

**MINUTES OF THE  
49<sup>TH</sup> MEETING OF WORKING GROUP OF NIH  
HELD AT NIH, ROORKEE, DURING 4-5 NOVEMBER 2019**

The meeting was held under the Chairmanship of Dr. S K Jain, Director, NIH. The list of participants of the meeting is given in Annexure-I.

**ITEM NO. 49.1: OPENING REMARKS BY THE CHAIRMAN**

Chairman, WG, welcomed the WG members and the Scientists of NIH. He flagged the issue of poor attendance of the Working Members, and invited suggestions to improve this situation. The majority of members were in favour of organizing the meeting only once a year, for 2-3 days.

The Chairman then requested the WG 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. A K Das	▪ Explore use of high-resolution data available from IMD
2.	Er. S S Shrimali	▪ Avoid overlap among studies
3.	Dr. Man Singh	▪ Ensure data availability while proposing a new study
4.	Dr. Bhishm Kumar	▪ Improve NIH website; metadata on NIH website ▪ NIH should focus more on applied research
5.	Dr. S S Grewal	▪ To present summarized findings in a slide ▪ Scientists may write popular articles for common users
6.	Dr. Anil Gautam	▪ Improve presentation
7.	Dr. Sadhana Malhotra	▪ Give advance notice to the members for possible dates

Next, the Chairman asked the Member-Secretary to take up the agenda.

**ITEM No. 49.2: CONFIRMATION OF MINUTES OF 48<sup>th</sup> MEETING OF WORKING GROUP**

The 48<sup>th</sup> meeting of the Working group was held during 2-3 May, 2019. The minutes of the meeting were circulated to all the members and invitees vide letter No. RMOD/WG/NIH-10 dated 28 May 2019. The members confirmed the minutes of the 48<sup>th</sup> Working Group meeting.

**ITEM No. 49.3: 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 48<sup>th</sup> working group meeting.

**ITEM Nos. 49.4: PRESENTATION AND DISCUSSION ON THE STATUS AND PROGRESS OF THE WORK PROGRAMME FOR YEAR 2019-20.**

The Member-Secretary requested the respective Divisional Heads to present the progress of studies carried out during 2019-20. 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. J.V. Tyagi, Scientist 'G' & Head of EHD presented a brief overview of the Division including available scientific manpower, status of studies, consultancy projects, publications, and technology transfer activities carried out by the Division. Thereafter the scientists of the Division presented the progress of their studies and the comments/suggestions received from the Working Group members are summarized below.

### Progress of Work Program for 2019-20

S. No.	Study	Recommendations/Comments
<b>Sponsored Projects (Continuing)</b>		
1.	<p><b>Title:</b> Environmental Assessment of Aquatic Ecosystem of Upper Ganga Basin</p> <p><b>Study Group:</b> M. K. Sharma (PI), Manohar Arora Pradeep Kumar, R. Singh, &amp; D. S. Malik (GKU)</p> <p><b>Sponsored by:</b> DST (NMSHE)</p> <p><b>Project Cost:</b> Rs. 2.25 Crore</p> <p><b>Duration:</b> 5 Years (04/16-03/21)</p>	<p>PI Dr. M. K. Sharma presented the study. There were no comments.</p>
2.	<p><b>Title:</b> Ground Water Quality Assessment with Special Reference to Sulphate Contamination in Bemetara District of Chhattisgarh State and Ameliorative Measures</p> <p><b>Study Group:</b> M. K. Sharma (PI), Surjeet Singh, &amp; Pradeep Kumar</p> <p><b>Partner:</b> WRD, Raipur &amp; CGWB, Raipur</p> <p><b>Sponsored by:</b> NHP-PDS</p> <p><b>Project Cost:</b> Rs. 25.4 Lakh</p> <p><b>Duration:</b> 03 Years (09/17-08/20)</p>	<p>PI Dr. M. K. Sharma presented the study and following suggestions were made:</p> <ul style="list-style-type: none"> <li>• Dr. Man Singh enquired about the sources of nitrate in the study area. Dr. Sharma replied that the analysis of ammonia will also be carried out in collected samples in future to confirm the source of nitrate.</li> </ul>
3.	<p><b>Title:</b> Water Quality Assessment of Southwest Punjab Emphasizing Carcinogenic Contaminants and their Possible Remedial Measures</p> <p><b>Study Group:</b> Rajesh Singh (PI), Pradeep Kumar, M. K. Sharma, &amp; Sumant Kumar</p> <p><b>Partner:</b> Water Resources Organization, Punjab</p> <p><b>Sponsored by:</b> NHP-PDS</p> <p><b>Project Cost:</b> Rs. 65.6 Lakh</p> <p><b>Duration:</b> 3 Years (09/17 – 08/20)</p>	<p>PI Dr. Rajesh Singh presented the study and following suggestions were made:</p> <ul style="list-style-type: none"> <li>• Dr. Bhism Kumar (Ex. Scientist, NIH &amp; IAEA) suggested to carry out the analysis of Radon in the samples.</li> </ul>
<b>Internal Studies (Continuing)</b>		
4.	<p><b>Title:</b> Water quality assessment of Haridwar District</p>	<p>No specific comments were made by the members of the Working Group.</p>

	<b>Study Group:</b> R.K. Nema (PI), Rajesh Singh, J. V. Tyagi & Pradeep Kumar <b>Duration:</b> 3 years (05/19-04/22)	
<b>Sponsored Projects (New Study)</b>		
5.	<b>Title:</b> Leachate Transport Modeling for Gazipur landfill site for suggesting ameliorative measures <b>Study Group:</b> Anjali (PI), Sudhir Kumar, J. V. Tyagi, M. K. Sharma, Nitesh Patidar <b>Partner:</b> CGWB (Delhi Unit) <b>Sponsored by:</b> NHP-PDS <b>Project cost:</b> Rs. 76.10 Lakh <b>Duration:</b> 3 Years (10/19 – 09/21)	PI Anjali presented the study and following suggestions were made: <ul style="list-style-type: none"> <li>• Dr. Bhisim Kumar suggested to go for dilution instead of removing colour from the sample or monitor the changes in parameters.</li> </ul>
<b>Internal Studies (New Study)</b>		
6.	<b>Title:</b> Simulation of Non-Point Source Pollution Processes in Song River <b>Study Group:</b> Pradeep Kumar (PI), J. V. Tyagi, M. K. Sharma & Rajesh Singh <b>Duration:</b> 4 years (11/19-10/23)	No comments were made.

