

**MINUTES OF THE
46TH MEETING OF WORKING GROUP OF NIH
HELD AT NIH, ROORKEE, DURING 8-9 FEBRUARY 2018**

The 46th meeting of the Working Group of NIH was held at NIH, Roorkee, during 8-9 February 2018 under the Chairmanship of Director, NIH. The list of the participants of the meeting is given in Annexure-I.

ITEM NO. 46.1: OPENING REMARKS BY THE CHAIRMAN

Dr. S K Jain, Director, NIH & Chairman, WG welcomed the Working Group members and the Scientists of the Institute. The Chairman informed the house about the expectation of the government that the research at NIH should lead to solution of practical problems. Also, he invited the WG members to closely interact with NIH scientists.

The Chairman then requested the Working Group members to give their general observations, suggestions and remarks on the scientific activities of the Institute. These are summarized below:

S N	Member	Suggestion(s)
1	Dr Pawan Labhsetwar	<ul style="list-style-type: none"> ▪ Impact assessment of training courses is needed
2	Dr R D Deshpande	<ul style="list-style-type: none"> ▪ Increase level of criticality in interpreting the data ▪ Strengthening of inter-divisional linkages by grouping of activities ▪ Work on pollution, remediation, rejuvenation ▪ Mapping of NIH scientists with WG members for specific studies ▪ Bring out review publications with help of WG members, etc.
3	Dr. Sadhna Malhotra	<ul style="list-style-type: none"> ▪ Improve soft skills ▪ Training on presentation and project management skills needed
4	Dr S S Grewal	<ul style="list-style-type: none"> ▪ Agenda write up should include brief results for ongoing studies
5	Dr U K Sinha	<ul style="list-style-type: none"> ▪ Include GNIP data in IMD database. No Indian data after 1990.
6	Mrs Jancy Vijayan	<ul style="list-style-type: none"> ▪ Prepare standard template for presentations
7	Dr Ramakar Jha	<ul style="list-style-type: none"> ▪ Write up on studies (in PDF format) may be sent in advance to WG members so that they come prepared. ▪ NIH may work on urban water management, smart city
8	Dr A P Dimiri	<ul style="list-style-type: none"> ▪ Align studies with BIMSTECH and SAARC countries, urban hydrology/ flooding
9	Sri Sudhindra M Sharma	<ul style="list-style-type: none"> ▪ Focus on transfer of research results to community, other stakeholders
10	Dr Ashok K Das	<ul style="list-style-type: none"> ▪ Share data from experimental catchment
11	Sri Punit K Mall	<ul style="list-style-type: none"> ▪ Transfer solution of practical problems to practitioners
12	Dr C T Dhanya	<ul style="list-style-type: none"> ▪ Create a data repository
13	Dr Shakeel Ahmed	<ul style="list-style-type: none"> ▪ Place more emphasis on conceptualization

After taking the views of the members and their self-introduction, the Chairman asked the Member-Secretary to take up the agenda of the meeting.

ITEM No. 46.2: CONFIRMATION OF THE MINUTES OF 45th MEETING OF THE WORKING GROUP

The 45th meeting of the Working group was held during 11-12 May 2017. The minutes of the meeting were circulated to all the members and invitees vide letter No. RMOD/WG/NIH-10 dated 06 June 2017. No Comments were received. The members confirmed the Working Group minutes.

ITEM No. 46.3: ACTION TAKEN ON THE DECISIONS/RECOMMENDATIONS OF THE PREVIOUS WORKING GROUP MEETING

Dr V C Goyal gave a brief account of the actions taken on the recommendations/ decisions of the 45th working group meeting.

ITEM Nos. 46.4 & 46.5: PRESENTATION AND DISCUSSION ON THE STATUS AND PROGRESS OF THE WORK PROGRAMME FOR YEAR 2017-18 AND FINALIZATION OF THE WORK PROGRAMME FOR YEAR 2018-19.

The Member-Secretary requested the respective Divisional Heads to present the progress of studies carried out during 2017-18 and work programme for the year 2018-19. Accordingly, the progress of various studies and sponsored projects was presented by all Scientific Divisions during the two day deliberations of the Working Group. The Division wise minutes of each study/project presented during the meeting are given next.

ENVIRONMENTAL HYDROLOGY DIVISION

Dr. C. K. Jain, Sc. 'G' and Head, EHD presented an overview, progress of studies and activities carried out by the division during 2017-18 and proposed Work Programme for 2018-19. He also gave an account of scientific personnel available at the division, sponsored and consultancy projects carried out, trainings courses organized and also future activities planned for the Division. The study-wise progress reported and suggestions / comments received on the various studies are as follows:

WORK PROGRAMME FOR 2017-18

S.No.	Study	Suggestions / Comments
Internal Studies (ongoing)		
1.	<p>Development of Habitat Suitability Curves for the Aquatic Species of Western Himalayan Streams</p> <p>Study Team: Pradeep Kumar (PI), C. K. Jain Duration: 2 Years (04/16-03/18) Status: In-progress</p>	<ul style="list-style-type: none"> • The relationships developed need to be checked for their significance. • Limitations of the methodology adopted need to be incorporated in the report. • Chairman advised that the report should be completed by 15th March 2018 and sent to NEERI for comments.
Sponsored Projects (ongoing)		
2.	<p>Environmental Assessment of Aquatic Ecosystem of Upper Ganga Basin</p> <p>Study Team: C. K. Jain (PI), Manohar Arora, M. K. Sharma, Pradeep Kumar, D. S. Malik (GKU) Duration: 5 Years (04/16-03/21) Sponsored by: DST under NMSHE Project Cost: 2.25 Crore Status: In-progress</p>	No specific comments.
Sponsored Projects (New)		
3.	<p>Ground Water Quality Assessment with Special Reference to Sulphate Contamination in Bemetara District of Chhattisgarh State and Ameliorative Measures</p> <p>Study Team: M. K. Sharma (PI), C. K. Jain, Surjeet Singh, Pradeep Kumar Partner: WRD, Raipur - A. K. Shukla, Ashok Verma, P. C. Das Duration: 3 Years (09/17-08/20) Sponsored by: NHP-PDS Project Cost: 25.4 Lakh Status: In-progress</p>	Dr. Pawan Labhasetwar (NEERI) advised that impact on health should be studied and safe ground water sources should be identified based on aquifer characteristics.
4.	<p>Water Quality Assessment of Southwest Punjab Emphasizing Carcinogenic Contaminants and their Possible Remedial Measures</p> <p>Study Team: Rajesh Singh (PI), M. K. Sharma, Sumant Kumar, Pradeep Kumar Partner: Irrigation Department, Punjab Duration: 3 Years (09/17-08/20)</p>	Dr. Pawan Labhasetwar pointed out that there are more than 3000 carcinogenic contaminants and the problem should be studied holistically with proper data base. He further indicated that results should be reported carefully after consulting subject experts.

	Sponsored by: NHP-PDS Project Cost: 65.6 Lakh Status: In-progress	
Consultancy Projects (ongoing)		
5.	Study on Ash Disposal from Telangana STPP into Mine Void of Medapalli Open Cast Mines Study Team: C. K. Jain (PI), Sudhir Kumar, Y. R. S. Rao, S. D. Khobragade, Anupma Sharma, , M. K. Sharma, Pradeep Kumar Duration: 15 Months (04/16-06/17) Sponsored by: NTPC Project Cost: Rs. 54.96 Lakh Status: Draft Final Report submitted and comments awaited.	-
6.	Downstream Impacts of Water Withdrawal by TTPS from Brahmani River Study Team: Pradeep Kumar (PI), C. K. Jain, M. K. Sharma Duration: 6 Months (02/18-07/18) Sponsored by: NTPC Project Cost: Rs. 20.0 Lakh Status: In-progress.	-

WORK PROGRAMME FOR 2018-19

S.No.	Study	Study Team	Duration / Status
Internal Studies (Cont.)			
1.	Development of Habitat Suitability Curves for the Aquatic Species of Western Himalayan Streams and Assessment of Environmental Flows	Pradeep Kumar (PI) C. K. Jain	3 Years (04/16-03/20)
Sponsored Projects (Cont.)			
2.	Environmental Assessment of Aquatic Ecosystem of Upper Ganga Basin	C. K. Jain (PI), NIH Manohar Arora, NIH M. K. Sharma, NIH Pradeep Kumar, NIH D. S. Malik, GKU	5 Years (04/16-03/21) Sponsored by: DST Project Cost: 2.25 Crore Status: In-progress
3.	Ground Water Quality Assessment with Special Reference to Sulphate Contamination in Bemetara District of Chhattisgarh State and Ameliorative Measures	M. K. Sharma (PI) C. K. Jain Surjeet Singh Pradeep Kumar Partner: WRD, Raipur A. K. Shukla Ashok Verma P. C. Das	3 Years (09/17-08/19) Sponsored by: NHP-PDS Project Cost: 25.4 Lakh Status: In-progress
4.	Water Quality Assessment of Southwest Punjab Emphasizing Carcinogenic Contaminants and their Possible Remedial Measures	Rajesh Singh (PI) M. K. Sharma Sumant Kumar Pradeep Kumar Partner: Irrigation Department, Punjab	3 Years (09/17-08/20) Sponsored by: NHP-PDS Project Cost: 65.6 Lakh Status: In-progress

Consultancy Projects (ongoing)			
5.	Study on Ash Disposal from Telangana STPP into Mine Void of Medapalli Open Cast Mines	C. K. Jain (PI) Sudhir Kumar Y. R. S. Rao S. D. Khobragade Anupma Sharma M. K. Sharma Pradeep Kumar	15 Months (04/16-06/17) Sponsored by: NTPC Amount Rs. 54.kh Lacs Status: Final Draft Report submitted and comments awaited.
6.	Downstream Impacts of Water Withdrawal by TTPS from Brahmani River	Pradeep Kumar (PI) C. K. Jain M. K. Sharma	6 Months (02/18-07/18) Sponsored by NTPC Amount: 20 Lakh. Status: In-progress

Note: The study on Environmental Assessment of Village Ponds in Uttarakhand and Western UP has been dropped from EHD and merged with RMOD with Dr. Rajesh Singh, Sc. 'C' as one of the members of the study group.

