIH/GWD/HP-II/10-12	Coastal Groundwater Dynamics and Management in the Saurashtra Region, Gujarat.	Anupma Sharma (PI) N. C. Ghosh C. P. Kumar C. K. Jain Sudhir Kumar D. S. Rathore Surjeet Singh Rajan Vatsa + GWRDC, Gandhinagar	2.5 years *(10/09 – 06/12)* ***New study***	HP-II

WATER RESOURCES SYSTEM DIVISION

A. Internally Funded Studies

Reference Code	Project	Project Team	Duration/ Status	Funding
NIH/WRSD/NIH/09-12	Application of a distributed hydrological model for river basin planning and management	M. K. Goel (PI) Vijay Kumar D. S. Rathore Deepa Chalisgaonkar Rama Mehta	*3 years* *(10/09 –03/12)* ***Continuing study***	NIH
NIH/WRSD/NIH/09-12	Use of remote sensing in soil moisture and water balance estimation-case study of the Solani catchment	Sanjay K. Jain and J. V. Tyagi IIRS Dehradun	*3 years* *(04/09 –03/12)* ***Continuing study***	NIH
NIH/WRSD/NIH/09-11	GIS based dams and drought information system	D.S. Rathore (PI) Deepa Chalisgaonkar R.P. Pandey	*1.5 years* *(10/09-3/11)* ***New study***	NIH
NIH/WRSD/NIH/10-11	*NIH_ReSyP* – A software for Reservoir Analysis (Version – 1)	M. K. Goel (PI) Deepa Chalisgaonkar	*1 year* *(4/10-3/11)* ***New study***	NIH
NIH/WRSD/NIH/10-11	Web Based Information System	Deepa Chalisgaonkar	*2 years*	

	For Major And Important Lakes in India	(PI) Suhas Khobragade	*(4/10-3/12)* ***New study***	NIH
NIH/WRSD/NIH/10-11	Analysis of water management scenarios in Tapi River basin using MIKE Basin	Rama Mehta (PI) M.K. Goel Vijay Kumar	*3 years* *(4/10-3/11)* ***New study***	NIH
NIH/WRSD/NIH/10-11	Computationally simple functions for approximating normal and log- normal distributions	Sushil K. Singh (PI)	*1 year* *(4/10-3/11)* ***New study***	NIH
NIH/WRSD/NIH/10-11	A simple IUH model for runoff modeling	Sushil K. Singh (PI)	*1 year* *(4/10-3/11)* ***New study***	NIH
NIH/WRSD/NIH/10-11	Prediction of dispersion coefficient of streams using kriging technique	Vijay Kumar (PI) S K Singh	*1 year* *(4/10-3/11)* ***New study***	NIH

B. Purpose Driven Studies under HP-II

Reference Code	Project	Project Team	Duration/ Status	Funding
NIH/WRSD/NIH/08-03/12	Integrated approach for snowmelt runoff studies and effect of anthropogenic activities in Beas basin	Sanjay K. Jain (PI) Sharad K. Jain-IITR Vijay Kumar Bhism Kumar Renoj Theyyan	*4 years* *(04/08 –03/12)* ***Continuing study***	HP-II
NIH/WRSD/NIH/09-04/12	Hydrological Assessment of Ungauged Catchments (Small Catchment)	P. K. Bhunya (PI) D.S. Rathore P.C. Nayak Niranjan Panigrahy Sanjay Kumar Suhas Khobragade Director (H&WR P), Govt. of Orissa	*3 years* *(05/09 – 4/12)* ***Continuing study***	HP-II
NIH/WRSD/NIH/08-03/13	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 (PI) Sharad K. Jain-IITR Vijay Kumar J.V. Tyagi Rama Mehta	*4 years* *(04/09 – 3/13)* ***Continuing study***	HP-II

ITEM NO. 32.6: ANY OTHER ITEM WITH THE PERMISSION OF THE CHAIR.

Member Secretary, WG informed that the present composition of the Working Group was constituted couple of years back. However, the Institute felt the need of reconstitution of the Working Group in view of the emerging thrust

areas of research and other impinging issues. The present Working Group has three committees, approved by the Governing Body, they are: (i) Surface Water Group, (ii) Ground Water Group, and (iii) Hydrological Observation and Instrumentation Group. To get advantages of different experts, the Institute since last couple of years has been convening meetings of the Working Group for continuous two days by combining all three groups into a single meeting. This has proven good results.

Chairman, WG invited suggestions from the members and scientists in that respect. It was emerged from the meeting that a single Working Group can be constituted in place of three groups drawing experts from all over the Country fitting to the Institute's future scientific requirement. The meeting can be organized for continuous two days. It was further suggested that members should be drawn in such a way that they should be from various fields of expertise including members from nongovernmental stakeholders and independent experts.

The meeting ended with vote of thanks to the Chair.

ANNEXURE-I

List of Members and Invitees participated in the Working Group Meeting:

1. Shri R.D. Singh Director, National Institute of Hydrology, Roorkee	**Chairman**
2. Prof. G. C. Mishra Deptt. of WRD & M, IIT Roorkee	Member
3. Prof. D. Kashyap Deptt. of Civil Engg., IIT Roorkee	Member
4. Dr. S.K.Mittal Scientist F C.S.I.O, Chandigrah	Member
5. Dr. V.V.S. Gurunadha Rao Sc.G NGRI, Hyderabad	Member
6. Dr. K. Shivanna Professor, Homi Bhabha National Institute, Head, Isotope Hydrology Section, BARC,Mumbai	Member
7. Dr. S.K. Gupta Project Coordinator, CSSRI, Karnal	Member
8. Shri N.Y. Apte DDGM(H), IMD, New Delhi	Member
9. Dr. S.P. Agarwal IIRS, Dehradun	Member
10. Shri Rishi Srivastava Deputy Director, CWC R.O. Directorate New Delhi	Member
11. Shri S.K. Malhotra S.E., U.P. Irrigation, Saharanpur	Member
12. Shri Subash Mitra S.E., IRI, Roorkee	Member
13. Shri D. S. Bundela Sr. Scientist, CSSRI, Kernal	Invitee
14. Dr. N.C. Ghosh Scientist- F, NIH, Roorkee	Member-Secretary

Scientists from National Institute of Hydrology, Roorkee

1. Dr. Bhishm Kumar, Sc.F & Head Hydrological Investigations Division
2. Dr. V K Choubey, Sc.F & Head Environmental Hydrology Division
3. Dr. Rakesh Kumar, Sc.F & Head Surface Water Hydrology Division
4. Dr. V. C. Goyal, Sc.-F
5. Dr. S.K. Singh, Sc.F
6. Shri C.P. Kumar, Sc. 'F'
7. Dr. Sanjay Kr. Jain, Sc.E2
8. Dr. Avinash Agarwal, Sc.E2
9. Dr. J.V. Tyagi, Sc.E2
10. Dr. Sudhir Kumar, Sc.E2
11. Shri D.S. Rathore, Sc.E2
12. Dr. M.K. Goel, Sc. E2
13. Smt. Deepa Chalisgaonkar, Sc.E1
14. Dr. A K Lohani, Sc.E1
15. Dr. Vijay Kumar, Sc.E1
16. Dr. R P Pandey, Sc.E1
17. Shri Omkar Singh, Sc.E1

18. Shri S.D. Khobragade, Sc.E1
19. Dr. P K Bhunya, Sc.E1
20. Dr. S.P. Rai, Sc.E1
21. Shri A R Senthil Kumar, Sc.E1
22. Dr. M.S. Rao, Sc.C
23. Shri S K Verma, Sc. C
24. Dr. Rama Mehta, Sc.C
25. Dr. Sanjay Kumar, Sc.C
26. Dr. Surjeet Singh, Sc. C
27. Shri D. G. Durbude, Sc. C
28. Smt. Archana Sarkar, Sc.C
29. Dr. Manohar Arora, Sc.C
30. Dr. M.K. Sharma, Sc.C
31. Shri Pankaj K. Garg, Sc.B
32. Shri Rajan Vatsa, Sc.B
33. Shri Digambar Singh, Sc.B

Annexure - II

ENVIRONMENTAL HYDROLOGY DIVISION

Dr. V.K. Choubey, Sc. F & Head (EHD), presented an overview of the technical activities carried out by the division & progress made on different studies during last six months, and also presented the proposed work programme of the division for the year 2010-'11. Thereafter, he requested the concerned PIs to present the detailed progress of the each study. Study-wise suggestions and discussions emerged are given below.