#### Training Programmes organized during 2019-20

SN	Topic	Duration	Place
1.	Hydrologic Modelling using SWAT (Coordinator: Dr. J. V. Tyagi)	Two weeks 20-31 May 2019	Roorkee
2.	Ground Water Quality Monitoring & Assessment under NHP-PDS (Coordinator: Dr. M. K. Sharma)	5 Days 3-7 June 2019	Roorkee
3.	Water Quality Assessment & Management under NHP-PDS (Coordinator: Dr. Rajesh Singh)	5 Days 17-21 June 2019	Roorkee

## GROUND WATER HYDROLOGY DIVISION

Dr. Anupma Sharma, Scientist 'F' presented a brief overview, status of studies and activities carried out by the division since the 48<sup>th</sup> Working Group meeting held in May, 2019. She gave an account of scientific personnel available in the division; internal, sponsored and consultancy projects - ongoing and completed; and also future activities planned by the division. Dr. Sharma informed that two in-house R&D studies and twelve sponsored studies were approved for the year 2018-19. In addition to the above studies, scientists of the division have a major role in activities of the National Hydrology Project (NHP), DSS planning and management in selected states, development of groundwater module for “*Integrated Hydrologic Model*” with IIT Kharagpur and procurement related activities.

The number of research papers published in various journals, lectures delivered in various training courses and number of M.Tech./Ph.D. students guided/guiding during the period were also reported. The progress of following studies was presented by respective Principal Investigators and emerged suggestions are given below.

S. No.	Project	Project Team	Duration & Status	Funding Source
<b>Internal Studies</b>				
1. NIH/GW H/NIH/1 9-20	The Regional Hydrological Impact of Farm-Scale Water Saving Measures in the Gangetic Plains	Sumant Kumar (PI), C. P. Kumar, Archana Sarkar, Surjeet Singh, P. K. Mishra	1 year (08/19 – 07/20) <i>Status: In progress</i>	Internal Study (in collaboration with CSIRO, Australia)
<b>Sponsored Projects</b>				
2. NIH/GW H/NIH/1 5-19	Peya Jal Suraksha - Development of Six Pilot Riverbank Filtration Demonstrating Schemes in Different Hydrogeological Settings for Sustainable Drinking Water Supply	Surjeet Singh (Lead), B. Chakravorty, Y. R. S. Rao, Anupma Sharma, Sumant Kumar, Gopal Krishan, Suman Gurjar, Anju Chaudhary, Sanjay Mittal	2.5 years (11/15–12/19) Extended till Dec. 2019 <i>Status: In progress</i>	Sponsored by DoWR, RD & GR under Plan Fund
3. NIH/G WH/PD S/17-20	Hydro-geochemical Evolution and Arsenic Occurrence in Aquifer of Central Ganges Basin	Sumant Kumar (PI), Sudhir Kumar, Rajesh Singh, Gopal Krishan, Anju Chaudhary <i>Partner Organization:</i> MWRD, Bihar <i>Collaborator:</i> Brijesh Yadav, IIT Roorkee and N.S. Maurya, NIT Patna	3 years (12/17-11/20) <i>Status: In progress</i>	Sponsored by NHP under PDS

4. NIH/G WH/PD S/17-21	Assessment of Impacts of Groundwater Salinity on Regional Groundwater Resources, Current and Future Situation in Mewat, Haryana – Possible Remedy and Resilience Building Measures	Gopal Krishan (PI), Surjeet Singh, C. P. Kumar, S. K. Verma <i>IIT-Roorkee:</i> M. L. Kansal, Brijesh Yadav (PI) <i>Sehgal Foundation, Gurgaon:</i> Lalit Mohan Sharma	4 years (12/17-11/21) <i>Status: In progress</i>	Sponsored by NHP under PDS
5. NIH/GW H/DST/1 8-20	Future Secular Changes and Remediation of Groundwater Arsenic in the Ganga River Basin - FAR GANGA	B. Chakravorty (India Lead), Surjeet Singh (Dy. Lead), Sumant Kumar, Gopal Krishan, Suman Gurjar <i>Other India Partners:</i> IITR, IITKg, MCS, Patna <i>UK Partners:</i> Univ. of Manchester, BGS, Salford University, Univ. of Birmingham	3 years (01/18 - 12/20) <i>Status: In progress</i>	DST-Newton Bhabha-NERC- India-UK Water Quality Research Programme
6. NIH/GW H/DST/1 8-20	Impact of Rainwater Harvesting on Groundwater Quality in India with Specific Reference to Fluoride and Micro-pollutants	Anupma Sharma (India Lead), Sumant Kumar, Gopal Krishan, Suman Gurjar, M. K. Sharma <i>Other Indian Partners:</i> IIT Ropar, IIT Jodhpur <i>UK Partner:</i> School of Water, Energy and Environment, Cranfield University <i>Project Partners:</i> Water Harvest, Excellent Development (UK based NGOs)	3 years (01/18 - 12/20) <i>Status: In progress</i>	DST-Newton Bhabha-NERC- India-UK Water Quality Research Programme
7. NIH/GW H/CEHM /18-22	Integrated Management of Water Resources for Quantity and Quality in Upper Yamuna Basin upto Delhi	Anupma Sharma (PI) Sanjay K. Jain, Archana Sarkar, M. K. Sharma, L. N. Thakural, Sumant Kumar, Suman Gurjar, Vishal Singh, Nitesh Patidar <i>Partner Organizations:</i> Water Resources & Irrigation Dept. Haryana, Groundwater Dept. UP, Yamuna Basin Organization, CWC, New Delhi	4 years (04/18-03/22) <i>Status: In progress</i>	Special Project under “Centre of Excellence” (NHP)
8. NIH/GW H/MoES/ 19-19	Improving our Understanding of the Aquifer Systems in Sunderbans	Gopal Krishan (PI), C. P. Kumar (Co-PI)	6 months (06/19 - 11/19) <i>Status: In progress</i>	Sponsored by India-UK Water Centre (MoES & NERC)

1. Project Code: NIH/GWH/NIH/19-20: **The Regional Hydrological Impact of Farm-Scale Water Saving Measures in the Gangetic Plains**

Dr. Surjeet Singh briefed about the study background, objectives, methodology and deliverables. Dr. J. V. Tyagi, Scientist-G and head, EHD advised to look into how the regional hydrological impacts of farm scale savings will affect the Gangetic plains.

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

Dr. Surjeet Singh (PI) briefed about the study and progress made on the pilot water supply demonstration schemes at four sites during the last six months. No comments were received.

3. Project Code: NIH/GWH/PDS/17-20: **Hydro-geochemical Evolution and Arsenic Occurrence in Aquifer of Central Ganges Basin**

Dr. Gopal Krishan presented the background, statement of the problem, aquifer depth-wise arsenic occurrence, correlations and future planned work. No specific comments were received.

4. Project Code: NIH/GWH/PDS/17-21: **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, progress and future plans of the study with main emphasis on causes and remediation of salinization. No specific comments were received.