GROUND WATER HYDROLOGY DIVISION

Dr. N. C. Ghosh, Scientist 'G' & Head presented an overview, progress of studies and activities carried out by the division from May 2017 to January 2018. He gave an account of scientific personnel available at the division, sponsored and consultancy projects being done, conference and trainings organized, and also future activities planned by the Division. Dr. Ghosh informed that three in-house R&D studies and six sponsored studies were approved for the year 2017-18, out of which three in-house and two sponsored studies were completed and four sponsored studies will continue in the next year work program. In addition to continuing studies, seven new sponsored studies have been proposed for the year 2018-19.

Dr. Ghosh informed that during the year 2017-18, the division has (i) successfully organized 7th International Ground Water Conference (IGWC-2017) on "Groundwater Vision 2030 : Water Security, Challenges and Climate Change Adaptation", during 11-14 December, 2017 at ICAR-NASC complex, Pusa, New Delhi; (ii) has been awarded two DST-NERC-Indo-UK- Newton –Bhabha Fund Water Quality Research program projects: a) "Future Secular Changes and Remediation of Groundwater Arsenic in the Ganga River Basin-FAR GANGA", and b) "Impact of Rainwater Harvesting on Groundwater Quality in India with Specific reference to Fluoride and Micro-pollutants".

The study-wise progress reported and suggestions emerged are given below.

1. **Project Ref. Code: NIH/GWD/NIH/15-19: Peya Jal Suraksha - Development of Six Pilot Riverbank Filtration Demonstrating Schemes in Different Hydrogeological Settings for Sustainable Drinking Water Supply**

Dr. N. C. Ghosh (PI) informed that currently four sites: Agra & Mathura in U. P. along Yamuna river, Berhara village in Arrah district in Bihar along the Ganga river, and Varaha River at Vishakapatnam are being pursued for developing RBF wells through respective state water supply department. Dr. Ghosh requested for one year extension of the project from April, 2018 and the Working Group approved it.

2. **Project Ref. Code: NIH/GWD/NIH/14-17: Management of Water Resources for Quantity and Quality in Yamuna-Hindon Inter-basin**

Dr. Anupma Sharma (PI) informed about the declining groundwater levels in different districts of the Yamuna-Hindon inter-basin and the increasing pollution in the Hindon river and its tributaries. The numerical model developed by using Visual Modflow was described. The water

quality analysis of samples taken from Hindon river and groundwater taken from villages located within a zone of 500 m on either side of river was presented. The presence of trace metals above acceptable limits in groundwater samples corresponding to pre- and post-monsoon season along with location of villages and industries in the region was illustrated. WG suggested that the presence of trace metals should also be investigated for urban areas in the region including Delhi. She informed that the study would be completed by March 31, 2018, and further analysis would be undertaken in a follow up study.

3. **Project Ref. Code: NIH/GWD/NIH/16-20: Ground water fluctuation and conductivity Monitoring in Punjab- New evidence of groundwater dynamics in Punjab from high frequency groundwater level and salinity measurements**

Dr. Gopal Krishan (PI) presented the progress and the future work plans. He described the action taken on the comments made during the 45th WG meeting and suggestions given for inserting few specific objectives. To collate new evidence on recharge processes, groundwater quality, groundwater residence times, and connectivity of the layered aquifer systems and surface water, by repeated sampling of shallow and deep piezometers using a suite of environmental tracers were carried out.

4. **Project Ref. Code: NIH/GWD/NMSHE/16-20: Study of river - aquifer interactions and groundwater potential in the upper Ganga basin up to Dabrani**

Dr. Surjeet Singh (PI) described the soil and landuse maps developed, status of installation of piezometer, water sampling & analysis being carried out, future plans and results of water quality and isotopic analysis. He informed that site-wise analysis of water quality and isotopic results is in progress. Dr. Deshpande inquired whether the isotopic data are falling on the GMWL. PI informed that all the data points are lying along the GMWL.

5. **Project Ref. Code: NIH/GWD/NIH/16-18: Web Enabled “Conjunctive Use Model for Management of Surface and Ground Water using concept of MAR and ASR”**

Suman Gurjar (PI) presented the progress made in the study, which is completed. She informed that the model will be hosted on NIH website by February, 2018. WG suggested to mention limitations of the model in the web enabled system.

6. **Project Ref. Code: NIH/GWD/NIH/16-17: Country-wide Capacity Building Program on “Bank Filtration for Sustainable Drinking Water Supply”**

Dr. N. C. Ghosh (PI) informed that out of four training courses sponsored by the DST, three have been organized. The third course was organized at Shillong in collaboration with PHED, Shillong during 18th -22nd September, 2017. The fourth (last) training course is scheduled to be held during 5th -9th March at NIH, Roorkee.

7. **Project Ref. Code: NIH/GWD/NIH/16-19: Grey Water to Blue Water – Natural Treatment Techniques for Transforming Wastewater into Sustainable Useable Water**

Dr. N. C. Ghosh (PI) informed that the land measuring 45 m x 45 m allotted by the Civil Administration along the Solani river in the Khanapur village is not suitable for installation of Bank Filtration well because of scientific, technical and tactical reasons, as the distance required for implementation of BF technology is not met and the given location does not meet the technical requirement. Hence, the progress of undertaking field experimental work is pending since May, 2017.

8. **Project Ref. Code: NIH/GWD/DST/18-20: Future Secular Changes and Remediation of Groundwater Arsenic in the Ganga River Basin-FAR GANGA**

Dr. N. C. Ghosh (Indian Lead) presented the project funded under the Indo-UK - DST NERC-EPSRC Newton Bhabha Fund. He informed that the project is a 4 x 4 consortium partner from each country and the Indian partners are NIH (Indian Lead); IIT Kharagpur, IIT Roorkee; and Mahavir Cancer Sansthan, Patna and that of UK partners are University of Manchester (UK Lead), British Geological Survey, Salford University; and Univ. of Birmingham. The project is of 3 years duration and cost is about 6.5 crore including UK budget.

Dr. Ghosh presented the objectives, aims, hypotheses to be tested, details about the work packages and responsibility in work packages by each partner.

9. **Project Ref. Code: NIH/GWD/DST/18-20: Impact of Rainwater Harvesting on Groundwater Quality in India with Specific reference to Fluoride and Micro-pollutants**

Dr. Anupma Sharma (India Lead PI) presented the study funded under the India-UK DST- NERC-EPSRC Water Quality Research Programme (Newton Bhabha fund). The study has recently commenced from Jan. 01, 2018. The names of institutes participating from UK and India along with the names of co-partners were informed. The research gaps, objectives of the study, and the work packages were also presented. The three different types of rainwater harvesting (RWH) structures that would be studied in detail in Rajasthan along with their locations were shown. WG suggested that another type of RWH structure, namely, the groundwater recharge shaft may also be investigated.

10. **Project Ref. Code: NIH/GWD/PDS/18-21: Ganges Aquifer Management in the context of Monsoon Runoff conservation for sustainable River Ecosystem Services- A Pilot study**

Dr. Surjeet Singh (PI) presented the background, statement of the problem, objectives, methodology and future plans of the study. Dr. M. L. Kansal, Professor, IITR suggested to modify the title of the study as "*Ganges Aquifer Management in the context of Monsoon Runoff conservation for sustainable River Ecosystem Services- A Pilot Study of Sot River Catchment*".

11. **Project Ref. Code: NIH/GWD/PDS/18-20: Assessment of impacts of groundwater salinity on regional groundwater resources, current and future situation in Mewat, Haryana – possible remedy and resilience building measures**

Dr. Gopal Krishan (PI) presented the background, statement of the problem, objectives, methodology and future plans of the study. Director, NIH advised PI to discuss with Dr. C.T. Dhanya, IIT-Delhi about simulation work.

12. **Project Ref. Code: NIH/GWD/PDS/18-20: Hydro-geochemical Evolution and Arsenic Occurrence in Aquifer of Central Ganges Basin**

Mr. Sumant Kumar (PI) informed that the study has been approved as purpose driven study (PDS) under the National Hydrology Projects (NHP). Dr. U. K. Sinha informed that BARC, Mumbai and CGWB, Patna had conducted many studies related to Arsenic in the study area (Bhojpur, Bihar) and reports are available. Chairman, WG suggested PI to contact Dr. Sinha to get his guidance and the relevant papers and report.