1. ASSESSMENT OF GROUND WATER QUALITY IN CLASS I CITIES IN INDIA - PHASE I (CPCB sponsored project)

Dr M. K. Sharma informed that out of twenty five class I cities, twelve cities have been covered in first phase of the study. The post-monsoon sampling of twelve class-I cities viz; Guwahati, Raipur, Shimla, Jammu, Shillong, Aizawal, Kohima, Bhubneshwar, Agartala, Dehradun, Itanagar & Gangtok have been completed. About thirty samples from already identified 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 analysed for various water quality constituents viz; major cations and anions, metal ions, bacteriological parameters and are being analysed for metals, pesticides residue and PAH. Dr Sharma elaborated the findings of the study in brief. Dr Gurunadharao enquired about the status of arsenic in the studied areas, its source and depth of occurrence. Dr Sharma briefed the cities having arsenic contamination in ground water. Chairman suggested to ensure proper analysis of arsenic in the samples and to verify the arsenic results with other agencies. Dr Choubey informed that CPCB has already verified results submitted by NIH by repeating the analysis of same samples carried by NIH and NIH is in contact with regional offices of CPCB and CGWB if these exist in studied area. Processing of data and the preparation of report is under progress.

2. 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 and pumping test carried out in collaboration of GWRDC, Vadodara carried out in February 2010. Dr Gurunadha Rao enquired about the location of sample collection from Gujarat Refinery drain and suggested to verify the result before reporting. Dr Sharma replied that due care has already been taken in sampling and analysis. Dr Sharma further elaborated the results of

source identification using chemographs of ground water and drains/rivers. In a reply to Chairman's query, Dr. Sharma briefed the model and its data requirement which already been discussed with the Co-PI of the study, Dr Keshari, IIT, Delhi and collected from the collaborating state agency GWRDC, Gandhinagar. Chairman suggested to complete the objectives of the study. Dr Sharma noted the suggestion for further compliance.

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

Shri Omkar Singh, Scientist E1/Co-investigator informed that a field visit was made recently during February, 2010 at Shimla by the study team to discuss with the concerned officials of I&PHE about data requirement for this project and water quality sampling in problematic part of the study area. A list of data requirement was submitted to I&PHE, Shimla for the study. He informed that surface water quality sampling was carried out from various locations for physico-chemical and bacteriological analysis. The results of ground water quality in problematic area of Shimla were also presented and discussed about the bacteriological contamination observed at some sites in the area. The Working Group advised to inform the concerned authorities of I&PHE to take necessary measures. A proposal for organizing a training course for the I&PHE officials of Shimla on" Water Quality and its Management:" was also discussed. The details of STP's were also presented as desired by Dr. V.V.S. Gurunadha Rao (NGRI) in previous meeting. The Chairman advised that the modalities of proposed instrumentation at Shimla and fate of these instruments after completion of the project should be finalized in consultation with I&PHE (Shimla). The PI noted the suggestions.

4. ENVIRONMENTAL FLOW REQUIREMENT: A CASE STUDY OF RIVER

Shri. D.G. Durbude, Scientist C & PI presented the detailed progress of the study. He presented the literature survey carried out for this study and to finalize the methodology for estimating environmental flow requirement (EFR). He informed that based on the literature survey, the work will be carried out initially by using flow duration curves (FDCs)/Modified Tennant (Tessman) method and later on the refinement will be made as per the data availability for flow modeling. He also proposed the study area as d/s of the Shivanasamudram falls in the Cauvery river basin as per the demand from Karnataka Power Corporation Limited (KPCL), Bangalore. The Chairman advised to finalize the work element of the KPCL, Regional Center, NIH Belgaum and EHD, NIH Roorkee. Also, mentioned the details of the investigators involved from these organizations/offices. The PI noted the suggestions of the Chairman for compliance.

5. IMPACT OF KUMBHA MELA 2010 ON WATER QUALITY OF SURFACE WATER AND GROUND WATER RESOURCES IN AND AROUND HARDWAR CITY

Dr. M K Sharma presented the objectives and expected outcomes of the project proposal. Dr Sharma informed that Kumbha Mela 2010 has already been started and different R & D activities were being taken by different agencies/authorities. This study is being proposed to see the impact of Kumbh Mela on water quality of surface water and ground water resources in and around Hardwar City. To fulfil the objectives of the study, sampling of surface water (River Ganga) at different locations and ground water sources in and around Hardwar City being extensively used for drinking purpose will be carried out at fortnight interval of time till June 2010 and collected samples will be analysed for physico-chemical parameters: pH, EC, TDS,

Alkalinity, Hardness, COD, BOD, Major Cations (Na, K, Ca, Mg), Major Anions (HCO_3, Cl, SO_4, NO_3), Minor Ions (F, PO_4) and bacteriological parameters (Total and Faecal Coliform). Data for different sets will be processed as per BIS and WHO standards to examine the suitability of river water and ground water for drinking purpose. Suitability of river water for irrigation purpose will be assessed on the basis of total soluble salts, SAR, RSC. Further hydrological soil properties (infiltration, hydraulic conductivity, texture, etc.) around along River Ganga (Rishikesh to Hardwar) will be determined through field and laboratory works. The outcomes of report on the impact of Kumbh Mela-2010 on surface and ground water quality of Hardwar will help policy maker and decision maker. Chairman approved the study with suggestion to take due care in proper analysis of samples specially river Ganga as it is the national river. Dr Sharma noted the suggestion for further compliance.

6. ASSESSMENT OF GROUND WATER QUALITY IN CLASS I CITIES IN INDIA – PHASE II (CPCB sponsored project)

Dr M. K. Sharma presented the research proposal in detail. Dr. Sharma informed that out of 25 class I cities, thirteen cities (Chandigarh, Panjim, Gandhinagar, Shrinagar, Ranchi, Thiruvananthapuram, Imphal, Pondicherry, Kavaratti, Daman, Silvassa, Ratlam, Bilaspur) will be covered in the Phase – II during 2010-11. He further informed that in order to meet the objectives of the project, ground water samples from 12 class I cities will be collected during pre- and post-monsoon seasons and will be analysed for various water quality constituents viz; major cations and anions, metal ions, pesticides and bacteriological parameters. Data for pre- and post-monsoon seasons will be processed as per BIS and WHO standards to examine the suitability of ground water for drinking purpose, ionic relationships will be developed and water types will be identified. Spatial distribution map will be prepared in the form of contour diagrams to identify degraded water quality zones. Suitability of ground water for irrigation purpose will be assessed on the basis of total soluble salts, SAR, RSC and boron content. Classification of water will be made using Piper trilinear diagram, Durov plots, Chadha's diagram,U S Salinity Laboratory Classification and Gupta Classification. Chairman approved the study.

7. SPATIAL VARIABILITY OF GROUND WATER QUALITY IN JAMMU, KATHUA AND UDHAMPUR DISTRICTS, J&K (INDIA)

Dr. Choubey, Head (EHD) informed the working group about the new study being carried out by the EHD entitled "Spatial Variability of Ground Water Quality in Jammu and Kashmir Provinces, J&K (India)". The various features such as: brief objectives, methodology, study area and expected outcome of this study were presented by Shri Omkar Singh, Scientist E1/PI. The working group members (Dr. V.V.S. Gurunadha Rao, NGRI; Dr. S.P. Aggrawal, IIRS) advised to modify the title of this study and they further suggested that data set may be divided for development and validation of the semi-variograms of the ground water quality. The Chairman wanted to know the availability of data for both Jammu and Kashmir Divisions. The PI informed that the NIH-RC has monitored ground water quality in Jammu, Kathua and Udhampur Districts in the past and CGWB is also regularly monitoring the ground water quality in the area. The Chairman advised to initiate this study for Jammu, Kathua and Udhampur Districts with data as monitored by NIH Regional Centre in past, since the data availability was not prior discussed with CGWB for this study. Accordingly, PI modified the title of the study to restrict the study for available data of Jammu Division.

During the presentation of each study, the valuable suggestions/comments made by the honorable chairman and working group members were noted for possible compliance.