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

Dr. Surjeet Singh presented the study funded under the India-UK DST-NERC-EPSRC Water Quality Research Programme (Newton Bhabha fund). While presenting the objectives and hypotheses to be tested in the project, Dr. Singh reported the progress of the study during the last six months and also explained the future plans. No specific comments were received.

6. Project Code: NIH/GWH/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 approved under the India-UK DST-NERC-EPSRC Water Quality Research Programme (Newton Bhabha fund). The research gaps, objectives of the study, and the work packages were presented. The study sites, in which field investigations are being conducted, were discussed and the rainwater harvesting technique adopted in the study site was presented. The seasonal variation in groundwater levels and water quality parameters was shown with the help of graphs. In addition, the progress made in terms of collection of geological samples, and, chemical experiments and analysis under way in laboratory was explained.

7. Project Code: NIH/GWH/CEHM/18-22: **Integrated Management of Water Resources for Quantity and Quality in Upper Yamuna Basin up to Delhi**

Dr. Anupma Sharma (PI) presented the special study taken up under the Centre of Excellence for Hydrologic Modeling in National Hydrology Project. She informed in brief about the background of the study and the project partners. The existing water resources issues and challenges in Upper Yamuna Basin were explained. The project entails large data processing, field investigations and modeling studies pertaining to surface water and groundwater flows, contaminant transport and water resources management. The progress made in respect of data collection and processing, field experiments and hydrologic modeling was presented. It was informed that in view of the large study area, satellite data is being used to the extent possible. In this regard, results of rainfall-runoff modeling performed using VIC model were shown. It was informed that the calibrated model would be used to generate water availability under climate change. Spatial estimates of groundwater recharge obtained using WetSpass were also explained. On queries from the working group members, the input data required for the computation and recharge percentage were informed. It was further informed that the results using WetSpass would be validated using field data.

8. Project Code: NIH/GWH/MoES/19-19: Improving our Understanding of the Aquifer Systems in Sunderbans

Dr. Gopal Krishan presented motivation for the study, development of a conceptual model of the island aquifer systems collating aquifer property data and to assess potential and feasibility of aquifer storage and recovery. No specific comments were received.

The work program of the division for the year 2019-20 is given below.

**WORK PROGRAM FOR THE YEAR 2019-20**

S. No.	Project	Project Team	Duration & Status	Funding Source
<b>Internal Studies</b>				
1. NIH/GW H/NIH/1 9-21	Application of Satellite Data Products for Water Resources Assessment	Suman Gurjar (PI), Vishal Singh, Surjeet Singh, C. P. Kumar, P. K. Singh	2 years (05/19 - 04/21) <i>Status: In progress</i>	Internal Study
2. NIH/GW H/NIH/1 9-20	The Regional Hydrological Impact of Farm-Scale Water Saving Measures in the Gangetic Plains	Sumant Kumar (PI), C. P. Kumar, Archana Sarkar, Surjeet Singh, P. K. Mishra	1 year (08/19 – 07/20) <i>Status: In progress</i>	Internal Study (in collaboration with CSIRO, Australia)
<b>Sponsored Projects</b>				
3. NIH/GW H/NIH/1 5-19	Peya Jal Suraksha - Development of Six Pilot Riverbank Filtration Demonstrating Schemes in Different Hydrogeological Settings for Sustainable Drinking Water Supply	Surjeet Singh (Lead), B. Chakravorty, Y. R. S. Rao, Anupma Sharma, Sumant Kumar, Gopal Krishan, Suman Gurjar, Anju Chaudhary, Sanjay Mittal	2.5 years (11/15–12/19) Extended till Dec. 2019 <i>Status: In progress</i>	Sponsored by MoWR, RD & GR under Plan Fund
4. NIH/GW H/NMSH E/16-20	Study of River - Aquifer Interactions and Groundwater Potential at Selected Sites in the Upper Ganga Basin up to Dabrani	Surjeet Singh (PI), C. P. Kumar, R. J. Thayyen, Sudhir Kumar, Manohar Arora, Gopal Krishan, Nitesh Patidar, Anjali	5 years (01/16 - 12/20) <i>Status: In progress</i>	Sponsored by DST under NMSHE SP-8

5. NIH/GW H/BGS/1 7-20	Groundwater Fluctuations and Conductivity Monitoring in Punjab - New Evidence of Groundwater Dynamics in Punjab from High Frequency Groundwater Level and Salinity Measurements	Gopal Krishan (PI), Surjeet Singh, C. P. Kumar, M. S. Rao <i>From: BGS, UK</i> Dr. Dan Lapworth (PI) Prof. Alan MacDonald	3 years (12/17-11/20) <i>Status: In progress</i>	Sponsored by BGS, UK
6. NIH/G WH/PD S/17-20	Hydro-geochemical Evolution and Arsenic Occurrence in Aquifer of Central Ganges Basin	Sumant Kumar (PI), Sudhir Kumar, Rajesh Singh, Gopal Krishan, Anju Chaudhary <i>Partner Organization:</i> MWRD, Bihar <i>Collaborator:</i> Brijesh Yadav, IIT Roorkee and N.S. Maurya, NIT Patna	3 years (12/17-11/20) <i>Status: In progress</i>	Sponsored by NHP under PDS
7. NIH/G WH/PD S/17-21	Assessment of Impacts of Groundwater Salinity on Regional Groundwater Resources, Current and Future Situation in Mewat, Haryana – Possible Remedy and Resilience Building Measures	Gopal Krishan (PI), Surjeet Singh, C. P. Kumar, S. K. Verma <i>IIT-Roorkee:</i> M. L. Kansal, Brijesh Yadav (PI) <i>Sehgal Foundation,</i> <i>Gurgaon:</i> Lalit Mohan Sharma	4 years (12/17-11/21) <i>Status: In progress</i>	Sponsored by NHP under PDS
8. NIH/G WH/PD S/17-21	Ganges Aquifer Management in the Context of Monsoon Runoff Conservation for Sustainable River Ecosystem Services - A Pilot Study	Surjeet Singh (PI), C. P. Kumar, Sudhir Kumar, Suman Gurjar, Gopal Krishan	4 years (12/17-11/22) <i>Status:</i> <i>In progress</i>	Sponsored by NHP under PDS
9. NIH/GW H/DST/1 8-20	Future Secular Changes and Remediation of Groundwater Arsenic in the Ganga River Basin - FAR GANGA	B. Chakravorty (India Lead), Surjeet Singh (Dy. Lead), Sumant Kumar, Gopal Krishan, Suman Gurjar <i>Other India Partners:</i> IITR, IITKg, MCS, Patna <i>UK Partners:</i> Univ. of Manchester, BGS, Salford University, Univ. of Birmingham	3 years (01/18 - 12/20) <i>Status: In progress</i>	DST-Newton Bhabha-NERC- India-UK Water Quality Research Programme