13. **Project Ref. Code: NIH/GWD/PDS/18-20: Integrated Management of Water Resources for Quantity and Quality in Upper Yamuna Basin upto Delhi**

This project shall be undertaken as a special project under the "Centre of Excellence for Hydrologic Modeling" after it is approved by the NHP cell of MoWR, RD & GR.

14. Project Ref. Code: NIH/GWD/NIH/18-19: Follow-up on “**Strategic Basin Planning for Ganga River Basin**”

Er. Suman Gurjar (PI) proposed the study “*Application for Conjunctive use management of Surface Water and Ground Water in Saryu Nahar Pariyojana, U.P.*” using integrated model developed by Deltares, Netherlands. Working Group recommended the study and suggested to explore the model in detail and its ease of implementation and usage. The knowledge gained in this study can be used in the “Center of Excellence for Hydrologic Modelling” at NIH.

Er. Suman Gurjar also gave a presentation on Internet of Things (IoT) and its applications in water resources, viz Smart water solution for irrigated agriculture using sensors and ICT tools, water distribution management, real time monitoring of water levels in reservoir, real-time, continuous and remote monitoring of water quality, etc. It was suggested that this type of research work can be taken up as PDS under NHP.

WORK PROGRAM FOR 2018-19

S. No.	Project	Project Team	Duration & Status	Funding Source
1. NIH/GWD/NIH/15-19	Peya Jal Suraksha - Development of Six Pilot Riverbank Filtration Demonstrating Schemes in Different Hydrogeological Settings for Sustainable Drinking Water Supply.	N.C. Ghosh (Project Lead), B. Chakraborty, Y.R.S. Rao, Anupma Sharma, Surjeet Singh, Sumant Kumar, Gopal Krishan, Suman Gurjar, Anju Choudhury, Sanjay Mittal, Ram Chandar, Staff of SW Lab	21/2 year (11/15 – 4/18) Status: Continuing study. Extended upto 04/2019	Sponsored by MoWR, RD & GR under Plan Fund.
2. NIH/GWD/BGS/16-20	Ground water fluctuation and conductivity monitoring in Punjab- New evidence of groundwater dynamics in Punjab from high frequency groundwater level and salinity measurements	From : NIH, Roorkee Gopal Krishna, (PI), Surjeet Singh, C. P. Kumar, N.C Ghosh From : BGS, UK Dr. Dan Lapworth (PI) Prof. Alan MacDonald (project coordinator)	03 Years (01/16-11/20) Status: Continuing study.	Sponsored by BGS, UK
3.NIH/GWD/NM SHE/16-20	Study of river - aquifer interactions and ground water potential at selected sites in the upper Ganga basin up to Dabrani.	Surjeet Singh (PI), N.C. Ghosh, R. J. Thayyen, Manohar Arora, Gopal Krishan,	1 year (01/16 – 12/20) Status: Continuing study	Sponsored by DST under NMSHE SP-8.
4. NIH/GWD/NIH/16-19	Grey Water to Blue Water –Natural Treatment Techniques for Transforming Wastewater into Sustainable Useable Water	N.C. Ghosh (Project Leader), Anupma Sharma, Surjeet Singh, Sumant Kumar, Suman Gurjar, Anju Chaudhury, Sanjay Mittal, Ram Chandar	3 years (11/16-10/19) Status: Continuing study (progress in hold)	Sponsored by NWM, MoWR, RD & GR
5.NIH/GWD/DST /18-20	Future Secular Changes and Remediation of Groundwater Arsenic in the Ganga River Basin- FAR GANGA	NIH-Team: N. C. Ghosh (Indian Lead) Surjeet Singh; Sumant Kumar; Gopal Krishan; Suman Gurjar Other Indian partners: IIT Rke; IIT Khg; & Mahavir	3 years (01/18 – 12/20) Status : New Study.	DST-Newton Bhabha- NERC- India- UK Water Quality Research

		Cancer Sansthan, Patna. UK- Partners: Prof. David Polya – UK lead; Univ. of Manchester; BGS; Salford University; Univ. of Birmingham.		Programme.
6.NIH/GWD/DST /18-20	Impact of Rainwater Harvesting on Groundwater Quality in India with Specific reference to Fluoride and Micro-pollutants.	NIH-Team: Anupma Sharma (Indian Lead); Sumant Kumar; Gopal Krishan; Suman Gurjar and M. K. Sharma Other Indian partners: IIT Ropar & IIT Jodhpur. UK Partner: Cranfield Univ. Alison Parker – UK Lead; Cranfield University Pablo Campo Moreno, School of Water, Energy and Environment; Cranfield University	3 years (01/18 – 12/20) Status: New Study.	DST-Newton Bhabha- NERC- India- UK Water Quality Research Programme.
7. NIH/GWHD/PD S/18-21	Ganges Aquifer Management in the context of Monsoon Runoff conservation for sustainable River Ecosystem Services- A Pilot study	Surjeet Singh, (PI), N.C Ghosh, Sudhir Kumar, C. P Kumar, Suman Gujar, Gopal Krishan	04 Years (02/18-02/21) Status: New Study	Sponsored by NHP under PDS
8. NIH/GWHD/PD S/18-20	Assessment of impacts of groundwater salinity on regional groundwater resources, current and future situation in Mewat, Haryana – possible remedy and resilience building measures	NIH, Roorkee, India Gopal Krishan (PI), N. C. Ghosh, Surjeet Singh, C.P. Kumar. Haryana Irrigation Department Consultants IIT-Roorkee Brijesh Yadav (PI) Sehgal Foundation, Gurgaon Lalit Mohan Sharma	03 years (01/18 12/20) Status : New Study.	Sponsored by NHP under PDS
9. NIH/GWHD/PD S/18-20	Hydro-geochemical Evolution and Arsenic Occurrence in Aquifer of Central Ganges Basin	Sumant Kumar (PI), N.C. Ghosh, Sudhir Kumar, Rajesh Singh, Gopal Krishan, Anju Chaudhary, Ram Chandar	03 years (01/18 12/20) Status : New Study	Sponsored by NHP under PDS
10.NIH/GWD/PD S/18-20	Integrated Management of Water Resources for Quantity and Quality in Upper Yamuna Basin upto Delhi.	NIH Team: Dr. Anupma Sharma (Lead)	05 years (02/18-01/23) Status: New Study	Special Project under “Centre of Excellence”
11. NIH/GWD/NIH/1 8-19	Application for Conjunctive use management of Surface Water and Ground Water in Saryu Nahar Pariyojana, U.P.	Suman Gurjar (PI), Jyoti P. Patil (Co-PI), N.C. Ghosh, Sumant Kumar, Anupma Sharma, Surjeet Singh	1 year (04/18-03/19) Status: New Study	NIH Internal Study

HYDROLOGICAL INVESTIGATIONS DIVISION

Dr Sudhir Kumar, Scientist-G and Head presented the brief details of various studies being carried out under the H. I. Division along with number of research papers published/accepted for publication/communicated and analytical work carried out at the Nuclear Hydrology Laboratory. He also informed about the proposed training course of the Division.

The progress of studies was presented by the respective P.I. of the study. The actions suggested by the working group for various studies are as follows:

INTERNAL STUDIES:

S.N.	Project	Duration	Status	Action(s) Suggested
1.	Interaction between groundwater and sea water along the northern part of east coast of India	2 years (01/15-12/16) Extended to 12/2017	Completed	No specific action suggested
2.	Lake-Groundwater Interaction Studies for Sukhna Lake, Chandigarh	3 years (04/15-03/18)	Completed	No specific action suggested
3.	Isotopic Investigations in parts of Upper Yamuna River Basin	2 years (04/16 – 03/18)	Completed	No specific action suggested
4.	Radiocarbon dating of deeper groundwater of Indo-Gangetic Basin	3 years (04/16 – 03/19)	Continuing Study	No specific action suggested

SPONSORED PROJECTS:

SN	Project	Duration	Funding	Status	Action(s) Suggested
1.	Understanding of hydrological processes in Upper Ganga basin by using isotopic techniques	5 Years (04/16-03/21)	NMSHE Project	Continuing Study	No specific action suggested
2.	Rejuvenation of Springs and Spring-fed Streams in Mid-Himalayan Basin using Spring Sanctuary concept	3 Years (06/16 - 05/19)	Project with GBPIHE	Continuing Study	No specific action suggested
3.	Dating very old ground waters of deeper aquifers in Ganga Plains, India	3 Years (06/16 - 05/19)	IAEA	Continuing Study	No specific action suggested

WORK PROGRAMME FOR 2018-2019

SN.	Project Title	Duration	Remarks
<u>INTERNAL STUDIES:</u>			
1.	Radiocarbon dating of deeper groundwater of Indo-Gangetic Basin	3 years (04/16 – 03/19)	Continuing Study
<u>SPONSORED PROJECTS:</u>			