HYDROLOGICAL INVESTIGATIONS DIVISION

Dr Bhishm Kumar, Sc. F and Head of the Division presented in brief the various studies being carried out by the 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 and is given as under:

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

Dr. M. S. Rao presented the progress of the study. He informed that with stable isotopic analysis of air moisture it was possible to distinguish the source of moisture in the air. He informed that a total 368 samples were collected at NIH, Roorkee and Sagar during the period October, 2009 to January, 2010. These include atmospheric moisture, rainwater, groundwater and river water. Stable isotope analysis of all the samples have been completed at Nuclear Hydrology Laboratory at NIH. Further, in order to monitor isotopes in air-moisture all along the monsoon track from east-coast (Kakinada port) to Jammu, two new stations are set-up for atmospheric moisture sampling at (i) Regional Centre, Kakinada and (ii) Regional Centre, Jammu, in addition to the existing Sagar and Roorkee. While discussing the results he presented the relationship between δD of atmospheric moisture collected by condensation method, rainfall amount with time and explained that the relationship clearly indicates the depletion in the isotopic composition of atmospheric moisture whenever rain occurs. Further, the seasonality effect divides the entire data spectrum into three sub-units as: the most depleted water vapors of monsoon period ($\delta^{18}O < -22$, $dD < -86$); enriched vapours ($\delta^{18}O > -4.5$, $dD > -8.14$) of local origin and the mixed vapours formed from the combination of these two sources. At any time during this cycle, the relative proportion of local moisture to regional inflow moisture can be estimated from the relative contribution from the end member source composition. He explained that the minor dips that appear in isotopic composition of water vapour in the pre-monsoon season (Feb-May) probably indicate insurgent moist air due to Western Disturbances. He informed that the start of down fall (depletion) and start of enrichment in the isotopic spectrum of air-moisture coincides with the onset & withdrawal of monsoon season, as per the dates announced by IMD, New Delhi. The study consolidates the idea that isotopes in air-moisture are useful means to understand arrival and departure of monsoon vapors. Further, the correlation analysis of isotopic composition of vapour and absolute humidity exhibited inverse relationship. He also presented results from R.C. Sagar for the same period which also depicted a pattern similar to that observed at Roorkee.He also presented an empirical relation based on experimental data set to estimate un-fractionated isotopic data (which is obtained using Trapping method) from semi-fractionated isotopic data (obtained from the conventional Condensation method).

Chairman asked to analyze the data on regional perspective as the meteorological phenomena is a regional feature. In this regard, Sh. Apte suggested to collect samples from more locations. Dr. Bhishm Kumar informed that to get regional perspective IMD is providing samples under IWIN from its stations spread all over the country. These samples are getting analyzed at PRL, Ahmedabad. The regional perspective can be analyzed only after getting the data from PRL. Dr. Rao further added that under IWIN, NIH is presently analyzing samples from Roorkee and

Sagar. Recently, two more stations – Kakinada and Jammu have been proposed to get more isotopic details on monsoon wind trajectories. Further, in this regard, wind trajectories data is being asked from Director (NHAC-NWP), IMD, New Delhi has been contacted. However, the data that will be received will be particular to the station-New Delhi.

Dr. Shivanna informed that a similar study was carried by them at W.B, Karnataka, TN and results were compared with IAEA data and the results exactly matched. Dr. Rao informed that the paper by Dr. Shivanna will be consulted for further action in this respect.

S. P. Agrawal suggested that the Kalpana Sattelite data should be used in the interpretation. Dr. Rao assured that the action in this regard will be taken up and will be reported in the next Working Group meeting.

Mr. Mitra asked to find the effect of local climate in terms of percentage. Dr. Rao replied that isotope dynamics in meteorological processes still need more work to get understood. Quantitative estimation can be made once the processes are interpreted.

Sh. S. K. Mittal asked what is the role of various organizations. Dr. Bhishm Kumar informed that the role of 13 IWIN member IWIN is very clearly defined and this has already been explained in sufficient detail in previous Working Groups.

The Working Group noted the progress of the study.

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

Dr. M. S. Rao presented the progress of the study. He informed about the various data collected and the field visits taken up. He also presented the fabrication of the depth water sampler created by the Division for collection of water samples from piezomters. Discussing the progress, he informed that using elevation data downloaded from the internet (Aster), DEM and natural drains were prepared using Spatial Analyst Hydrology Tools in Arc GIS 9.3. Depths to water table in shallow and deep aquifers were analyzed. Groundwater Flow in shallow and deep aquifer using data for 2002 & 2008 were analyzed. Analyses of $\delta^{18}O$ and δ D of groundwater, river and rainfall samples were done. Spatial variation of groundwater draft in the entire Bist-Doab region was analyzed in relation with the flow conditions for samples collected over the period 2009 using data for the year 2007. In order to investigate hydrological impact on agriculture produce, cropping pattern of the entire region was analyzed using data from 1980-2007. Further, he informed that the procurement of various equipments is in progress. He also presented the analysis of the data and the various results obtained. The pre monsoon water table for Jalandhar district for the period of 33 years clearly indicates long term fall in water table which needs urgent attention for the groundwater recuperation. The groundwater flow in shallow and deep aquifers is mainly in the direction diagonally along NE-SW direction and along east-west direction in the southern part of the study area parallel to the River Satluj. Both NE-SW and east-west flows converge at the location near Harike which is also the confluence point of the rivers Beas and Satluj. This is also seen as near surface depth of groundwater at Harike.

He informed that the depth to water table and piezometeric head in the deeper aquifer for the period 1999-2009 were analyzed and it was observed that the water table is most shallow for the central region connecting River Beas in the north-west and river Satluj in the south-east (parallel to Siwalik range). Along this tract, groundwater is shallower towards the river Beas (eg., Dasuya). Water table at maximum depth is distributed mainly in the south-eastern parts (eg. Nawapind Tapria) and in patches in southern parts (eg., Shahkot) of the study area. The rate of decline in water table is found maximum at "Nawapind Tapria" whereas it is minimum at

"Shahkot". The peizometric-head in deep aquifer is maximum at "Shahkot" and minimum at "Dasuya" similar to that in the case of shallow aquifers. The rate of decline in water table is found maximum at "Kapurthala" whereas it is minimum at "Shahkot". Further, he presented the results of the analysis of stable isotopic variation in surface and groundwater bodies in the study area. Isotopic indices of river water samples were determined by analyzing the river water samples collected at equidistance locations along the river courses of Satluj and Beas for the premonsoon period of 2009. The average of isotopic values of rivers Satluj and Beas were presented. It was observed that $\delta^{18}O$ for most of the reach of river Satluj ranges from (-11 ‰ to -10 ‰) except near the confluence zone of rivers Beas & Satluj where the isotopic value of the river Satluj becomes -.6.6 ‰ indicating major contribution to the inflow from the river Beas. The groundwater recharge through seepage from Doab canal is restricted mainly to the south east part.

Dr. Gurunadha Rao enquired whether isotopic values change with depth. Dr. Rao informed that this can be answered more clearly once the aquifer based sampling through piezometers is completed which is planned for the year 2010-2011 with the help of CGWB, NWR, Chandigarh.

The Working Group noted the progress of the study.

3. 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 this is the second phase of the study. The first phase was completed during March, 2009 and it was felt that detailed investigations with more data are needed to understand the surface water groundwater intersection in NCT Delhi. The first study was carried out taking one cross-section of piezometers across river Yamuna. This study indicated significant interaction of surface water with groundwater in the Palla area of Delhi. But due to complex hydro-geological conditions in the area, like presence of paleochannels etc, some questions remained partially answered. Also due to the sensitivity of the study, it was recommended by the WG and TAC to extend this study for a further period of 3 years to have reliable results. Keeping this in mind it was decided to repeat the study at one more cross section in this area. So the second phase was taken up.

Discussing the progress of the study Dr. Sudhir Kumar informed that groundwater samples have been collected from eighteen existing wells located along 2 cross sections almost perpendicular to the Yamuna River on the Delhi side. Water level monitoring indicated that during the monsoon season of 2009 the recharge to the floodplain was only upto 1.8 m whereas during 2008 it was upto 3.52 meters. Further he informed that during the monsoon season, the river water samples are being collected on daily basis. He presented variation of $\delta^{18}O$ in the river Yamuna during the monsoon season. He also presented the analysis of the water levels being measured in piezometers at weekly interval on Delhi side of the river Yamuna as well that of the isotopic composition of rainfall samples being collected at the field site.

Sh. Gurunadha Rao suggested that resistively survey may be carried out, if possible, to confirm the presence of paleochannel in the area. Dr. Sudhir Kumar informed that a depression has been observed in satellite data which indicates the presence of paleochannel in the area.

The working group noted the progress.

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

The study was presented by Dr. Sudhir Kumar. He informed that the study has been approved as a purpose driven study under the Hydrology Project II. He further informed that the study requires a comprehensive multi-institutional, multi-disciplinary and multi-locational study approach. The State Groundwater Departments would provide crucial inputs pertaining to hydro-geology, hydrology, land use etc. Inputs from NGO's and other stake holders will also be considered. Conjunctive use of surface/ groundwater, artificial recharge/ draft regulation and institutional interventions would be crucial decision variables. After a detailed understanding of hydro-geology, hydrology and land use practices, conceptual model for groundwater management shall be attempted. Further, he said that experience of groundwater hydrologists/ hydro-geologists will be used in arriving at policy guidelines which will be the basis 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.