10. NIH/GW H/DST/1 8-20	Impact of Rainwater Harvesting on Groundwater Quality in India with Specific Reference to Fluoride and Micro-pollutants	Anupma Sharma (India Lead), Sumant Kumar, Gopal Krishan, Suman Gurjar, M. K. Sharma <i>Other Indian Partners:</i> IIT Ropar, IIT Jodhpur <i>UK Partner:</i> School of Water, Energy and Environment, Cranfield University <i>Project Partners:</i> Water Harvest, Excellent Development (UK based NGOs)	3 years (01/18 - 12/20) <i>Status: In progress</i>	DST-Newton Bhabha-NERC-India-UK Water Quality Research Programme
11. NIH/GW H/CEHM /18-22	Integrated Management of Water Resources for Quantity and Quality in Upper Yamuna Basin upto Delhi	Anupma Sharma (PI) Sanjay K. Jain, Archana Sarkar, M. K. Sharma, L. N. Thakural, Sumant Kumar, Suman Gurjar, Vishal Singh, Nitesh Patidar <i>Partner Organizations:</i> Water Resources & Irrigation Dept. Haryana, Groundwater Dept. UP, Yamuna Basin Organization, CWC, New Delhi	4 years (04/18-03/22) <i>Status: In progress</i>	Special Project under “Centre of Excellence” (NHP)
12. NIH/GW H/DST/1 9-23	Enhancing Food and Water Security in Arid Region through Improved Understanding of Quantity, Quality and Management of Blue, Green and Grey Water	Anupma Sharma (Lead NIH), C.P. Kumar, Nitesh Patidar (Lead: CAZRI Jodhpur, Partners: NIH Roorkee, IISWC Dehradun, CSWRI Bikaner, CIAH Bikaner, NIAM Jaipur)	5 years (03/19 - 02/24) <i>Status: In progress</i>	Sponsored by DST
13. NIH/GW H/NMC G/19-20	Environmental Flow Assessment for Yamuna River from Hathnikund Barrage to Okhla Barrage	Anupma Sharma (PI), Sharad K. Jain, Manohar Arora, Pradeep Kumar, Rajesh Singh, Vishal Singh	1 year (04/19 - 03/20) <i>Status: In progress</i>	Sponsored by NMCG
14. NIH/GW H/MoES/ 19-19	Improving our Understanding of the Aquifer Systems in Sunderbans	Gopal Krishan (PI), C. P. Kumar (Co-PI)	6 months (06/19 - 11/19) <i>Status: In progress</i>	Sponsored by India-UK Water Centre (MoES & NERC)
<b>Other R &amp; D Projects</b>				

15. NIH/GW H/CEHM /18-21	Development of Groundwater Module for Integrated Hydrologic Model	Anupma Sharma (PI), B. Chakravorty, Surjeet Singh, Suman Gurjar, Sumant Kumar, Nitesh Patidar	3 years (08/18 -07/21) <i>Status: In progress</i>	CEHM, NHP
<b>Consultancy Projects</b>				
1.	Assessment of Saline and Freshwater Zone in Faridkot, Fazilka and Muktsar Districts of Malwa Region of Punjab	Gopal Krishan (PI)	10 months (03/19-12/19) <i>Status: In progress</i> Cost: Rs.17.70 lakh	Punjab Government
2.	Expansion of Salinization in Aquifers in Punjab	Gopal Krishan (PI)	1.5 year (03/19-09/20) <i>Status: In progress</i> Cost: Rs.1.18 crore	Punjab Government
3.	Water Availability Study based on Hydrological Investigations and Rainfall-Runoff Modeling of Upper Hindon Basin	Anupma Sharma (PI)	12 months (04/19-03/20) <i>Status: In progress</i> Cost: Rs.11.80 lakh	Irrigation Deptt., Saharanpur
4.	Hydro-geological Study of Goindwal Sahib Area of Tarn Taran District, Punjab	Surjeet Singh (PI)	6 months (09/19-02/20) <i>Status: In progress</i> Cost: Rs.15.93 lakh	GVK Power Ltd., Tarn Taran (Punjab)

### HYDROLOGICAL INVESTIGATIONS DIVISION

Dr Sudhir Kumar, Scientist-G and Head of the H. I. Division presented the brief details of the Division including the scientific staff strength and infrastructure. He briefly introduced about the scientific work of the Division and the various studies being carried by the Division including the new proposals, along with details about the publications by the Division and analytical work carried out at the Nuclear Hydrology Laboratory. He also informed about the technology transfer activities organized/proposed by the Division during April-October, 2019.

**Table 1: Status of studies carried out by HI Division during April-October, 2019**

Type of study/Project	Continuing in Studies	New studies proposed	Total
Internal Studies	2	0	2
Sponsored Projects	7	1	8
Consultancy Projects	4	1	5
Total	13	2	15

**Table 2: Details of training Courses/Workshops organised and Proposed by HI Division during 2019-20**

S. N.	Title of Training Course/Workshop	Duration	Venue	Co-ordinator
1.	Conservation and management of lakes, wetlands and springs	24 - 28 Jun 2019	NIH, Roorkee	S. D. Khobragade

2.	Tools and techniques of hydrological investigations	04 - 08 Nov 2019	NIH, Roorkee	S. M. Pingale
3.	Coastal Hydrology	Jan 2019	W. Bengal	M. S. Rao
4.	Hydrological Techniques	Feb 2020	NIH, Roorkee	M. S. Rao
5.	Groundwater and its role in rural development	Mar 2020	Midnipur, WB	Sudhir Kumar

**Table 3: Details of samples analyzed by HI Division Labs during April-September, 2019**

S.N.	Parameter analysed	No. of samples
1	$\delta^2\text{H}$ on DI-IRMS	2,417
2	$\delta^{18}\text{O}$ on DI-IRMS & CF-IRMS	3,081
3	Tritium enrichment	102
4.	Tritium measurements	85
5	WQ samples on IC	575

**Table 4: Details of Research Publications by HI Division during 2018-19**

	Published	Accepted	Communicated
Books/Book Chapter	2	-	-
International Journals	5	2	3
National Journals	-	-	-
International Conferences	5	-	-
National Conferences	-	-	-

The progress of each individual study for the year 2019-20 was presented by the respective P.I. of the study. Dr. Sudhir Kumar presented the studies of the two scientists who were on leave. The comments/actions suggested by the working group for various studies are as follows:

**INTERNAL STUDIES:**

SN	Project	Study Team	Duration	Status	Comments/ Action(s) Suggested
1.	Integrated hydrological investigations of natural water springs in lesser Himalaya, Uttarakhand	S M Pingale (PI), Sudhir Kumar Suhas Khobragade S. S. Rawat Rajeev Gupta	3 years (04/19to 03/22)	Continuing Study	i) The Dr. Grewal suggested giving special attention while planning springshed management measures especially choice of vegetation, which reduce infiltration. ii) Dr. Bhishm Kumar suggested to collect some spring and rain water samples for Tritium analysis.