1.	Understanding of hydrological processes in Upper Ganga basin by using isotopic techniques	5 Years (04/16-03/21)	NMSHE Project
2.	Rejuvenation of Springs and Spring-fed Streams in Mid-Himalayan Basin using Spring Sanctuary concept	3 Years (06/16 -05/19)	Project with GBPIHE
3.	Dating very old ground waters of deeper aquifers in Ganga Plains, India	3 Years (06/16 -05/19)	IAEA under CRP
4.	Integrated Study on groundwater dynamics in the coastal aquifers of West Bengal for sustainable groundwater management	3 ½ year (1/18 – 6/21)	PDS under NHP
5.	Chemical & Isotopic Characterization of Deep Aquifer Groundwater of Middle Ganga Basin	3 ½ year (1/18 – 6/21)	PDS under NHP
6.	Development of a comprehensive plan for conservation and sustainable management of Bhimtal and Naukuchiatal lakes, Uttarakhand	3 Years (1/18 – 12/20)	PDS under NHP

SURFACE WATER HYDROLOGY DIVISION

WORK PROGRAM FOR 2017-18

S.No. & Ref. Code	Title	Study Team	Duration
SPONSORED STUDIES			
1.NIH/SWHD/NIH/15-18	WaterRAIN-Him: Changes in water Resources Adaptation options in Indian-Himalayan basins	Archana Sarkar Sanjay K Jain	Ongoing 3 years (1 Jan 2015 to 31 Mar. 2018) Total Cost: 188000 SEK
2.NIH/SWHD/NIH/14-18	Effect of Changing Global Tropospheric Temperature on Asia-Pacific Monsoon Circulation and Rainfall Fields across India	Ashwini Ranade	Ongoing 3.5 years (Oct. 2014 to May 2018) Total Cost: 12.6 Lac
3.NIH/SWHD/NIH/16-20	Hydrological modeling in Alaknanda basin and assessment of climate change impact	A.K. Lohani Sanjay K. Jain Archana Sarkar V.S. Jeyakanthan L.N. Thakural	Ongoing 5 years (Jan. 2016 to Dec. 2020) Total Cost: 42.296 Lac
INTERNAL STUDIES			
4.NIH/SWHD/NIH/14-18	Study of Rainfall Patterns and Comparison of Rainfall Data from different Sources for Uttarakhand State	Archana Sarkar N.K. Bhatnagar Vaibhav Garg Rakesh Kumar	Ongoing 3 years (April 2014 to Mar. 2018)

5.NIH/SWHD/NIH/15-18	Snowmelt Runoff Modelling and Study of the Impact of Climate Change in Sharda River Basin	Archana Sarkar Vaibhav Garg N.K. Bhatnagar	Ongoing 3 years (April 2015 to March 2018)
6.NIH/SWHD/NIH/15-18	Flood and Sediment studies in Himalayan basin using MIKE-11 Model	A.K. Lohani Sanjay K. Jain	Ongoing 3 years (April 2015 to March 2018)
7.NIH/SWHD/NIH/15-19	Study of Hydrological Changes in selected watersheds in view of climate change in India	L.N. Thakural D.S. Rathore Surjeet Singh Sanjay Kumar Jain Shard Kumar Jain	Ongoing 4 years (April 2015 to March 2019)
8.NIH/SWHD/NIH/16-17	Generalization and parameter estimation of GEV distribution for flood analysis: Specific application on Indian data	Sushil K. Singh	Completed 1 year (April 2016 to Sep. 2017)
9.NIH/SWHD/NIH/16-19	Application and development of analytical models on data collected at NIH under Saph-Pani Project "The study was discontinued by the Working Group"	Sushil K. Singh	Discontinued
10.NIH/SWHD/NIH/16-18	Snow cover variability in the Upper Yamuna Basin	Naresh Kumar Manohar Arora Rakesh Kumar	Ongoing 2 years (April 2016 to June 2018)
11.NIH/SWHD/NIH/17-19	Development and regionalization of unit hydrograph for runoff modeling on Indian catchments	Sushil K. Singh	Ongoing 1 years (April 2017 to March 2019)
12.NIH/SWHD/NIH/17-21	Development of regional relationships for water availability analysis and flood estimation for lower Godavari basin (3f)	Sanjay Kumar Rakesh Kumar J. P. Patra Pankaj Mani	Ongoing 4 years (April 2017 to March 2021)
13.NIH/SWHD/NIH/17-20	Development of regional methods for design flood estimation in Uttarakhand	J.P.Patra Rakesh Kumar Pankaj Mani Sanjay Kumar	Ongoing 3 years (April 2017 to March 2020)

WORK PROGRAM FOR 2018-19

NEW STUDIES (Sponsored)			
14.NIH/SWHD/NIH/17-19	Impact Assessment of Climate Change on Water Resources and Agriculture in Banas basin in Western India using Climate change Indicators(CII's)	Archana Sarkar Surjeet Singh T. Thomas	3 years (Sep. 2017 to Feb. 2019) Total Cost: 24200 Euros
15.NIH/SWHD/NIH/17-20	Water efficient irrigation by using SCADA system for medium irrigation project (MIP) Shahnehar	R.P. Panday J. P. Patra Rajesh Singh N.K. Bhatnagar	3 years (Dec 2017-Dec 2020) Total Cost:75 Lac NIH Component: 15 Lac

NEW STUDIES (Internal)			
16.NIH/SWHD/ NIH/18-21	Evaluation of seasonal extreme rain events across river basins of India in 3D global temperature change scenario	Ashwini Ranade Archana Sarkar	3 years (April 2018 to March 2021)

S. No.	Title of Project/ Study, Study Group, Start/ Completion Dates	Status and Recommendations/ Suggestions
SPONSORED STUDIES		
1.	<p>WaterRAIN-Him: Changes in water Resources and Adaptation options in Indian-Himalayan basins (Ongoing)</p> <p>In collaboration with SMHI, Sweden, SEI, Sweden and IIT Delhi, India which has been funded by Swedish Research Council (through SMHI, Sweden).</p> <p style="text-align: center;"><u>Study Group:</u></p> <p>Archana Sarkar Sanjay K Jain DOS: 1 Jan2015 DOC: 31 Mar. 2018</p>	<p>Dr Archana Sarkar informed that the main aim of this project is to assess the impacts on the water fluxes due to change in climate in the Indian-Himalayan basins, i.e. Ganges. She further presented results pertaining to climate change impacts under three scenarios and four time periods on precipitation, temperature, evapotranspiration, drought and runoff/discharge at Ganga river basin scale as well as regional scale of four selected regions within the Ganga basin. Dr Sarkar informed that two stakeholder workshops were also organized under the project at NIH in 2015 and 2017 and the final report of the project will be submitted to Swedish Research Council before Dec 2018.</p>
2.	<p>Effect of Changing Global Tropospheric Temperature on Asia-Pacific Monsoon Circulation and Rainfall Fields across India (Ongoing)</p> <p>Sponsoring Agency : Science and Engineering Research Board (SERB), DST, New Delhi.</p> <p style="text-align: center;"><u>Study Group:</u></p> <p>Ashwini Ranade</p> <p>DOS: Oct. 2014 DOC: May 2018</p>	<p>Dr. Ashwini Ranade, PI of the project presented the current status of the project, the analysis carried out in last six months, and important results of the study.</p>
3.	<p>Hydrological modeling in Alaknanda basin and assessment of climate change impact (Ongoing) (PDS)</p> <p style="text-align: center;"><u>Study Group:</u></p> <p>A.K. Lohani Sanjay K. Jain Archana Sarkar V.S. Jeyakanthan L.N. Thakural DOS: Jan. 2016 DOC: Dec. 2020</p>	<p>Dr A.K. Lohani, Scientist G mentioned that the land use, DEM, River network, Snow cover area maps have been prepared. Furthermore, temporal meteorological data have been collected for the study basin. Flow data has been collected and analyzed for different gauging sites. VIC model has been setup for the study basin and the calibration and fine-tuning of the model parameters is in progress.</p>