Discussing the progress of the study, Dr. Sudhir Kumar informed that two watersheds have been identified in the Tumkur and Chitradurga districts for carrying out groundwater management studies and a visit was made during the first half of January 2010 to Bangluru, Chitradurga and Tumkur districts for identifying the actual field conditions, selection of site for installation of equipment and data collection. GIS Database has been prepared for both the watersheds including Base map, Drainage map, Road map and Water storage structures maps etc. Maps of Lithology, landuse and landcover, soil type and geomorphology etc. have been prepared also for both the watersheds. Water level data (Depth to water level and reduced water level) have been collected for about 14 observation wells in Chitradurga watershed (only for 2009) and 15 in Tumkur watershed (from 1971 to 2009) and contours prepared. Rainfall data of 8 rain gauge stations for Chitradurga watershed (from 2004 to 2008) and 16 rain gauge stations for Tumkur watershed (from 1971 to 2008) is being analyzed. Water Quality data have also been collected for 13 observation wells for Chitradurga watershed (2009) and 20 for Tumkur watershed (from 1997 onwards). About 15 groundwater samples from Chitradurga and Tumkur watershed have been collected from different wells for Stable isotopic analysis.

The working group noted the progress of the study.

5. 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, Arnigad and Bansigad near Mussoorrie have been selected for the study. Arnigad micro-watershed having an area of 3 km^2 is covered with dense oak forest while Bansigad micro-watershed having an area of 2 km^2 is covered with degraded mix forest of oak and pine. Both the watersheds are on the south facing hill slope. Highest and the lowest elevations of both the project areas are approximately equal. Other morphometric parameters such as, relief ratio, stream order, form factor, and elongation ratio etc are almost same. Geology of both the watersheds is same and the difference is only in land-cover. Discussing the results obtained from the analysis of the various collected data, Dr. S. P. Rai informed that the average air temperature varies between 15.5^{0}C (minimum) and 25^{0}C (maximum) in degraded watershed and 18^{0}C to 22^{0}C

in forested watershed. The relative humidity is observed to be minimum in summer months and maximum in rainy months. The evaporation rate varied from minimum 2.5 mm/day in rainy months to maximum 6 mm/day in summer months. Monthly average discharge in degraded watershed (Bansigad) varies between 0.01m^3/sec (minimum) in the month of November to 1.02 m^3/sec (maximum) in the month August. The watershed becomes dry during the May and June. However, in the forested watershed, it varies between 0.05 m^3/sec in the month of June to 0.88 m^3/sec in the month of August. It remains perennial throughout the year. Hydrograph analysis reveals that rainfall response on stream discharge of both the watersheds is very quick. However, the recession part of hydrograph differs in both the watersheds. The discharge declines slowly in Arnigad stream during post monsoon months while it declines at a faster rate in Bansigad stream and it dries up in summer months. The preliminary observations reveal that the stream flowing through dense forest sustains during non-monsoon months due to input from the delayed subsurface flow. Further, he informed that the total rainfall received during April 2008 to March 2009 in the Arnigad and Bansigad micro watersheds are 2905 mm and 2958 mm respectively which is generating a runoff of 1627 mm and 1932 mm respectively. Monthly distributions of runoff in both the micro watersheds vary significantly. During the monsoon period from June to September both the watersheds receive about 86-88% of the total rainfall while runoff percentage during June to September is 81% in Bansigad and 60% in Arnigad watershed. Runoff from the Bansigad (degraded) micro watersheds is 19% higher than the Arnigad (dense) micro watershed. During the period, from October 2008 to March 2009, both the watersheds received rainfall approximately 3% of the total rainfall received during the year. Runoff during the same period was 545mm from the Arnigad (dense) and 361mm from the Bansigad (degraded). These results indicate that runoff is more uniform in case of the dense forest. Runoff in both the catchments is maximum during August and minimum during the May. Total runoff in Bansigad during the month of August is 60% higher than that of Arnigad and from July to September, it is 48% higher than that of Arnigad. Runoff coefficient during the monsoon period, June to September is 0.39 and 0.61 for Arnigad and Bansigad micro watersheds respectively. During post monsoon months, stream discharge from the degraded watershed reduces drastically. Discharge in Arnigad stream becomes higher than the Bansigad stream. Total runoff in Arnigad during the non-monsoon period from October to March is 184mm (50%) more than that of Bansigad.

Dr. Rai also presented the analysis of the isotopic composition of rainfall and stream water data. He informed that $\delta^{18}O$ of rain varies between minimum –21.2 ‰ in the month of September and maximum +2.6 ‰ in the month of June at Bansigad site and it varies between minimum –16.7 ‰ in the month of August and maximum +5.7 ‰ in the month of May at Arnigad site. He also presented the relations between δD and $\delta^{18}O$ developed for the study area. He informed that the slope and the intercept of the best fit line of both watershed are close to those of local meteoric water line for the Bhagirathi River basin. Regarding the isotopic composition of the stream water he mentioned that the depleted isotopic signature of stream discharge during the rainy months and enriched values during the pre-monsoon months reveal the seasonal variations due to change in source of contribution. During the monsoon months, stream discharge is dominated by surface runoff while during non rainy months, subsurface flow dominates. He also presented the relations for the stable isotopic signatures of stream discharge in the watersheds and pointed out that slope and the intercept of the best fit line of stream discharge of both the watershed are close to local meteoric water line, which indicates that source of stream discharge is only local precipitation.

Further, Dr. S. P. Rai informed that sediment delivery from both the watersheds has been measured on the basis of daily sampling during monsoon period. The suspended concentration in stream water discharged through V notch in the forested watershed has been found to vary from 2

mg/l during summer months to 8170 mg/l during rainy period while it was recorded as 2 mg/l to 5860 mg/l in the degraded watershed of Bansigad.

To a query from Dr. Avinash Agrawal, Dr. S. P. Rai informed that the factor of watershed area has been taken into the consideration for the purpose of comparison of discharge. Dr. N. C. Ghosh asked to check the dimensional homogeneity of the equation used for estimation of ground water storage.

6. SEDIMENTATION STUDIES OF ROPAR LAKE, PUNJAB USING ISOTOPE TECHNIQUES

The study was presented by Sh. S. D. Khobragade. He informed that the study was taken up on the request of Punjab Council of Science and Technology, Chandigarh who was interested in knowing the sedimentation rate in the water body. He informed that in this study sedimentation rate in the lake is being studied using the isotope techniques. While discussing the progress of the study he informed that the new equipment (i.e. Multichannel Spectrometer) purchased by the HID Division, for the analysis of the sediment samples has been installed in the last week of August 09. Field visits were made to the study site in June, 2009 and November, 2009. Sediment cores have been collected from 7 locations in the lake as well as from 4 locations in the lake bed along the shore of the lake. The sediment cores have been cut into sediment samples of 2 cm or 4 cm thickness depending upon the core size. In total, 178 sediment samples consisting of 98 samples from the lake and 80 samples from the exposed lake bed along the shore have been collected. The samples are being analyzed for Cs-137 activity to determine the pattern and rate of sedimentation. Analysis of two cores has been completed and results indicate that there is very little C-137 activity in the sediment samples. He said that this could be because it was let known during filed investigations that about 20 years back the area was flooded and the lake gates had to be opened, washing most of the sediments. However, he said that the scenario would be clear only when all the cores are analyzed and if no Cs-137 activity is observed, then analysis of Pb-210 activity would be carried out which would need an additional time of about two months. Dr. Bhishm kumar said that no formal extension to the study is required however, the report can be submitted after two months.

The working group noted the progress of the study.

7. ASSESSMENT OF GROUNDWATER RESOURCES AND DEVELOPMENT POTENTIAL OF YAMUNA FLOOD PLAIN, NCT DELHI

Dr. Sudhir Kumar presented the study. He informed that the study is being undertaken as a consultancy project which has been sanctioned by Delhi Jal Board and would be jointly undertaken with various organizations such as IIT Delhi, CGWB Delhi, ICAR Delhi, CWC Delhi and Delhi Jal Board. The total cost of the project is Rs.36.267 lac with NIH Component being Rs.26.594 lac. Dr. Sudhir Kumar further informed that under this study it is envisaged to achieve various objectives such as estimation of groundwater resources in the Yamuna floodplains, estimation of groundwater development potential in space and time through ground water simulation studies, assessment of the impact of groundwater extraction from floodplains on hydrological regime, and assessment of groundwater quality vis-a-vis availability of drinking water. He further elaborated that the study would also include various aspects such as deciphering

the disposition of aquifer system within and adjacent to floodplain, ascertaining the groundwater flow direction in reference to river Yamuna, assessment of the total groundwater resources within the floodplains, delineation of the groundwater contaminated areas, to evolve strategy for development of potable ground water, and investigation of impact of ground water development on hydrological regime. He added that the possibility of augmentation of ground water in the floodplain using flood water of river Yamuna would also be explored in the study. Discussing the methodology, Dr. Kumar informed that the study would involve processing and analysis of available data with partner Institutions, field investigations, ground water quality analysis, isotope tracer techniques and ground water flow modelling. Informing about the output of the study, he expressed that the study shall bring out the total groundwater potential of Yamuna floodplain in Delhi. Areas with poor groundwater quality shall be demarcated. Also, suitable areas for groundwater abstraction shall be identified.