2.	Isotope fingerprinting of precipitation over Indian Region	Nidhi Kalyani (PI) Sudhir Kumar MS Rao Scientists from RC's	3 years (04/19to 03/22)	Continuing Study	No specific action suggested
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**SPONSORED PROJECTS:**

SN	Project	Study Team	Duration	Funding	Status	Comments/ Action(s) Suggested
1.	Understanding of hydrological processes in Upper Ganga basin using isotopic techniques	Suhas Khobragade (PI) Sudhir Kumar Rajesh Singh M. Arora R. J. Thayyen S.K. Verma	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	Sudhir Kumar (PI) S.K. Verma	3 Years (06/16 - 05/19) <i>Proposed to be extended till</i>	Project with GBPIHE	Continuing Study	No specific action suggested
3.	Dating very old ground waters of deeper aquifers in Ganga Plains, India	MS Rao (PI) Sudhir Kumar S.K. Verma	3 Years (06/16 - 05/19)	IAEA	Continuing Study	PI/Co-PI of the project informed that during the 3 field excursions, only 13 deep piezometers (> 250 m) to tap deep groundwater for isotopic and chemical analysis were found suitable. Hence, it was requested to extend the study area to include neighboring states of UP falling in the Ganga Basin and also to accept inclusion of production wells (in addition to piezometers) that are tapping groundwater from depth > 200m bgl. PI requested to modify the name of the project from "Chemical & isotopic investigation of

						<i>groundwater in Deep Aquifers of Middle Ganga Basin” to “Chemical &amp; isotopic investigation of groundwater in Deep Aquifers of Ganga Basin” (the word ‘middle’ will be omitted)</i>
4.	Chemical & Isotopic Characterization of Deep Aquifer Groundwater of Middle Ganga Basin	Sudhir Kumar (PI) M. Someshwar Rao S.K. Verma	3 ½ year (1/18 – 6/21)	PDS under NHP	Continuing Study	No specific action suggested
5.	Integrated Study on groundwater dynamics in the coastal aquifers of West Bengal for sustainable groundwater management	M. Someshwar (PI), Sudhir Kumar, S.K. Verma A. R. Senthil Kumar	3 ½ year (1/18 – 6/21)	PDS under NHP	Continuing Study	No specific action suggested
6.	Development of a comprehensive plan for conservation and sustainable management of Bhimtal and Naukuchiatal lakes, Uttarakhand	Suhas Khobragade Sudhir Kumar Rajiv Gupta	3 Years (1/18 – 12/20)	PDS under NHP	Continuing Study	No specific action suggested
7.	Unravelling Submarine Discharge (SGD) zones along the Indian subcontinent and its islands (Mission SGD) – Pilot Study	Sudhir Kumar MS Rao SM Pingale BK Purandra YRS Rao	1 year (04/19 – 03/20)	MoES through NCESS	Continuing Study	No specific action suggested
8.	Groundwater Rejuvenation As Climate change Resilience for marginalized and	Sudhir Kumar MS Rao SM Pingale	2 years (06/19 – 5/21)	IIT Bombay, Mumbai	New study	No specific action suggested

gender sensitive GangeS (GRACERS)					
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**ANNEXURE-I**

**APPROVED WORK PROGRAMME FOR 2019-2020**

S. N.	Project Title	Study Team	Duration	Remarks
<b><u>INTERNAL STUDIES:</u></b>				
1	Integrated hydrological investigations of natural water springs in lesser Himalaya, Uttarakhand	S M Pingale (PI), Sudhir Kumar S. D. Khobragade Soban Singh Rawat Rajeev Gupta	3 years (04/19-03/22)	Continuing Study
2	Isotope fingerprinting of precipitation over Indian Region	Nidhi Kalyani (PI) Sudhir Kumar MS Rao Scientists from RC's	3 years (04/19-03/22)	Continuing Study
<b><u>SPONSORED PROJECTS:</u></b>				
1.	Understanding of hydrological processes in Upper Ganga basin by using isotopic techniques	Suhas Khobragade (PI) Sudhir Kumar Rajesh Singh M. Arora R. J. Thayyen S.K. Verma	5 Years (04/16-03/21)	Continuing Study under NMSHE Project
2.	Rejuvenation of Springs and Spring-fed Streams in Mid-Himalayan Basin using Spring Sanctuary concept	Sudhir Kumar (PI) S.K. Verma	3 Years (06/16 -05/19)	Continuing Study Project with GBPIHE
3.	Dating very old ground waters of deeper aquifers in Ganga Plains, India	MS Rao (PI) Sudhir Kumar C.K. Jain S.K. Verma	3 Years (06/16 -05/19)	Continuing Study IAEA under CRP
4.	Chemical & Isotopic Characterization of Deep Aquifer Groundwater of Middle Ganga Basin	Sudhir Kumar (PI) C.K. Jain M. Someshwar Rao S.K. Verma	3 ½ year (1/18 – 6/21)	Continuing PDS under NHP
5.	Integrated Study on groundwater dynamics in the coastal aquifers of West Bengal for sustainable groundwater management	M. Someshwar (PI), Sudhir Kumar, S.K. Verma A. R. Senthil Kumar V. S. Jeyakanthan	3 ½year (1/18 – 6/21)	Continuing PDS under NHP

6.	Development of a comprehensive plan for conservation and sustainable management of Bhimtal and Naukuchiatal lakes, Uttarakhand	SuhasKhobragade Sudhir Kumar	3 Years (1/18 – 12/20)	Continuing PDS under NHP
7.	Unravelling Submarine Discharge (SGD) zones along the Indian subcontinent and its islands (Mission SGD) – Pilot Study	Sudhir Kumar MS Rao Nidhi Kalyani BK Purandara YRS Rao	1 year (04/19 – 03/20)	Continuing Study under NCESS, MoES
8.	Groundwater Rejuvenation As Climate change Resilience for marginalized and gender sensitive Ganges (GRACERS)	Sudhir kumar MS Rao SM Pingale	2 years (06/19 – 5/21)	New Study with IIT Bombay, Mumbai

**CONSULTANCY PROJECTS:**

SN	Project	Sponsored by	Duration	Status
1.	Hydro-geological study for Darlipali STPP, Odisha	NTPC	9 months (09/15-07/16)	Draft Final Report Submitted
2.	Hydro-geological and isotopic study for 1x660 MW Harduaganj PTS, UP	UPRVUNL	12 months (11/15-10/16)	Draft Report submitted
3.	Hydrogeological Studies for Dewatering of Jhamarkotra Mines	RSMML	5 years (11/16 – 10/21)	Continuing Project
4.	Pollution source identification using stable isotopic investigations in and around chemical division, GIL, Nagda, MP	NEERI	3 ½ years (10/18 - 03/22)	Continuing Project
5.	Assessment of Impact of Mining on Surface Water Bodies In and Around The Lease Area of S.M.P.L. at Village Kolkarhiya Of Tehsil Pawai In District Panna, Madhya Pradesh	04 months (11/19-03/20)	SMPL	New Project