INTERNAL STUDIES		
4.	<p>Study of Rainfall Patterns and Comparison of Rainfall Data from different Sources for Uttarakhand State (Ongoing)</p> <p style="text-align: center;"><u>Study Group:</u></p> <p>Archana Sarkar N.K. Bhatnagar Vaibhav Garg Rakesh Kumar</p> <p>DOS: April 2014 DOC: Mar. 2018</p>	<p>Dr Archana Sarkar, Sc D & PI presented the background, objectives, methodology and results of the study. Results of trend analysis of historical rainfall series of number of rainfall events of various intensity (annual and monsoon) by parametric and non-parametric methods for ten rainfall stations (grid centres) five each in Kumoan and Garhwal regions using IMD gridded rainfall data of 113 years (1901 to 2013) was explained. Further, results of rainfall from three sources (observed, TRMM and APHRODITE) were presented showing better accuracy of TRMM data in comparison to APHRODITE. Dr Dimri asked to mention the limitations of data in the final report. Dr Sarkar informed that the final report of the study will be submitted by the end of April 2018.</p>
5.	<p>Snowmelt Runoff Modelling and Study of the Impact of Climate Change in Sharda River Basin (Ongoing)</p> <p style="text-align: center;"><u>Study Group:</u></p> <p>Archana Sarkar Vaibhav Garg N.K. Bhatnagar</p> <p>DOS: April 2015 DOC: March 2018</p>	<p>Dr Archana Sarkar, Sc D & PI presented the background, objectives, methodology and results of the study. Degree day approach along with soft computing has been followed for hydrological modeling including snowmelt runoff modelling. Various scenarios (hypothetical) of precipitation and temperature were considered to study the impact of climate change on the hydrological regime of the study basin. Results showing various snow cover maps for four years using MODIS data as well as results of SRM, SNOWMOD & ANN models simulation were presented. Dr Sarkar further explained the results of the comparison of various models and impact of climate change using hypothetical results. Chairman of the working group, pointed out the importance of the study due to the proposed Pancheshwar dam in the study basin. Dr Kireet Kumar suggested for collaboration with NIH for working in the Sharda basin. Final report of the study will be submitted by the end of April 2018.</p>
6.	<p>Flood and Sediment studies in Himalayan basin using MIKE-11 Model (Ongoing)</p> <p style="text-align: center;"><u>Study Group:</u></p> <p>A.K. Lohani Sanjay K. Jain</p> <p>DOS: April 2015 DOC: March 2018</p>	<p>Dr A.K. Lohani, Scientist G presented the progress and mentioned that an event of Assiganga cloudburst 2012 has been considered for the study. Various raster and vector maps of the study area have been prepared using the satellite data, DEM and google earth. Dr Lohani mentioned that cloudburst flood routing in Assiganga and Bhagirathi rivers have been carried out using MIKE-11 software. Results were superimposed on Google Earth for better display and interpretation. Historical sediment data (prior to the construction of Tehri Dam) of Bhagirathi river was also collected and study of temporal sediment variation and sediment-discharge correlation was carried out at the selected site. Dr. P.R. Ojasvi, inquired the sediment data shown is total sediment load or suspended sediment. Dr Lohani confirmed that the data is suspended sediment load. Report writing is in progress.</p>
7.	<p>Study of Hydrological Changes in selected watersheds in view of climate change in India (Ongoing)</p> <p style="text-align: center;"><u>Study Group:</u></p> <p>L.N. Thakural D.S. Rathore Surjeet Singh</p>	<p>PI of the study presented the objectives, methodology and the status of the ongoing study. The GIS database created by using Digital Elevation Model (DEM) and satellite imagery for flow accumulation, stream network, watershed boundary, Land use/Land cover thematic maps in addition to soil map for the four watersheds was presented. Spatio-temporal analysis of hydro-meteorological data using parametric and non-parametric approaches for the Ramganga, Bina and Chaliyar river basins</p>

	Sanjay Kumar Jain Shard Kumar Jain DOS: April 2015 DOC: March 2019	was also presented in the meeting. The outcomes/results of hydrological models (NAM and SWAT) calibrated and validated for the three river basins i.e. Ramganga, Bina and Chaliyar river basins were also presented. The study has been extended for a period of one year. Dr. Pawan Labhassetwar, NEERI suggested to interact with the stakeholder departments. Director NIH advised PI to visit the study area.
8.	Generalization and parameter estimation of GEV distribution for flood analysis: Specific application on Indian data (Completed) Study Group: Sushil K. Singh DOS: April 2016 DOC: Sep. 2017	Dr. S. K. Singh informed that the study model (Unified Extreme-Value, UEV-unified extreme value distribution) developed in a previous report unifying the three extreme-value distributions (EV-1, EV-2, and EV-3 or Gumbel, Frechet, and Weibull distributions, respectively), which better replaces the widely used GEV (generalized extreme-value distribution) has been applied illustratively on measured/published data on a few GD sites on Indian catchments particularly in different CWC-subzones. The two methods proposed in the report/ paper have been applied to estimate the parameters of the new model (UEV distribution). Concept of deterministic confidence limit with its quantification is proposed in the paper, which is easy to apply, and avoids the tedious process involved in currently used statistical hypothesis-testing with a probabilistic confidence interval, has been used to quantify the confidence limit of the UEV application in each case. Results show that the applications of the proposed UEV closely reproduce the observed data with good predictive reliability besides ease in application outperforming the prior methods.
9.	Application and development of analytical models on data collected at NIH under Saph-Pani Project Study Group: Sushil K. Singh	The Working Group decided to discontinue the study and accordingly the study has been dropped.
10.	Snow cover variability in the Upper Yamuna Basin (Ongoing) Study Group: Naresh Kumar Manohar Arora Rakesh Kumar DOS: April 2016 DOC: June 2018	Shri Naresh Kumar, Scientist B mentioned that MODIS Mod 10A2 snow data from National Snow and Ice Data Center (NSIDC) for a period 2000 to 2016 have been downloaded. All the 8-day MODIS snow data were imported from HDF-EOS format to IMAGINE Image format and transformed to the projection WGS1984-UTM44N (Universal Transverse Mercator). The data have been clipped to the extent of the study area. Data base preparation in ArcGIS (Basin map and drainage network) from DEM has been completed. Data analysis is in progress. As suggested by the working group a new objective, "Modelling of melt water at Paonta Sahib" has been added to the study.
11.	Development and regionalization of unit hydrograph for runoff modeling on Indian catchments (Ongoing) Study Group: Sushil K. Singh DOS: April 2017 DOC: March 2019	Dr S K Singh informed that the development of the new model for runoff modeling is complete and the development of method/procedure for the estimation of its parameters is in progress. Testing of the model is in progress. The PI requested for extension of time up to March 2019 and the same was agreed by the Working Group.

12.	<p>Development of regional relationships for water availability analysis and flood estimation for lower Godavari basin (3f) (Ongoing)</p> <p style="text-align: center;"><u>Study Group:</u></p> <p>Sanjay Kumar Rakesh Kumar J. P. Patra Pankaj Mani</p> <p>DOS: April 2017 DOC: March 2021</p>	<p>Dr. Sanjay Kumar explained the background, objectives and methodology. The study specifically focuses on developing design flood estimation methods for partially gauged or un-gauged regions based on the concept of regionalization using L moments approach. The study would also develop relationship between mean annual peak floods and physiographic characteristics of the basin and develop regional relationships for NASH and Clark IUH model parameters. Daily discharge data of 21 sites in the lower Godavari basin has been collected and at site frequency analysis based on L-moments approach is in progress. He also mentioned that various CWC reports, PMP atlases and other relevant literature have been collected for the study. It was informed that climate change impact on design flood estimation is one of the objectives of the study.</p>
13.	<p>Development of regional methods for design flood estimation in Uttarakhand (Ongoing)</p> <p style="text-align: center;"><u>Study Group:</u></p> <p>J.P.Patra Rakesh Kumar Pankaj Mani Sanjay Kumar</p> <p>DOS: April 2017 DOC: March 2020</p>	<p>Mr. Jagadish Prasad Patra, presented the objectives, need for such study with brief methodology. Daily rainfall data of about 30 raingauge stations were collected from IMD along with gridded rainfall data from 1901 to 2013. The progress of at site flood frequency analysis using L-moments approach for annual maximum peak flood series data of CWC gauging sites were also presented. Further it was explained that the non-stationary aspect of data series will also be considered in frequency analysis for climate change aspects.</p>
NEW STUDIES (Sponsored)		
14.	<p>Impact Assessment of Climate Change on Water Resources and Agriculture in Banas basin in Western India using Climate change Indicators (CII's) (New Study)</p> <p>In collaboration with SMHI, Sweden, SEI, Sweden and 12 other countries which has been funded by ECMWF (through SMHI, Sweden)</p> <p style="text-align: center;"><u>Study Group:</u></p> <p>Archana Sarkar Surjeet Singh T. Thomas</p> <p>DOS: Sep. 2017 DOC: Feb. 2019</p>	<p>Dr Archana Sarkar, PI, presented the background and objectives of this international study Banas river basin located in the State of Rajasthan in western India has been selected for applying the products of GLORIOUS C3S Global Service. Bisalpur drinking water cum irrigation project is constructed across river Banas with an ultimate irrigation potential of 55224 hectare (irrigation during the months of October to March for the Rabi crop), besides providing 458.36 MCM of drinking water for Jaipur, Ajmer, Beawar, Kishangarh, Nasirabad and other enroute cities/town/villages. Therefore, it is important to assess the water availability of this reservoir using climate impact indicators for future years and suggest suitable adaptation options. Dr Sarkar further informed that Climate indicators namely, temperature (min & max), rainfall, solar radiation, soil moisture, water temperature and drought indicators will be used in the Banas basin to assess the future climate impacts on the water availability in the Bisalpur reservoir and crop yields in the command area.</p>
15.	<p>Water efficient irrigation by using SCADA system for medium irrigation project (MIP) Shahnehar (New Study) (PDS)</p>	<p>Dr. R.P. Pandey, Scientist G and PI reported that this is a PDS taken up in collaboration with the Department of Irrigation & Public Health Engg. (I&PHE) Himachal Pradesh. A field visit of the Shahnehar Project areas has been conducted by the NIH team in December 2017 for reconnaissance survey and to work out the modalities of</p>