The proposal was approved by the working group

8. DEVELOPMENT OF SPRING SANCTUARIES IN AN URBAN AND A RURAL WATERSHED IN DISTRICT PAURI GARHWAL, UTTARAKHAND

Dr. S. P. Rai presented the study. He informed that the study is being taken up as a joint project with the GBPIHED. The project will be of three year duration and it would be partly funded by GBPIHED while the remaining funding would come from NIH. Discussing the need and background of the study Dr. S. P. Rai informed that springs are the major source of drinking and other household activities in the hilly terrain of Uttarakhand. The dwindling of discharges of springs and spring fed streams in the populated Lesser Himalayan terrain of Western Himalayas has become a matter of serious concern. Therefore, it is essential to augment the diminishing discharge of springs. Further he informed that in this connection, Jal Sansthan Uttarakhand has approached NIH for identification of recharge zones of the springs. Also, GBPIHED has approached to NIH for collaborative study of recharge zone identification and implementation of recharge techniques. Discussing the objectives, Dr. Rai informed that the main objectives of the study are to decipher the recharge zone of springs falling in the study area, to analyze the relationship between rainfall, evaporation, landuse/land cover and ecological factors with spring discharge and to implement spring sanctuary strategy in the identified recharge area in order to enhance the discharge. Discussing the methodology, Dr. Rai informed that detailed Geological Mapping of the study area would be done including the ddelineation of lithological units. Trends or patterns of structures would be analysed. Geomorphological Investigations (such as morphometric analysis along with slope analysis) would be carried out. Water samples would be collected from precipitation, spring and ground water and isotopic signatures would be determined. The isotopic data would be analysed in conjunction with the geological data to identify the recharge zones and based on this rejuvenation measures for springs would be suggested. The rejuvenation measures would include designing and identifying locations for developing engineering structures such as infiltration trenches, water storage tank and bunds etc. Biological measures, if necessary, would also be suggested.

The proposal was approved by the working group

9. STUDY OF VARIABILITY OF SNOW AND GLACIER CONTRIBUTION IN MELT WATER OF GANGOTRI GLACIER AT GOUMUKH USING ISOTOPIC TECHNIQUES

Dr. S. P. Rai presented the study. Discussing the need of the study Dr. Rai informed that

the snow and glacier melt runoff contributes significantly to all north India Himalayan rivers during summer when demand of water increases for hydropower, drinking and irrigation etc. Due to lack of information on hydrological processes of snow/glacier regime and assured availability of melt water, water resources management policies at lower reaches of the glacier fed rivers are often formulated without considering the impact of snow and glacier on river hydrology. Generally, the contribution of snow and glacier melt runoff into annual flow of the different Himalayan rivers have been studied on meso-scale, considering the glaciers and seasonal snow cover area as a single unit. While, climate change will greatly affect the glacier melt contribution. Therefore, it becomes essential to understand the contribution of snow and glacier melt to the river in headwater region along with the rain on river discharge. He informed that the study has been taken up as an internal project of NIH for duration of three years.

Informing about the objectives of the study he said that the major objectives of the study are isotopic characterization of melt water near snout, isotopic characterization of Snow, Glacier and Rain near snout and estimation of snow and Glacier melt using two component model. Discussing the methodology, Dr. Rai informed that the study would be carried out using isotope techniques. Stable isotopes of oxygen and hydrogen, environmental radioisotopes like H-3 and artificial radioisotope like Cs-137 will be used for the characterization. Chemical analysis (major cation and anion) of collected samples will also be carried out. Discharge and meteorological data will be used for analysis of isotopic data. Further Dr. Rai said that this will be the first attempt to estimate the contribution of snow and glacier in melt water of Gangotri glacier. The long term isotopic data of melt water near snout would be useful to study the impact of climate change on melting of Hamalayan glaciers.

Dr. Gurunadha Rao appreciated the study and said that the study is particularly significant in light of the climate change scenarios as the results would be more realistic. Dr. Shivanna also appreciated the study.

10. IDENTIFICATION OF RECHARGE ZONES OF SOME SELECTED SPRINGS OF UTTARAKHAND USING ISOTOPES

The study was presented by Sh. S. D. Khobragade. He informed that the two year study would be carried out as internally funded study. While discussing the need of the study he informed that a there are a number of springs in Uttarakhand and many of these are the only sources of water in their areas. However, many of these springs have reported a continuous reduction in their discharge in recent times, while some are drying out during summers. So a request has been received from Uttarakhand Jal Sansthan, Dehradun to take up studies on these springs. Further he informed that , although request has been received to study springs of about 10 districts, keeping in view the feasibility, only a few springs (2 -5) would be taken up in the first phase and the study area would be finalized in consultation with the Uttarakhand Jal Sansthan, Dehradun and other concerned organizations. While discussing the objectives of the study Sh. Khobragade informed that the study would be carried out to identify recharge areas of the springs and to suggest remedial measures for rejuvenation of these springs. Discussing the methodology, he informed that the study would be carried out using isotopes particularly, stable isotopes of oxygen and hydrogen including environmental tritium. However, hydro-geological and geo-chemical aspects will also be studied and the isotopic data will be correlated with the hydro-geological and geo-chemistry data. DEM of the study area would be prepared. Sites for measuring discharge and rainfall would be established. Water samples would be collected from various sources such as precipitation, ground water, spring water etc. The samples would be collected on weakly basis during the non-monsoon season and on daily basis during the monsoon

season. The samples would be analyzed for environmental isotopes. He informed that meteoric water line and altitude effect will be established for the study area to determine the recharge zones. Based on the analysis of the data, recharge sources of the springs would be identified and accordingly remedial measures for the rejuvenation of the springs would be suggested. Discussing the output, Sh. Khobragade informed that the output of the study would be in the form of a report wherein remedial measures for the rejuvenation of the springs would be suggested based on the investigations carried out for the identification of the recharge zone(s). The report would also include the Local Meteoric Water Line and isotopic signatures of different waters in the study area as well as other Hydro-geological data of the study area.

The proposal was approved by the working group.

SURFACE WATER HYDROLOGY DIVISION

Dr. 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 studies was presented by the respective P.I. of the study. The details are as under.

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

Dr. Avinash Agarwal presented the progress of the project to the house in brief. Initially he informed about the past progress of the project in relation with the old instrumentation, data status, analysis of spring flow, flow duration curve, spring rainfall analysis, delineation of recharge zone, infiltration and rainfall characteristics, water balance, new instrumentation, two new river gauging sites each in one watershed as in Bainsoli and Tayari. He further added that the shape file for watersheds for drainage characteristics, land use, soil texture, spring, tanks and instruments sites have been prepared using Arcview. The sediment sampling on four gauging sites is continuing manually. Further while reporting the progress of last six months, Dr. Agarwal informed about the socio economic survey results, location of water user and satellite imageries procured and analysis carried out. It was also informed that around three hundred soil samples have been collected in Anjanisain watershed for analysis of soil texture.

Dr. S P Agarwal enquired whether the irrigated land is being irrigated by only spring water or by any other sources. It was informed that the area has water resources as springs and the main river. The springs are mainly used for drinking water supply and for human and animal use. The rest water goes to the main channel and at the outlet of watershed. This water is used for irrigation. There are some tanks in which the unused spring water is stored and that stored water is used for irrigation that is why the irrigated land is very less within the watershed. Further the main concern of the project is the distribution of spring water for drinking water supply and the distribution of the available spring water to all users. In this connection all springs and their uses are marked by G.P.S. and listed in one group and survey table on this aspect was shown.

Dr. Avinash Agarwal appraised the working group members about the IEC activity. Dr. S. P. Agarwal suggested that it is very useful and effective activity concerned to water awareness and it should be placed on the web site of NIH.