**SURFACE WATER HYDROLOGY DIVISION**

**Work Program for the Year 2019-20**

<b>ONGOING STUDIES (SPONSORED)</b>			
<b>S. No. &amp; Ref. Code</b>	<b>Title</b>	<b>Study Team</b>	<b>Duration</b>
1.NIH/SWHD/16-21	Hydrological modeling in Alaknanda basin and assessment of climate change impact (NMSHE)	A.K.Lohani Sanjay K. Jain Archana Sarkar V.S. Jeyakanthan L.N. Thakural	5 years (April 2016 to March 2021)
2.NIH/SWHD/17-20	Water efficient Irrigation by using SCADA system for medium irrigation Project (MIP) Shahnehar (PDS-NHP)	R.P. Pandey J.P. Patra Rajesh Singh N.K. Bhatnagar	3 years (Dec 2017 to Dec 2020)

<b>ONGOING STUDIES (INTERNAL)</b>			
<b>S. No. &amp; Ref. Code</b>	<b>Title</b>	<b>Study Team</b>	<b>Duration</b>
3.NIH/SWHD/19-22	Development of drought monitoring system for early warning and preparedness for a selected region in India	R.P. Pandey D.S.Rathore Ravi Galkate Sunil Gurrapu Suman Gurjar	3-years (May 2019 to March 2022)
4.NIH/SWHD/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	4 years (April 2017 to March 2021)
5.NIH/SWHD/18-20	Assessment of Climate Change Impact on Water Availability and Agriculture in part of Banas basin	Archana Sarkar Surjeet Singh Suman Gurjar Sunil Gurrapu	2 years (Nov 2018 to October 2020)
6.NIH/SWHD/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 K. Jain Sharad K. Jain	4 years (April 2015 to March 2020)
7.NIH/SWHD/17-20	Development of regional methods for design flood estimation in Uttarakhand	J.P. Patra Rakesh Kumar Pankaj Mani Sanjay Kumar	3 years (April 2017 to March 2020)
8.NIH/SWHD/18-21	Evaluation of seasonal extreme rain events across river India in 3D global temperature change	Ashwini Ranade Archana Sarkar	3 years (April 2018 to March 2021)
9.NIH/SWHD/18-21	Evaluation of the influence of low-frequency atmosphere-ocean oscillations on annual floods in the watersheds of the Indian subcontinent	Sunil Gurrapu Ashwini Ranade J.P. Patra	3 years (Nov 2018 to March 2021)



10.NIH/SW HD/18-20	Evaluation of water quality of Government schools in Roorkee block, District Haridwar	N.K. Bhatnagar M.K. Sharma L.N. Thakural Reena Rathore	2 years (Oct 2018 to sept. 2020)
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Dr. Rakesh Kumar, Sc G & Head, Surface Water Hydrology Division presented the various activities of the division. The concerned PI of the study presented the progress of his study during the working group meeting. The record of discussions for the respective study is given below:

S.N.	Title of Project/ Study, Study Group, Start/ Completion Dates	Status and Recommendations/Suggestions
<b>SPONSORED STUDIES</b>		
1.	<p>Hydrological modeling in Alaknanda basin and assessment of climate change impact (NMSHE)</p> <p><b>Study Group:</b> A.K. Lohani Sanjay K. Jain Archana Sarkar V.S. Jeyakanthan L.N. Thakural <b>DOS:</b> April 2016 <b>DOC:</b> March 2021</p>	<p>Dr A.K. Lohani, Scientist G and PI of the project presented the progress of the study. Initially, VIC model was setup for the study area. Thereafter, WIN-SRM model has been setup. Flow data of various gauging sites and meteorological data was collected from CWC and processed. Calibration and fine-tuning of both VIC and WINSRM models with the available data is in progress. Climate projection data required to project impact of climate change on river flow has been received recently through another NMSHE study.</p>
2.	<p>Water efficient irrigation by using SCADA system for medium irrigation project (MIP) Shahnehar (Ongoing) PDS under NHP.</p> <p><b>Study Group:</b> R.P. Pandey J. P. Patra Rajesh Singh N.K. Bhatnagar</p> <p>Department of Irrigation &amp; Public Health Engg. (I&amp;PHE), Govt. of Himachal Pradesh</p> <p><b>DOS:</b> Dec. 2017 <b>DOC:</b> Dec. 2020</p>	<p>Dr. R.P. Pandey, Scientist G and PI of the project presented progress of the study. The primary objectives of this study are to assess water availability at head works and 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 include development of a system of water supply database of quantum of water used to each beneficiary so the charges can be levied accordingly; devising a possible system of change in cropping pattern owing to real time monitoring of available water at various reaches of the canal; evaluation of land and water management intervention to minimize water losses throughout the canal and distribution system, water courses and in the field application to enhance the water use efficiency; devising a mechanism for equitable distribution of water to the farmers in each crop period from head to tail reaches. Comparison of Water Efficient Irrigation approach with the conventional system and to identify and evaluation of intervention to minimize water losses throughout the canal distribution system, water courses and in the field application to enhance the water use efficiency. NIH conducted field investigations in the Shahnehar command area and three experimental sites</p>