	<p align="center"><u>Study Group:</u></p> <p>R.P. Pandey J. P. Patra Rajesh Singh N.K. Bhatnagar</p> <p>DOS: Dec 2017 DOC: Dec 2020</p>	<p>the project works. Primary objective of this study is to devise a suitable approach to improve irrigation water use efficiency in Shah Nehar Project (SNP) and automation of the irrigation water supply system based on real time crop water demands. The proposed methodology and the work component includes development of a system of water supply database of quantum of water used to each beneficiary so the charges can be levied accordingly. The deliverables of the study will be estimates of water availability at headwork's and irrigation water requirements for various crops at different growth stages & time period; quantification of irrigation water loss in different conveyance & distribution systems, field channels, and irrigation application method; identification of components of irrigation system needing intervention to enhance water use efficiency; and experimental assessment of SCADA based approach in the enhancement of water use efficiency.</p>
NEW STUDIES (Internal)		
16.	<p>Evaluation of seasonal extreme rain events across river basins of India in 3D global temperature change scenario (New Study)</p> <p align="center"><u>Study Group:</u></p> <p>Ashwini Ranade Archana Sarkar</p> <p>DOS: April 2018 DOC: March 2021</p>	<p>Dr. Ashwini Ranade, PI has proposed a new internal study and presented the objectives, dataset and methodology. The study mainly aims to understand the effect of global temperature change on the long-term rainfall fluctuations major and minor river basins. The study also highlights the meteorological conditions associated with large-sale extreme rain events in different parts of the country.</p>

WATER RESOURCES SYSTEMS DIVISION

Dr. Sanjay K Jain, Sc. G and Head (WRS Div.), presented an overview of the division – scientific strength, the ongoing studies, sponsored & consultancy studies, technical publications and training courses organized. He also informed about the progress of ongoing National Hydrology project (NHP) and its different components mainly the PDS and training programmes. Following are the comments received from working group on the various studies.

PI: Dr. M. K. Goel, Scientist “G”

1. Study title: NIH_Basin – A WINDOWS based model for water resources assessment in a river basin (Ongoing)

Dr. M. K. Goel (MKG) informed that envisaged objectives of the study included modifications in the modeling methodology and development of WINDOWS interface (named as NIH_Basin – NIH_Basin-Simulation) of the model. He informed that no more modifications are planned for the time being and the FORTRAN code of the model is nearing finalization. After this, the data entry forms for WINDOWS interface would be developed.

Some of the members desired that simulation of sediment movement should also be a part of the model. MKG clarified that initially it is planned to complete the water balance aspect and later on modules for sediment analysis, water quality analysis, etc. will be added. Regarding the simulation of snowmelt runoff, MKG clarified that results of existing snowmelt model (WinSRM or SNOWMOD

etc.) runoff series can be considered as an input to the river basin simulation at a desired node. Some members expressed that assumption of uniformity of conditions in a grid (of size, say 1 km) may not truly represent the actual field conditions. Director, NIH clarified that model is planned to serve as a hydrological tool for supporting management and policy decisions at basin scale and since the river basins cover large areas, some compromise with regard to the grid size has to be made. MKG clarified that grid-size is a variable and depending on the size of study basin, the smaller or larger grid-size can be selected.

2. Study title: National Mission for Sustaining the Himalayan Ecosystem (NMSHE) (Ongoing)

MKG made a general presentation of the NMSHE project on the first day of the Working Group meeting. He informed about the concepts of NMSHE Task Force and the objectives of 11 sub-projects which are under progress at NIH under NMSHE.

The progress of six sub-projects under NMSHE being carried out in the WRS division was presented by MKG.

Sub-project – 1: Development of a project website and hydrological database in Upper Ganga Basin (PI-Dr. M. K. Goel, Sc-G)

Dr. Ojasvi suggested that springs are an important source of water for Himalayan population and geo-tagging of springs in the study area may also be carried out. MKG informed that one Scientist from WHRC, Jammu had made a presentation on this aspect in the Niti Ayog and he is carrying out a PDS under NHP for the Ravi basin. It is also planned to carry out such activity for the study area in the present case. Some members expressed that for spring-related data, Wadia Institute and some State departments such as Jal Nigam of Uttarakhand State and NGOs may be contacted.

Sub-project – 2: Real-time snow cover information system for Upper Ganga basin (PI-Mr. D. S. Rathore, Sc-F)

Members suggested to refer to the SAC website for snow cover information.

Sub-project – 3: Glacial Lakes & Glacial Lake Outburst Flood (GLOF) in Western Himalayan Region (PI-Dr. Sanjay K. Jain, Sc-G)

No specific comments were received from members.

Sub-project – 4: Assessment of downstream impact of Gangotri glacier system at Dabrani and future runoff variations under climate change scenarios (PI-Dr. Renoj J. Thayyen, Sc-D)

Results of a new method of cloud cover removal is discussed and showed the snow cover duration changes during 2000 -2016 period for different elevation zones of the basin. RJT highlighted the significant decline in snow cover duration observed in 4000-4500 m elevation band. New finding of increasing uncertainty of discharge during May/June and September months since year 2000 as compared to previous decade (1989-1999) have been discussed. RJT also informed that an AWS has been installed in Harsil under this project. No specific suggestions received for this project

Sub-project – 5: Observation and modelling of various hydrological processes in a small watershed in Upper Ganga basin (PI-Dr. Sharad K. Jain, Sc-G)

The results of calculation of diffusion coefficient for the AWS site at Henva was discussed by RJT. Issues related to dominant katabatic winds in controlling the temperature was discussed. Members were informed about the successful installation of AWS at 1800 m a.s.l. on the mountain ridge under this project.

No specific suggestions received for this project

Sub-project – 11: Water Census and Hotspot analysis in selected villages in Upper Ganga basin (PI-Dr. P. K. Mishra, Sc-C)

Results of the recent survey of 27 villages were presented by MKG. In the absence of Dr. P. K. Mishra, PI, RJT explained that most of the surveyed village experience water problems during some time of the year. RJT highlighted that the recurrence of extreme events in the 1000-2000 elevation zone which also populated heavily making this elevation zone as hazard hotspot. Refinement of hazard hotspot mapping is possible with geotagging of the extreme events of past 7 years.

No specific suggestions received for this project

PI: Dr. Renoj J Thayyen (RJT), Scientist “D”

RJT presented three studies.

1. *Catchment scale evaluation of cold-arid cryospheric system Hydrology, Ganglass catchment, Ladakh (Ongoing)*

RJT presented the background of the project and summarized how ground ice melt and permafrost processes to be found important for the catchment. One year data retrieved from 22 ground temperature sensors were shown. It is also showed that extending zero curtain period from low to higher elevation sites. RJT also showed result of ground temperature profile modelling suggesting significant permafrost in the region.

No specific suggestions received for this project.

2. *Runoff modeling of Shyok River, Karakorum Range (Ongoing)*

RJT informed that the project is being executed in association with Border Roads Organisation (BRO) at Km 150 of Durbuk—DBO axis. The project was initiated in January 2015 and only discharge data have been collected so far and no meteorological data is available from the region. This leads to difficulty in modelling runoff from the basin. RJT discussed the snow cover depletion in the upper Shyok basin during 2016 period.

Considering the practical difficulty in installation of instruments and accessibility without any support from BRO, continuation of the study is difficult, RJT suggested discontinuation of this study.

No specific suggestions received for this project.

3. *Mass and Energy balance of Phuche and Khardung glaciers, Ladakh range (Ongoing)*

RJT presented the results of this SERB sponsored project and informed the members that the project is in second phase. The project is aimed at generating a long-term glacier mass balance data series from Ladakh region representing the cold-arid system of the Himalaya. The present project is focussing on studying the surface energy mass balance of Phuche and Khardung glaciers. RJT informed that the Phuche glacier experienced positive mass balance during 2016-17 ended on 30 September. Whereas Khardung glacier consistently experience negative mass balance. RJT informed that two weather stations were installed over the glacier for detailed SEB studies and a 10 m thermal profiler also installed on each glacier. RJT also showed result of energy balance data at 5600 m a.s.l. for the past two years.

No specific suggestions received for this project.

4. Dynamics of Himalayan Ecosystem and its Impact under changing climate scenario (Ongoing)

RJT informed that this project is funded by MoEF under National Mission on Himalayan Studies (NMHS). This project is undertaken in collaboration with Jawaharlal Nehru University and other 4 institutions. He informed about the procurement of 50 temperature/ humidity sensors and 10 rain gauges under this project. He discussed about the five proposed profiles across the Uttarakhand and updated that installation of three profiles have been already completed. RJT also presented the results of lapse rate analysis of Sutlej and Upper Ganga basin and discussed the monsoon lowering of SELR, unique and consistent temperature lapse rates equaling SALR values of the glacier regimes of both the study basin.

No specific suggestions received for this project.

PI: D. S. Rathore (DSR), Scientist “F”

1. Decision Support System for Water Resources Planning in Upper Bhima basin, Maharashtra (Ongoing)

The progress of the project was presented by Mr D.S. Rathore. It was informed that the study is near completion. DSS applications, namely drought categorization, reservoir operation, water quality modelling and conjunctive use modelling were presented. Basin wide drought categorization was done utilizing monthly rainfall data. Standardized Precipitation Index (SPI) of four- month scale was used in the application. Reservoir operation for Khadakwasla complex was investigated for historic and reduced inflow scenarios. For 20% reduced flow scenario, reduction in yield varied from 15-24% at different dependability. BOD and DO were simulated for Mula, Mutha and Bhima (up to Daund) for historic and reduced inflows and increased STP capacity. In NMRBC command, releases were apportioned in to sub commands based on crop area. Scenario of lower release in the tail sub command was simulated. Return flow to river and aquifer was 10% each. Mrs Vijayan enquired about the impact of reduced flow scenario in case of conjunctive use. It was informed that the scenario is yet to be modelled. Dr Dimri inquired whether soil moisture indices were estimated. It was informed that the index was not estimated.