2. HYDROLOGICAL STUDIES IN A FORESTED WATERSHED IN UTTARAKHAND

Dr. J.V. Tyagi, P.I. of the project presented the objectives, methodology, progress from Sept. 2009 to Feb. 2010 and 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 in Nainital District with the objectives 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 effects in terms of the variation in natural regeneration of Sal. Based on the analysis of data, it was concluded that the regeneration is better correlated with incidence of light intensity than the soil moisture storage. The simulation by ANSWERS model shows that the soil erosion is higher in areas under C3 canopy than those under C1 and C2 canopies. The high soil erosion under C3 canopy contributes to uprooting and washing away of tender seedlings during their establishment stage in early monsoon season. This may be one of the reasons, among others, for poor regeneration under C3 canopy. Dr. Tyagi also informed that as per the schedule, the project is to be completed by end of March, 2010, but the regeneration survey of Sal, which is normally conducted during February – March every year is still going on in the field and is expected to be over by end of March only. He submitted that this data is also to be analyzed in relation to previous years' data before presenting the result in the draft report and requested the Chairman, Working Group to allow extension of time up to August 2010 for analysis of new data and incorporation of the same in the report. The Chairman agreed and allowed for submission of draft report by August 2010.

Dr. S. P. Agarwal enquired about the reason for higher erosion under C3 canopy than under C1 and C2 canopies. It was informed by Dr. Tyagi that the C3 canopies stand on steeper slopes and have low understorey cover and as a result, the erosion is higher in C3 canopy.

3. DEVELOPMENT OF DROUGHT VULNERABILITY INDICES FOR PREPAREDNESS AND MITIGATION

Dr. Rakesh Kumar Sc. F and Head, Surface Hydrology Division invited Dr. R.P. Pandey Sc. E1 and PI to present the study. The PI presented completed study in the working group meeting. He informed that the complete study has been also presented in the R&D Session of INCOH at IIT Chennai on Feb 10, 2010 and the report is being finalized for submission. In the meeting the Chairman advised the PI to present the work done during past six months only. Accordingly PI presented the work done for completion of the project. Dr. Agarwal, from IIRS Dehradun enquired about consideration of differential weighing scheme for integrating different factors. The PI informed that the study has a scope for consideration of differential weighing scheme also and then it can be further evaluated. The chairman advised the PI to include the future scope of work in the study report including possibilities of differential weighing scheme.

4. STUDY ON INTEGRATED WATER RESOURCES MANAGEMENT OF SUB-BASIN TO COPE WITH DROUGHTS

The PI of the project Dr. R.P. Pandey presented the progress of the study made in past six months. The PI informed that the soil map, DEM, drainage map etc. have been prepared for the study area in Tons basin. Land use map and water availability maps are under preparation. The PI further informed that the permission for supply of discharge data for two sites in Tons basin has been obtained from CWC and this data will be collected shortly from CWC office Varanasi.

Matter is being perused with IMD for obtaining rainfall and other meteorological data. PI reported that a report on inventory of water resources in the basin is being prepared to assess strategic water resources for utilization during drought.

5. SNOW MELT RUNOFF MODELING USING FUZZY LOGIC

Dr. A.K. Lohani, presented the progress of the work. He informed that the catchment area of river Beas up to Pandoh dam site has been selected for the development of a fuzzy logic based snow melt runoff model. He informed that the fuzzy set theory can be successfully applied to inter-relate variables in hydrologic process calculations and modelling the aggregate behavior which is generally nonlinear in nature. He also presented the methodology adopted for developing the model and the tentative results. Dr. V.V.S. Gurunadha Rao, Deputy Director, NGRI suggested that the developed fuzzy model may be applied for the prediction of the snow melt runoff for the selected basin. Dr. Lohani agreed with Dr. Rao's suggestions. Dr. N.Y. Apte, DDG, IMD, New Delhi informed that the IMD is planning to install AWS in various parts of the country and collecting requirements of the various users. Dr. Manohar Arora, Scientist C, informed that NIH has already placed its requirements to IMD, New Delhi.

6. SNOW MELT RUNOFF MODELLING IN SUTLEJ BASIN

Shri A. R. Senthil Kumar, PI of the project, presented the objectives, methodology, and results of the study in brief for the period from April 2009 to September 2009. He also presented results of the study as per the suggestion of the Chairman working group suggested during the last working group meeting. He informed to working group members that the results of the ANN models for low flow, medium and high flow values were not as good as the ANN model for continuous flow data. Dr. Deepak Kashyap suggested to develop a conceptual model based on physical processes for predicting the flow, and to compare the results with ANN models. Shri Senthil Kumar replied that it would be done in the second year of the study. Dr. Manohar Arora, member of the study, supplemented that the parameters computed for Himalayan region would be used in the development of the conceptual model.

7. RUNOFF AND SEDIMENT MODELING IN A PART OF THE BRAHMAPUTRA RIVER BASIN USING ANN

Mrs Archana Sarkar, PI of the study presented the background, objectives, methodology and results of the study. Mrs Sarkar informed that the study area includes three gauging sites and one northern tributary. She informed the house 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 results are good and correlation is more than 90%. Rating curves using conventional technique have also been developed for the three sites but the results are much inferior compared o ANN techniques. She further informed that rainfall-runoff modeling as well as sediment yield modelling using ANN has been carried out for the Subansiri River basin. The results for both cases show a correlation of more than 90% when previous time step data of discharge and sediment are included in rainfall-runoff ANN models and sediment yield ANN models respectively. She informed that the reason behind such results is shortage of meteorological data (spatial and temporal). Sh. S.K. Mittal, Member of the working group asked about the contribution of the study as it is getting completed. Mrs Sarkar informed that the present study is the first study on hydrological modeling for the study area in Brahmaputra River basin. Therefore, the results could be useful for any further development work

in the basin. Moreover, lot of database has been generated for the study basin which forms a base for further research studies. Dr. S.P. Agarwal, Member of the working group asked if the developed ANN models can be used for other basins and whether the ANN models can be used for extrapolation. Mrs Sarkar informed that the developed ANN models can be used for other basins only when the other basins are hydrologically similar and also that the ANN models can not be used for extrapolation.

8. STUDY ON ENVIRONMENTAL FLOW FROM PROPOSED DAM OF TEESTA STAGE IV HE PROJECT

Dr. Manohar Arora informed that the study area has been changed from Loharinag Pala to Teesta site because of a sponsored project by NHPC. He presented the results obtained by various methods viz. Tenants method, Modified Tenants method, Flow Duration Method, 7Q10 Method and the analysis of flow data using the intermediate contributions as well. Dr. G. C. Mishra wanted to know as to how the water requirement of fishes will be met. Dr. Arora informed that CIFRI is doing the ecological part and then the combined recommendations will be incorporated the report of the study.

9. MONITORING AND MODELLING OF STREAMFLOW FOR THE GANGOTRI GLACIER

Dr. Manohar Arora presented the progress of the study. He informed the house that the field investigations were carried out till September 30th 2009. He presented the data collected and presented the analysis of the meteorological and discharge data. He further informed about the installation of the AWS at the meteorological observatory. He informed that AWS has been working and the quality of the data has improved after installation of the AWS.

10. DATA BOOK-HYDRO-METEOROLOGICAL OBSERVATORY 2001-2008

Shri A. R. Senthil Kumar presented the objectives, methodology and present status of the study. He also informed that entry of the hourly temperature for two years has been completed and the entry of hourly humidity data has been started. He also presented the graphical sample of the data entry for hourly temperature and humidity.

11. SNOWMELT RUNOFF MODELING AND STUDY OF THE IMPACT OF CLIMATE CHANGE IN PART OF BRAHMAPUTRA RIVER BASIN

Mrs Archana Sarkar, PI of the study presented the background, objectives, methodology and expected outcomes of the study. Mrs Sarkar informed the house that the National Action Plan for Climate Change has launched eight missions including National Water Mission. MoWR has chalked out an Action Plan to take up related studies on Indus, Ganges and Brahmaputra River basins through CWC, NIH and Brahmaputra Board. Mrs Sarkar informed that the Institute has already carried out related studies for the Indus and Ganges basins but the proposed study would be the first one for the Brahmaputra River basin. Mrs Sarkar informed that data generated for the Subansiri River basin in a previous study would be utilized in addition to other procured data during study. Degree day approach would be followed for hydrological modeling including snowmelt runoff modelling. Various scenarios of precipitation and temperature would be considered to study the impact of climate change on the hydrological regime of the study basin. Mrs Sarkar informed that one technical report would be prepared after every year of the study.

12. CLIMATIC SCENARIOS GENERATION FOR SATLUJ BASIN USING STATISTICAL DOWNSCALING TECHNIQUES

Dr. Manohar Arora presented the study and informed about the objectives, methodology and work programme. As this is a new initiative in the downscaling of GCM output to basin level, the methodology would be developed and modified as per the data availability.