		<p>have been identified. The deliverables of the study will be estimates of water availability at headwork's and irrigation water requirements for various crops a different growth stages &amp; time period; quantification of irrigation water loss in different conveyance &amp; distribution systems, field channels, and irrigation application method; identification of components of irrigation system needing intervention to enhance water use efficiency etc. Himachal Pradesh I &amp;PHE department is processing procurement of soil moisture sensors, Canal Ultrasonic Level Sensor, Power Supply, Telemetry RTU etc.</p> <p>Department of I &amp;PHE, Shimla is processing for procurement of Sensors, discharge monitoring units with main control unites. In the meantime, the assessment of irrigation requirement has been estimated using CROPWAT 8.0 and NASA Satellite energy data to theoretically account total Crop water requirement (CWR)for the area. Dr Man Singh, Director IARI suggested to verify the estimates of CWR as the values appear to be on lower side.</p>
3.	<p>Development of drought monitoring system for early warning and preparedness for a selected region in India</p> <p><b>Study Group:</b></p> <p>R.P. Pandey D.S.Rathore Ravi Galkate Sunil Gurrapu Suman Gurjar</p> <p><b>DOS:</b> May 2019 <b>DOC:</b> March 2022</p>	<p>Dr. R.P. Pandey, Scientist G and PI presented progress of the study. He stated that drought management including monitoring, early warning, preparedness and mitigations have emerged as priority areas to cope with risk to drought and enhance resilience. The primary purpose of the proposed project is to develop a scientific tool for regular drought monitoring and early warning system (EWS) for preparedness in drought affected Bundelkhand region located in central India. Dr. Pandey presented the base maps i.e. DEM, Soil Map, Land Use Land Cover map, drainage &amp; Slope maps etc. The analysis of long term annual and seasonal rainfall data (1901 to 2015) for the 13 districts in the study region indicated that there is evidence of persistence occurrence of droughts for 2-3 consecutive year and this has caused severe drought impacts the past decades in the area. Director NIH asked to send the project proposal to WTC, IARI New Delhi for comments and suggestions.</p>
4.	<p>Development of regional relationships for water availability analysis and flood estimation for lower Godavari basin (3f)</p> <p><b>Study Group:</b></p> <p>Sanjay Kumar Rakesh Kumar J.P. Patra Pankaj Mani</p>	<p>Dr. Sanjay Kumar presented the study and explained the background, objectives, methodology and progress. He stated that 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 regional relationships between parameters of the NASH and Clark IUH model and physiographic characteristics of the basin. He informed that empirical cumulative density function (Hazen, Weibul &amp; Cuunanne) have been developed for annual</p>

	<p><b>DOS:</b> April 2017 <b>DOC:</b> March 2021</p>	<p>maximum flood values at various sites. He stated that at site frequency analysis based on L-moments approach for eleven sites (for GEV distribution) has been completed. Regionalization of dependable annual flow has been completed. He stated that analysis for other objectives is in progress. Chairman inquired about impact of climate change on flood estimate. Dr. Sanjay Kumar replied that annual maximum series at most of these stations are not showing any significant trends. However, a few stations having sufficient data of about 40-50 years would be investigated for impact of climate change on flood estimates.</p>
5.	<p>Assessment of Climate Change Impact on Water Availability and Agriculture in part of Banas basin</p> <p><b>Study Group:</b></p> <p>Archana Sarkar Surjeet Singh Suman Gurjar Sunil Gurrapu <b>DOS:</b> Nov. 2018 <b>DOC:</b> October 2020</p>	<p>Dr Archana Sarkar presented the background, objectives, and the preliminary results from the trend analyses of historical rainfall and temperature datasets from the Banas River Basin, using Mann-Kendall's Technique and Sen's slope method. The downscaled climate data from 19 GCMs were downloaded from the Copernicus website under two future emission scenarios (RCP4.5 &amp; RCP8.5). Pre-processing of these datasets is currently under progress and will be completed with next few months. No comments were received from the committee members.</p>
6.	<p>Study of hydrological changes in selected watersheds in view of climate change in India</p> <p><b>Study Group:</b></p> <p>L.N. Thakural D.S. Rathore Surjeet Singh Sanjay K. Jain Sharad K. Jain <b>DOS:</b> April 2015 <b>DOC:</b> March 2020</p>	<p>Dr. Thakural presented the objectives, methodology and the status of the above study. The GIS database created to meet out the objectives of the study 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 were also presented in the meeting. The outcomes/ results of hydrological models calibrated and validated for the river basins i.e. Ramganga, Bina, Chaliyar and Dhadhar river basins were presented. For studying the impact of climate change, processed gridded rainfall and temperature data, for the river basins to generate Representative Concentrations Pathways (RCP) namely RCP2.6 RCP 4.5, RCP 6 and RCP 8.5 using statistical downscaling model (SDSM) and thereafter, bias corrected data which are the input for the model were presented in the meeting.</p>
7.	<p>Development of regional methods for design flood estimation in Uttarakhand</p> <p><b>Study Group:</b></p> <p>J.P. Patra</p>	<p>Mr. Jagadish Prasad Patra, presented the objectives, need for such a study with brief methodology. The various objectives of the proposed study were presented along with the progress. The results of at-site flood frequency analysis using L-moments approach for annual</p>

	<p>Rakesh Kumar Pankaj Mani Sanjay Kumar <b>DOS:</b> April 2017 <b>DOC:</b> March 2020</p>	<p>maximum peak flood series data of CWC gauging sites were presented in brief. The relationships developed to estimate design flood for various return periods with catchment area are also presented. The progress made in Nonstationary Extreme Value Analysis considering the aspect of non-stationary in the data series was also presented in detail for annual maximum peak flood series and 1day annual maximum rainfall series. It was stated that an unjustified assumption of stationarity could lead to an under-estimation of extreme floods. However, it was highlighted that effect on such non-stationary approach may not be always very critical in terms of water level for the site of the river under study viz. water surface in a bridge, over topping of embankments etc. Further, effect of Tehri dam for moderation of flood peaks at Rishikesh was also explained considering reservoir index as an additional co-variate. There were no specific comments on the study.</p>
<p>8.</p>	<p>Evaluation of seasonal extreme rain events across river India in 3D global temperature change <b>Study Group:</b> Ashwini Ranade Archana Sarkar <b>DOS:</b> April 2018 <b>DOC:</b> March 2021</p>	<p>Dr. Ashwini Ranade, PI of the project presented the objectives, work plan and current status of the project. She presented some of the important results of the study. Committee members well appreciated the work on the effects of changes in global atmospheric thermal structure on general and monsoon circulations and extreme rain events across India during 1979-2018.</p>
<p>9.</p>	<p>Evaluation of the influence of low-frequency atmosphere-ocean oscillations on annual floods in the watersheds of the Indian subcontinent <b>Study Group:</b>  Sunil Gurrapu Ashwini Ranade J.P. Patra  <b>DOS:</b> Nov. 2018 <b>DOC:</b> March 2021</p>	<p>Sunil Gurrapu the PI of the study presented the progress of the study. The preliminary results indicated that the annual mean and annual (water year) peak streamflow in Godavari and Narmada rivers show a strong signal of low-frequency atmospheric-ocean oscillations including Pacific Decadal Oscillation (PDO) and El Niño-Southern Oscillation (ENSO). However, the study is still under progress and more detailed analysis is to be carried out. Dr. S.S. Grewal suggested that the expected outcomes should be directed towards the benefit of the society/ country and it should not be the publication of papers and reports alone. As suggested, the expected outcomes will be described in detail and explained how the same can be beneficial to the society/ country.</p>