2. Design and development of DSS (H) platform for Neeranchal National Watershed Project (Ongoing)

The progress of the project was presented by Mr D.S. Rathore. It was informed that the DSS is to under development for State Level Nodal Agency (SLNA) of nine peninsular states in India. For each state, two districts and six watersheds in each district were identified. The features and architecture of the DSS were presented. The DSS is web based system which acts as repository of data, performs data analysis and provide decision support to users at watershed and district level. User management system is implemented through a content management system, Drupal. DSS allows visualization of data in map, table and graph form. Tools for computing potential evapotranspiration, water quality index, water poverty index are implemented for test/ sample data. Data for Chhattisgarh state are being entered in DSS. Dr S M Sharma informed that hydrogeological maps have been prepared by NRSC and are available in image format at Bhuvan portal and can be utilized in the project. Mr Rathore stated that the data were downloaded from internet and will be utilized in the study.

3. Investigating water stress using hydro-meteorological and remote sensing data (New Study, PDS)

The objectives of the study were presented by Mr D.S. Rathore. The objectives of the study are characterizing water stress using hydro-meteorological and remotely sensed data and vadoze zone modeling, studying impact of drought mitigation measures, field level soil moisture investigation, forecasting and regionalizing drought indices and devising reservoir operation policies.

PI: Shri M. K. Nema (MKN), Scientist “C”

1. Hydrological Processes and Characterization of Lesser Himalayan Catchments (Ongoing)

The progress of the study was presented by MKN. It was informed that almost all proposed instrumentation like 03 No. of AWSs; 10 no. of SRGs, two gauging sites, one AWLR; Eddy covariance tower, one COSMOS sensor; two Pan Evaporimeter etc. have been installed in the experimental catchment and data is being received at NIH, Roorkee. Soil monitoring station has also been established at project site. Some of the preliminary data analysis of rainfall, air temperature, humidity, wind speed and direction, solar radiation and various soil parameters were also shown and discussed during the presentation.

No specific comments were received from the members.

2. Modelling of Narmada basin using GWAHA Model

MKN presented the progress of the study. It was informed that the study is almost completed and going to be finalized by March-2018. It was also informed that a workshop is also planned in March, 2018 at Bhopal. Various results were shown and discussed during the presentation. With reference to the future climatic scenarios, Dr AP Dimri suggested to use RCM model outputs along with GCM models. He has given his consent to provide the RCM outputs. It was suggested Chairman that the study on use of climate change scenarios may be taken up as a separate study.

PI: D. Chalisgaonkar (DC), Scientist “F”

1. Development of Ganga Information Portal

Mrs Deepa presented the progress of the study. She informed that the major objective for developing such a portal are to collect scientific and technical information about river Ganga from varied sources, organize it in standardized format and provide a thin client scalable web enabled information system. The purpose is to provide easier, faster access, sharing of consistent and authentic information through a centralized repository in public domain, user-friendly and personalized way for several key areas related to public interest and to operate, update and maintain the e-portal on 24X7 basis. A sample session was also presented.

Working group noted the progress of the study.

2. Development of windows based software for hydrological data processing and Unit Hydrograph Analysis

Mrs Deepa presented the study and informed that flood estimation is one of the most important components of water resources project planning, design and operation. In NIH, a number of software/ computer program have been developed for these analyses. However, they were written in FORTRAN/Pascal/Basic languages which did not provide user-friendly environment to the users. In view of this, it is proposed to develop a WINDOWS based software to carry out hydrological data processing and unit hydrograph analysis for the estimation of flood for gauged as well as ungauged catchments of small and medium size.

Chairman suggested including design flood estimation in the software.

PI: Dr. M. Arora (MA), Scientist “D”

1. Modeling of Gangotri Glacier melt runoff and simulation of stream flow variation under different climate scenarios

Dr. Arora presented the progress of the study. He informed that the data collected for the ablation period of 2017 have been analyzed. The results for the study period 2014-2017 were presented before the experts. The HBV model was used to simulate the melt runoff and the results obtained by SNOWMOD and HBV was explained to the experts. The total volume of water from the glacier was very much in comparison to the previous year values. It was also informed to the members that climate scenarios are being developed and the model performance will be tested with this.

RESEARCH MANAGEMENT AND OUTREACH DIVISION (RMOD)

Dr V C Goyal, Sc. G and Head, presented an overview of the Division. He informed about the progress under Neeranchal National Watershed Project (NNWP). Thereafter, scientists of the Division presented their respective studies. Following are the comments/suggestions received from the working group members:

	Title of Project/Study, Study Team	Status and Recommendations/Suggestions
1.	Development of IWRM Plan for Ibrahim-Masahi village (Haridwar district) Team: Omkar Singh, V.C. Goyal, Subhash Kichlu and Rajesh Agarwal DOS: April 2013, DOC: September 2017 (Completed)	The results of the study were presented by Shri Omkar Singh (PI). PI also presented the IWRM plan for Ibrahimpur Masahi village. The study has been completed and the NTS will be commissioned by March 2018.
2.	Development of IWRM Plan for Jhansi, Lalitpur and Chhatarpur districts (MoWR-funded Bundelkhand-4 district project) Team: V. C. Goyal and Jyoti P Patil Co-investigators from MPCST, Bhopal: Sandeep goyal and Rajesh Saxena Co-investigators from UP-RSAC, Lucknow: Rajiva Mohan and Sudhakar Shukla DOS: Apr 2016, DOC: Mar 2018	The results and present status of study were presented by Dr. V C. Goyal (PI). The PI presented the three components of IWRM Plan prepared for the identified watersheds in Jhansi, Lalitpur and Chhatarpur districts. The PI also mentioned that the IWRM Plans are proposed to be handed over to the respective DMs in March 2018.
3.	Study on effect of climate change on sediment yield to Pong reservoir. Team: A. R. Senthil kumar, J. V. Tyagi, S. D. Khobragade and Manohar Arora DOS: Apr 2015, DOC: March 2018	The results and present status of the study were presented by Dr A. R. Senthil kumar (PI). The PI reported that the discharge and sediment yield at Nadaun Brdige (Pong reservoir) was simulated using SWAT. A six month extension was requested by the PI to carry out the downscaling of the climate scenarios from GCM models and simulate the future sediment yield using downscaled data. The working group approved the six-month extension up to September 2018.
4.	Effect of climate change on evaporation at point scale	The results and present status of the study were presented by Sh. Digambar

	<p>Team: Digambar Singh, A. R. Senthil kumar and Manohar Arora</p> <p>DOS: Apr 2014, DOC: October 2017 (Re-scheduled)</p>	<p>Singh (PI). The PI requested for an extension of six months to complete the downscaling of rainfall and temperature from GCM models and CORDEX and the computation of future evaporation and evapotranspiration for the downscaled scenarios. The working group approved the six-month extension up to June 2018.</p>
5.	<p>Bathymetric survey and water quality monitoring of selected ponds in Bundelkhand region for development of water management plan.</p> <p>Team: Digambar Singh, Omkar Singh, Subhash Kichlu and N R Allaka</p> <p>DOS: Apr 2018, DOC: March 2020</p>	<p>The proposed objectives, methodology and expected outcome were presented by Sh. Digambar Singh (PI). The PI mentioned that the proposed components of the study would include water quality analysis and bathymetric survey of some identified ponds in Jhansi, Lalitpur, Tikamgarh and Chhatarpur districts.</p>
6.	<p>Conservation of ponds in Ibrahimpur- Masahi Village and performance evaluation of natural treatment system</p> <p>Team: Omkar Singh, V C Goyal, Digambar Singh, Subhash Kichlu, and N R Allaka</p> <p>Co-investigators from Centre for Ecology & Hydrology, Edinburgh, United Kingdom: Prof. Laurence Carvalho, Er. Mike Clark</p> <p>DOS: Apr 2018, DOC: March 2020</p>	<p>The proposed objectives, methodology and expected outcome were presented by Sh. Omkar Singh (PI). The PI mentioned that the proposed study is the extension of the earlier study entitled "Water conservation and management in Ibrahimpur Masahi village of Haridwar district (Uttarakhand)", and the impact of Constructed Wetland (CW) on the water quality of the pond would be studied in collaboration with CEH, UK.</p>
7.	<p>Vulnerability assessment of identified watersheds in Neeranchal Project States</p> <p>Team: Dr Jyoti P Patil and nodal scientists from Regional centres (Bhopal, Patna, Kakinada, Belgaum)</p> <p>DOS: July 2017, DOC: June 2019 (NNWP)</p>	<p>The results and present status of the study were presented by Ms. Meeta Gupta, JRF. Ms Meeta informed that the required data for calculating the vulnerability index is being collected from secondary sources like census (population/livestock), state department web sites, statistical handbooks etc.</p>
8.	<p>Hydrological modelling in Bhagirathi basin up to Tehri dam and assessment of climate change impact</p> <p>Team: A R Senthil kumar, J. V. Tyagi, M. K. Goel, S. D. Khobragade, P. C. Nayak, Manohar Arora and Digambar Singh</p> <p>DOS: July 2016, DOC: June 2021 (NMSHE)</p>	<p>The results and present status of the study were presented by Dr. A. R. Senthil kumar (PI). The PI mentioned that the discharge and sediment yield at Tehri dam was simulated using SWAT.</p>
9.	<p>Rejuvenation of village ponds for identified villages in Muzaffarnagar and Meerut districts</p> <p>Team: V C Goyal, Omkar Singh, Digambar Singh and Subhash Kichlu</p> <p>Project Team: N .G. Shrivastava, Nihal Singh, Kalzang, Sandeep Yadav and Subhash Vyas</p> <p>DOS: July 2017, DOC: June 2020</p>	<p>The present status of the study was presented by Dr. V. C. Goyal (PI). The PI mentioned that the DPRs for 12 ponds have been prepared and waiting for the release of funds from MoWR, RD&GR. Sh. Sudhindra Mohan Sharma inquired about the location of floating wetland in the pond. Dr. N. G. Srivastava clarified that the floating wetland will be installed</p>