GROUND WATER HYDROLOGY DIVISION

Dr. N. C. Ghosh, Scientist-F & Head of the division presented an overview of the technical activities carried out by the division & progress made on different studies during last six months, and also presented the proposed work programme of the division for the year 2010-'11. Dr. Ghosh informed that out of 3 internally funded studies and 2 sponsored studies, one internally funded study shall be concluded and one sponsored study has already been concluded during the current year; and two studies shall continue during the year 2010-11; while one internally funded study shall be dropped in view of shortage of scientist. Dr. K. Shivanna of BARC observed that the studies being carried out and proposed by the division are conventional hydraulic types. He suggested that if NIH could undertake study to assess how much quantity of groundwater is being going as unutilized through the long coastline of the Country. On this point, Prof. Kashyap opined that as a policy a certain percentage of groundwater needs to be allowed to go through the sea line boundary to push back the intrusion of saline water ingress to the inland, therefore, one can think to work out how much groundwater in excess to the quantity as required for stoppage of saline water intrusion is going as unutilized from the inland groundwater domain. Thereafter, Dr. Ghosh requested the concerned PIs to present the detailed progress of the each study. Study-wise suggestions and discussions emerged are given below.

1. STUDY OF RISING GROUND WATER TABLE IN JODHPUR CITY, AND TO EVOLVE A MANAGEMENT PLAN TO CONTAIN THE RISING TREND.

Dr. N. C. Ghosh, P.I. of the project presented the progress of the study including few preliminary observations made from the analyses. He informed that the study has been sponsored by the Govt. of Rajasthan with a cost of 24.52 lacs of one and half year duration. The study is of real life concern as the area is experiencing the water logging conditions in many pockets and people are suffering by the rise in groundwater level. Towards the progress of the study, Dr. Ghosh informed that the data supplied and collected from different agencies are being analyzed for geo-referencing and consistency check. He informed that an interim report based on the preliminary analyses is to be submitted by March end to the sponsoring agency. It was further informed that Prof. (Retd.) G. C. Mishra has been appointed as the consultant to this project. Dr. Mishra shared his observations acquired from his field visit during October, 2009, and suggested that if the variation of the water table contour maps over the last years are generated correctly, then one can identify the direction and sources of rise in groundwater table in the area. Dr. Ghosh sought the advice from the Working Group members if they had any other ideas of analysis. Prof. Deepak Kashyap suggested that if the hydrologic components are estimated separately with reasonable accuracy, and by comparing those with the change in storages, which can be determined from the difference of water table contour maps, one can ascertain the influence of governing hydrologic component causing the rise in groundwater table reasonably. He suggested

for carrying out the water balance of the area first, before undertaking any distributed groundwater modeling. Dr. Skivanna suggested for isotopic analysis to detect the source.

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

Mr. C P Kumar presented the progress of the study. Dr. Deepak Kashyap inquired whether any groundwater level increase has been observed due to construction of water harvesting structures. It was informed that increase in groundwater levels has been observed and the respective findings of Gangeshwar watershed were presented by the PI in the last Working Group meeting.

3. QUANTIFICATION OF IMPACT OF RAINWATER HARVESTING ON GROUNDWATER AVAILABILITY IN ARAVALLI HILLS – PART II: MATHEMATICAL MODELING

During the presentation of the study by Shri C. P. Kumar, it was informed that this study is an extension of the earlier study wherein modeling of the Savna watershed will be taken up to assess the hydrological impact of rainwater harvesting structures. Dr. G. C Mishra suggested that in Step-1 in brief methodology presented - "unsaturated hydraulic conductivity" may be replaced by "soil moisture retention characteristics".

4. COASTAL GROUNDWATER DYNAMICS AND MANAGEMENT IN THE SAURASHTRA REGION, GUJARAT (PURPOSE DRIVEN STUDY UNDER HP-II)

Shri C. P. Kumar presented the progress of Purpose Driven Study taken-up under the Hydrology Project Phase-II. Dr. Deepak Kashyap suggested to give due consideration to recharge through salt pans in the study area for modeling. Dr. VVS Gurunadha Rao asked to verify if salinity in coastal area is due to seawater intrusion and not geogenic. Dr. G. C. Mishra suggested to examine correlation between outflow to sea and extent of seawater intrusion in order to establish that salinity is due to seawater intrusion. Dr. VVS Gurunadha Rao inquired whether any industries exist in the study area? It was informed that there is limestone mining in the area. Dr. G. C. Mishra advised to give due consideration of cavities formation in limestone for modeling.

5. IMPACT OF CLIMATE CHANGE ON DYNAMIC GROUNDWATER SYSTEM IN A DROUGHT PRONE AREA

Dr. Surjeet Singh presented the progress of the study. Dr. Deepak Kashyap suggested to conduct water balance separately as HELP model is a black box model. Dr. G. C. Mishra suggested to take upper soil moisture boundary condition depending upon the temperature and relative humidity. He also suggested to consider appropriate river boundary condition while modeling the groundwater simulation. Dr. Deepak Kashyap inquired whether varying river stages in view of climate change will be considering in the modeling. In this regard, Director, NIH suggested that different river stages scenarios may be considered for the modeling work. Dr. VVS Gurunadha Rao suggested that while estimating the recharge, isotope study may also be taken up with the help of Hydrological Investigations Division.

WATER RESOURCES SYSTEM DIVISION

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

Dr. Sanjay K. Jain presented the objectives and progress of the study. He explained the work carried out during the last six months. The hydro-meteorological data up to December 2009 have been collected from BBMB, Sundernagar. A field visit has been made during January 2010 and snow, stream flow samples from five sites has been collected. He informed that samples have been analysed by Dr. S.P. Rai, Sc. E1, Hydrological Investigations Division, and results of the analysis were presented. Dr. Rai informed that after getting daily sample from summer months, the results will be further modified. The trend analysis of rainfall and temperature data has been carried out by Dr. Vijay Kumar. The results of trend analysis were presented. It was also informed by Dr. Jain that the procurement of instruments and satellite data is in progress. The satellite data from NRSC are likely to be procured during the month of March 2010. The data would be utilized for carrying out the snow cover mapping. Dr. Apte suggested that the results of trend analysis can be sent to climate centre, IMD for validation. Application of down scaling technique is required for the assessment of projected climatological scenarios with active support of the consultants to be procured under HP-II very soon.

2. 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 a PDS has been taken up by BBMB. NIH is collaborating with BBMB for this study. Dr. Jain presented the objectives and work elements along with the progress of the study. The order has been placed for procurement of satellite data. The assessment of sedimentation rate using remote sensing data has been taken up and it is likely to be completed by the end of this year. He has shown the data base created in Arc SWAT. The sediment discharge analysis carried out for different sites of Satluj basin by Dr. Vijay Kumar was presented. Mr. Mitra asked about the boulder size coming at a site. Dr. Jain informed that the sample collection etc. is being carried out by BBMB. Chairman suggested that the required information can be obtained from BBMB. Mr. Srivastawa asked how life of reservoir can be obtained using remote sensing. Dr. Jain replied that the estimate of sedimentation rate/capacity of the reservoir may be utilized for determining the life of the reservoir.

3. WEB-BASED HYDROLOGY AND WATER RESOURCES INFORMATION SYSTEM FOR INDIA

Mrs Deepa Chalisgaonkar presented the progress of the study. Dr Mitra enquired whether the salient features and updated information on hydropower project will be available in this web application. Chairman suggested that the web site is required to be updated from time to time. He also emphasized that the technical report should be a concise report. Dr M.K. Goyal suggested that a brochure may be brought out for this web site. Dr Gurunadhha Rao enquired whether the pages will be dynamic. Dr Apte suggested to include news items related to hydrology and water

resources in the web application. Chairman suggested that the news items could be those related to floods, droughts and disasters, etc.. Dr S.P. Agarwal enquired regarding the uploading speed of the web site of NIH. He suggested for including the links to various sites e.g. Bihar Flood web site etc. Dr Lohani informed that presently the uploding speed of NIH web site is 512 kbps and shortly it will be shifted to BSNL network with speed of 25 kbps. Chairman suggested that link for the 'National Water Portal' may be provided.

4. HYDROLOGICAL ASSESSMENT OF UNGAUGED CATCHMENTS (SMALL CATCHMENT)

Dr. P K Bhunya presented the status of the study in brief covering the objectives, methodology, analysis, and results. He further appraised regarding duration of this purpose driven study (PDS). He also informed the progress of studies that was presented in last working group, and the works carried out since inception of this project till date. Dr. Bhunya presented the status of hydrological data, toposheet, imageries, and an experimental small catchment in Mahanadi. He presented the technical results which included regional flood frequency model, regional hydrographs parameters, water availability for Brahmani at Rengali g.d site, homogeneity tests, storm events, and the geomorphological parameters of 26 small catchments. Few photograsphs of the field visit were shown during the presentation. The technical publications including a book on soft computing techniques that was proposed in this project area were also discussed. He also presented the next year's work-program.

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

Dr. Sanjay K. Jain informed that IIRS, Dehradun is also collaborating in this study. He informed that first phase of the report is over in March 2009 and an interim report has been prepared. Dr. Jain informed that one more AWS has been installed in the catchment. Also IRS LISS IV data have been procured for land use map preparation. Dr. S P Agarwal informed that energy balance equation is also being applied for computation of ET. Chairman said that in first phase of the study, point values of ET have been used and spatial information will improve the result. He said that the results of runoff modeling and water balance may be presented in the next meeting.

6. APPLICATION OF A DISTRIBUTED HYDROLOGICAL MODEL FOR RIVER BASIN PLANNING AND MANAGEMENT

Dr. M K Goel presented briefly the objectives and scope of the work and the various models that are envisaged to be applied in the study. He presented in detail the work carried out since the last working group meeting. He described and presented the database development of the upper Bhima basin for the NIH model application. It was informed that most of the GIS data has been obtained and is being customized in the ILWIS GIS system for the model application. He presented data layers for basin boundary, DEM, drainage, reservoir locations, landuse, talukas, rainfall stations, river gauge stations, and climate stations.

Finally, he described the tentative quarterly plan of the targets of the study group for the next year for addressing various objectives of the study. The members conveyed their consent to the presentation.

7. GIS BASED DAMS AND DROUGHT INFORMATION SYSTEM

Mr. D.S. Rathore presented the progress of the study. He informed that Mapserver, an open source Internet GIS server, was selected for publishing of the GIS data on Internet. The software was downloaded, installed and tested. A tutorial application was also downloaded. Building of the HTML application is under progress. Standardized Precipitation Index (SPI) was identified as a drought index. The monthly rainfall data for the districts in India for year 1901 to 2002 are downloaded from the web site of the India Water Portal. A spreadsheet application was written for fitting probability distribution, testing of the goodness of fit and estimating rainfall values for the SPI indices applying inverse distribution. The rainfall values corresponding to SPI indices for different time scales will be calculated and disseminated. It is further proposed to estimate drought magnitude and return period for different time scales. Dr Apte observed that in case of any future change in the district boundaries, the district maps and indices would be required to be revised.

8. TECHNICAL REPORTS SUBMITTED TO WORKING GROUP CONSTITUTED BY MOWR, NEW DELHI

Dr. S. K. Singh, Scientist F informed that the following reports were submitted to the national level Working Group constituted by Ministry of Water Resources, Government of India, and headed by Member (D & R), Central Water Commission, New Delhi [the Working Group is currently being administratively monitored by Joint Secretary (Admn), Ministry of Water Resources on behalf of the Secretary to the Government of India, Ministry of Water Resources], under one of its terms of reference as "Stream-aquifer relationships and aquifer recharge."

1. Streamflow depletion due to pumping and aquifer responses due to stream-stage change.
2. Flow depletion induced by pumping well from stream for basic management cases.

Working Group noted the progress of the ongoing studies of Water Resources Systems Division.

9. *NIH_ReSyP* – A SOFTWARE FOR RESERVOIR ANALYSIS (VERSION – 1)

Dr. M K Goel described the background of the study. He informed that work is going since 2002 on the development of WINDOWS based software for various kind of reservoir analysis. Different modules of the software include capacity computation, conservation operation, flood control operation, hydropower analysis, reservoir routing, and miscellaneous other modules. He described that the software in the present form is dependent on MS ACCESS and MS Excel systems and cannot work independently.

He proposed to develop the stand-alone package so that it could be worked with any computer. He also proposed to add two new modules to the existing system to make it more robust. He also envisaged preparing the information brochure for the software for first-hand information of the package. It was informed that two training courses are proposed to be organized during the year to create mass awareness about the software and to obtain the views of the State engineers for making it more useful. The members appreciated for the envisaged efforts of the team.

10. WEB BASED INFORMATION SYSTEM FOR MAJOR AND IMPORTANT LAKES IN INDIA

Smt. Deepa Chalisgoankar presented the study. She informed that the objective of the study is to develop a web-based information system for major and important lakes in India and

attach it to the Web-based Hydrology and Water Resources Information System for India developed by the Institute. She said that this is an attempt to develop a web based inventory / Information system for lakes in India which intends to provide information regarding the various hydrological and limnological aspects of the lakes of India. She further informed that all the available information on various lakes would be gathered and provided in the system such as location (latitude / longitude), morphology and morphometry, water uses, type of origin and historical significance, physical characteristics, biological characteristics, thermal regime, water quality characteristics, sedimentation, water balance, lake dynamics etc. Also, information on environmental status of the lakes and the major problems/environmental threats and conservation measures undertaken/being undertaken for the lakes would be incorporated. Efforts would also be made to provide bibliography of the research carried out on the lakes till date, and the list of the various organizations involved in conservation, management and research on the lakes. Further, it would also include a mini dictionary of the important terms related to Lake Hydrology and Limnology for the ready reference of the users. She expressed that the proposed web based system will be helpful for the users working in the area of research related to conservation and management of lakes in India.

Dr. M.K. Goel enquired whether the information system would include only natural lakes or man made lakes also. Sh. Khobragade informed that both categories of lakes would be included. However, large multipurpose dams of modern origin would be excluded. Dr. Mitra asked why only major and important lakes are being included. Sh. Khobragade explained that there are thousands of lakes in India and some of which are very small and not much significant. So it has been decided to include only the important lakes in the study. Chairman suggested that there should not be any restriction on size as such, and all the lakes whose information is available, should be included in the information system. Chairman asked the P.I. to prepare the frame work of the web based information system and present it in the next meeting.

11. PREDICTION OF DISPERSION COEFFICIENT OF STREAMS USING KRIGING TECHNIQUE

Dr. Vijay Kumar, Scientist 'E1' and PI presented the objectives of the study and methodology to be adopted. It is intended to use the kriging technique for the prediction of dispersion coefficient in streams from the flow and cross-sectional characteristics of streams. Dr. S P Agarwal, Scientist, IIRS, Dehradun suggested to use the co-kriging technique as several variables are involved. The PI informed that to take care of several variables, it is intended to form non-dimensional groups of variables and thus the intended kriging technique would take into account several variables related to stream flow and geometric properties of the stream.

12. COMPUTATIONALLY SIMPLE FUNCTIONS FOR APPROXIMATING NORMAL AND LOG-NORMAL DISTRIBUTIONS.

Dr. S.K. Singh presented the objectives, methodology and intended outcome of the study. Computationally simple functions (calculations for which can be performed on a hand-held calculator) are intended to be developed for normal and log-normal distributions, which would be of help to field engineers and practitioners dealing with the frequency analysis of floods and deterministic modeling of flood prediction using unit hydrograph as a frequency distribution.

There were no comments. Chairman advised to have relevant discussions in the next meeting with the presentation of results.

13. A SIMPLE IUH MODEL FOR RUNOFF MODELING.

Dr. S. K. Singh presented the objectives, methodology and intended outcome of the study, in which it is intended to develop a computationally simple function/distribution for instantaneous unit hydrograph for event based runoff modeling. It is also intended to impart to it a possible conceptual and physical justification with illustration to field data. It is hoped that, it would be of help to field engineers and practitioners because of its computational simplicity.

There were no comments. Chairman advised to have relevant discussions in the next meeting with the presentation of results.

14. ANALYSIS OF WATER MANAGEMENT SCENARIOS IN TAPI RIVER BASIN USING MIKE BASIN

The brief outline of the study was presented by Ms. Rama Mehta. She informed that the major objectives of this study include identification of water resources issues in the study area, Model setup for Tapi river basin upto Ukai dam using Mike basin software and analysis of different water management scenarios. She told that the model applications will be carried out upto Ukai dam. Mr. Rishi Srivastava suggested that there is major problem of flood control in the Surat city which is downstream of Ukai dam. Is it possible to extend this study area upto Surat? The matter was deliberated at length and it was concluded that flood operation study for Ukai dam can not be considered as a part of this study because of hourly time step consideration. However if required, the study can be subsequently taken up for flood operation analysis of Ukai dam.

Working Group considered and recommended the new proposed studies for the WRS Division.