		in the settling chamber. Mrs Jancy Vijayan inquired about the control of nutrient load in the pond. Dr. N. G. Srivastava clarified that the nutrient load will be controlled by integrated approach through floating wetland and microbial inoculum.
10.	Development of water allocation plan for a Neeranchal watershed in Chhattisgarh Team: A. R. Senthil kumar, Jyoti P Patil, T R Nayak and Rajesh Agarwal DOS: Apr 2018, DOC: March 2020 (New study)	The proposed objectives, methodology and expected outcome were presented by Dr. A. R. Senthil kumar (PI). The PI mentioned that the water availability at district level would be computed by a suitable hydrologic model. The water allocation plan would be developed using WEAP model.
11.	Development of Innovation Centre for Eco-prudent Wastewater Solutions (IC-EcoWS) Partner Institutions: National Institute of Hydrology, Roorkee Indian Institute of Technology Bombay (IITB) Department of Civil Engineering, MNIT Jaipur Institute of Rural Management Anand.	Dr. V. C. Goyal (PI) mentioned that the study would commence once the approval is received from DST.

WORK PROGRAMME FOR 2018-19

SN	Title of Project/Study	Funding	Study Team	Duration	Status
Internal Study					
1	Study on effect of climate change on sediment yield to Pong reservoir	NIH	A R Senthil kumar (PI) J V Tyagi, S D Khobragade	Apr 2015- Sep 2018	Ongoing
2	Effect of climate change on evaporation at point scale	NIH	Digamber Singh (PI) A R Senthil Kumar, Manohar Arora	Jun 2014- Jun 2018	Ongoing
3	Bathymetric survey and water quality monitoring of selected ponds in Bundelkhand region for development of water management plan	NIH	Digamber Singh (PI) Omkar Singh, Subhash Kichlu, N R Allaka	Apr 2018- Mar 2020	New Study (Follow up of Bundelkhand 4- district project)
4	Conservation of ponds in Ibrahimpur- Masahi Village and performance evaluation of natural treatment system	NIH,CEH (UK) & IITR	NIH: Omkar Singh (PI) V C Goyal, Digamber Singh, Subhash Kichlu, NR Allaka IITR: Himanshu Joshi CEH: Laurence Carvalho, Mike Clarke	Apr 2018- Mar 2020	New Study (Follow up of earlier study)
Sponsored Projects					
1	Vulnerability assessment of identified watersheds in Neeranchal Project States	NNWP	Jyoti P Patil (PI) + RCs	Jul 2017- Jun 2019	Ongoing
2	Hydrological modelling in Bhagirathi basin up to Tehri dam and assessment of climate change impact	NMSHE	A R Senthil kumar (PI) J. V. Tyagi, M. K. Goel S. D. Khobragade P. C. Nayak, Manohar Arora	Mar 2016- Mar 2021	Ongoing

3	Rejuvenation of village ponds for identified villages in Muzaffarnagar and Meerut districts	MoWR-funded project	V C Goyal (PI) Omkar Singh, Digamber Singh, Rajesh Singh, Subhash Kichlu, Rakesh Goel	Apr 2017- Mar 2020	Ongoing
4	Development of water allocation plan for a Neeranchal watershed in Chhattisgarh	NNWP	A R Senthil kumar (PI) T R Nayak, Jyoti P Patil Rajesh Agarwal	Apr 2018- Mar 2020	New Study
5	Development of Innovation centre for EcoPrudent Wastewater Solutions	DST	V C Goyal (PI), Jyoti P Patil, Amrendra Bhushan + from NIT Jaipur, IIT Bombay and IRMA Anand	5 Years	New Study (subject to approval)

Dr. V C Goyal thanked the members for their valuable contributions during deliberations in the Working Group meeting.

The meeting ended with vote of thanks to the Chair.

ANNEXURE-I

List of Working Group Members who attended the 46th WG meeting

1.	Dr. S.K. Jain, Director, NIH	Chairman
2.	Sh. Ankit Dudeja, CWC, New delhi	Member
3.	Dr. Ashok K. Das, IMD, New Delhi	Member
4.	Smt. Jancy Vijayan, NWDA, New Delhi	Member
5.	Dr. P R Ojasvi, ICAR-IISWC, Dehradun	Member
6.	Dr. S K Bartarya, WADIA, Dehradun	Member
7.	Er. Kireet Kumar, GBPIHED, Almora	Member
8.	Dr. U K Sinha, BARC, Mumbai	Member
9.	Dr. R D Deshpande, PRL, Ahmedabad	Member
10.	Dr. Pawan Labhassetwar, NEERI, Nagpur	Member
11.	Dr. S P Aggarwal, IIRS, Dehradun	Member
12.	Dr. Shakeel Ahmed, CSIR-NGRI, Hyderabad	Member
13.	Dr. Varun Joshi, GGSIP, New Delhi	Member
14.	Prof. K K Singh, Kurukshetra	Member
15.	Prof. A K Saraf, IIT, Roorkee	Member
16.	Prof. M L Kansal, IIT, Roorkee	Member
17.	Dr. S S Grewal, Chandigarh	Member
18.	Dr. C T Danya, IIT, Delhi	Member
19.	Dr. Kaushal K. Garg, ICRISAT, Hyderabad	Member
20.	Prof. Ramakar Jha, NIT, Patna	Member
21.	Prof. A P Dimri, JNU, New Delhi	Member
22.	Dr. Sadhana Malhotra, Mindspace, Dehradun	Member
23.	Sh. Sudhindra Mohan Sharma, Indore	Member
24.	Sh. Punit Kumar Mall, IRI, Roorkee	Member
25.	Dr. N C Ghosh, Sc.G & Head GWH Division, NIH	Member
26.	Dr. Rakesh Kumar, Sc. G & Head SWH Division, NIH	Member
27.	Dr. C K Jain, Sc.G & Head EH Division, NIH	Member
28.	Dr. Sudhir Kumar, Sc. G & Head HI Division, NIH	Member
29.	Dr. Sanjay K. Jain, Sc. G & Head WRS Division, NIH	Member
30.	Dr. V C Goyal, Sc. G & Head, RMO Division, NIH	Member-Secretary

Scientists from National Institute of Hydrology

	EH Division		SWH Division
1	Dr. M.K. Sharma, Sc.D	16	Dr. J.V. Tyagi, Sc.G
2	Dr. Rajesh Singh, Sc.C	17	Dr. A.K. Lohani, Sc.G
3	Dr. Pradeep Kumar, Sc.C	18	Dr. R.P. Pandey, Sc.G
	GWH Division	19	Dr. S.K. Singh, Sc.F
4	Er. C.P. Kumar, Sc.G	20	Dr. Sanjay Kumar, Sc.E
5	Dr. Anupama Sharma, Sc.E	21	Dr. Archana Sarkar, Sc.D
6	Dr. Surjeet Singh, Sc.E	22	Dr. L.N. Thakural, Sc.C
7	Er. Sumant Kumar, Sc.C	23	Sh. J.P. Patra, Sc.C
8	Mrs. Suman Gurjar, Sc.C	24	Dr. Ashwini A. Ranade, Sc.C
9	Dr. Gopal Krishan, Sc.C	25	Sh. Naresh Saini, Sc.B
	HI Division	26	Sh. N.K. Bhatnagar, Sc.B
10	Dr.Suhas Khobragade, Sc.F		WRS Division
11	Dr. M.S. Rao, Sc.E	27	Dr. M.K. Goel, Sc.G
12	Sh. S.K. Verma, Sc.D	28	Smt. Deepa Chalisgaonkar, Sc. F
	RMO Division	29	Er. D.S. Rathore, Sc.F
13	Er. Omkar Singh, Sc.F	30	Dr. Renoj J. Thayyen, Sc.D
14	Dr. A R Senthil Kumar, Sc.E	31	Dr. Manohar Arora, Sc.D
15	Sh. Digamber Singh, Sc.C	32	Sh. Manish Nema, Sc.C