10.	<p>Evaluation of water quality of Government schools in Roorkee block, District Haridwar</p> <p><b>Study Group:</b> N.K. Bhatnagar M.K. Sharma L.N. thakural Reena Rathore <b>DOS:</b> Oct. 2018 <b>DOC:</b> Sept. 2020</p>	<p>PI of the study Shri Neeraj Bhatnagar presented the study. He explained the details of data collected and the analysis carried out so far. Dr. Anil Gautam suggested coliform testing should be carried out. The Chairman suggested that this study and the study entitled, "Water Quality Assessment of Haridwar- PI: RK Nema Sc B" should be merged. The Chairman also suggested that spatial maps showing locations of the sampling sites should be included in the report of the study.</p>
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## WATER RESOURCES SYSTEMS DIVISION

### SUGGESTION/ COMMENTS RECEIVED FROM MEMBERS DURING 49<sup>th</sup> WORKING GROUP MEETING (04-05<sup>rd</sup> Nov, 2019)

Dr. Sanjay K Jain, Sc. G and Head, presented an overview of the division – scientific strength, the ongoing studies, sponsored & consultancy studies, technical publications and training courses organized. Thereafter scientists of the division presented their studies. Following are the comments received from working group members on the presentations of the various studies. The presentations were made first for the six NMSHE studies carried out in the division followed by Internal studies (Completed/Ongoing), sponsored studies and new proposed studies.

**PI: Dr. M. K. Goel (MKG), Scientist “G”**

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

MKG initiated the combined presentation on NMSHE sub-projects where-in six presentations for six sub-projects of NMSHE (in which Scientists of WRS Division are involved) were made.

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

Dr. M. K. Goel (MKG) presented the progress of the SP-1 sub-project of NMSHE project of DST. He presented the results of data processing, identification of outliers and double mass curves of some affected stations. It was informed that corrected and gap-filled hydro-meteorological data of various CWC and IMD stations has been provided to various other sub-project teams for application and modeling. He also presented the recent modifications in the project web site showing the data availability charts and the spatial data in real-time tab for visualization of users.

The members praised for the efforts of NIH in various NMSHE project progress. Sh. Ashok K. Das suggested that identified outliers in the rainfall data of IMD stations can be re-confirmed from the National Data Centre of IMD at Pune. He suggested that IMD issues forecasts of rainfall and such data request can be made to IMD for visualization in the project web site.

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

The study was presented by Mr D.S. Rathore. Mr Rathore informed that the study is extended to pan Himalaya. Post processing of MODIS 8-day snow extent maps was completed for four basins, namely Satluj, Yamuna, Upper Ganga and Subansiri. For Teesta, it is nearly complete and for other seven basins it will be taken up soon. Trends in mean snow cover for seasons, namely October- November, February-March and March- June were estimated. For Subansiri, mean snow in March- June could not be determined due to less cloud free scenes in the season. Trend was negative for in October- November was

negative for all basins except Yamuna. In February- March, trend is negative for Upper Ganga. Trend was positive in all basins in March- June. None of the trends were significant. Snow statistics for elevation zones (500 m) was also presented for Upper Ganga. Web applications were prepared for visualization of snow extent in Upper Ganga and Satluj basins. The applications display year-wise, month-wise and minimum/ maximum snow extent. Dr Shrimali expressed view that in the web application, snow area shall be displayed. Information on snow depth will also be useful. Dr S.P. Aggarwal said that though snow depth can be determined but it is not in the scope for the project. Mr Rathore agreed that the snow area will be displayed in the web application.

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

The study was briefly presented by Dr. Sanjay K Jain and informed that hydrodynamic modelling of vulnerable lakes is under progress. Dr. S P Agarwal asked about the criteria of identification of vulnerable lakes. Dr. Jain explained various criteria which have been looked into to identify the vulnerable lakes. Dr. Man Singh asked why all the criteria have not been applied. Dr. Jain informed that due to difficult terrain it is not possible to collect information from the field. He also said that due to this reason even volume/depth of the lake is also computed using empirical relationships. Dr. Grewal asked to include the Ravi basin also as the study area. Dr. Jain informed that he will explore the possibility of the same.

**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)**

No specific comments were received from members.

**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)**

No specific comments were received from members.

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

The study was briefly presented by Dr. P. K. Mishra and informed about the progress made since the last working group meetings. He discussed about the IPCC based Livelihood Vulnerability Index (LVI\_IPCC) assessment for the Rudraprayag district. Dr. S P Agarwal asked about the indicators considered in the vulnerability index estimation which is relative in nature. Dr. Mishra informed that a stake holders workshop was organised last year in Dehradun in which these indicators were discussed. The comments given by the experts were subsequently incorporated in village and household proforma prepared for the data collection through field visit. Dr. Shrimali suggested not to consider population in the contributing factor 'Exposure', and to follow the revised guidelines for vulnerability assessment. Dr. A. K. Lohani suggested that concept of fuzzy logic can be introduced to address vulnerability issue. The suggestion given by the experts were well taken.

**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 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 (COSMOS) has also been established at project site. Analysis and time series graphs of few of the meteorological, hydrological and lithological variable were presented. The results of the evapotranspiration (ET) estimated by Eddy-covariance (EC) flux tower were compared with the ET estimates by Penman-Monteith method. ET estimates by METRIC and SEBAL have also been estimated and compared with the FAO recommended Penman Monteith method. No specific comment was received.

**PI: Dr. P. K. Singh (PKS), Scientist “D”**

***1. Developments of Water Accounts for Subarnarekha Basin Using Water Accounting Plus (WA+) Framework (Ongoing)***

PKS presented the ongoing study on Developments of water account for Subarnarekha basin using WA+ Framework. He briefly discussed the importance and relevance of global data used in WA+ as input, before presenting the results on Sheet 4 and Sheet 6 on utilized flow and groundwater respectively. The presentation on WA+ was appreciated by all the experts. During discussion, it was instructed by the Director NIH to apply WA+ to the different basins of India and for successfully completion of this task, high configuration Computer Systems and One Research Associate may be taken under the study.

**PI: Dr. Vishal Kumar (VK), Scientist “C”**

***1. Real time flood modelling using HEC-RTS modelling framework (Ongoing)***

VK presented study on Real time flood modelling using HEC-RTS framework in Periyar river basin. He briefly presented the different components under HEC-RTS. He also shared the findings of flood modelling.

No specific comments were received from the members.

**PI: Deepa Chalisgaonkar, Scientist “G”**

***1. Development of window based software for Flood Estimation (Ongoing)***

Mrs. Deepa presented the study. She informed that the estimation of flood for small or large catchments is pre-requisite for the success of any water resource project. Overestimation of flood could result in construction of uneconomical while underestimation of floods could lead to failure of project. Keeping this in view a window based software is being developed which has number of modules.

She informed that the software will be capable of presenting the results in tabular as well as graphical form. It is expected that the field engineers will find this package useful. The working group noted the progress of the study.

**PI: Renoj J. Thayyen (RJT), Scientist “E”**

***1. Dynamics of Himalayan Ecosystem and its impact under changing climate scenario-Western Himalayas (Ongoing)***

RJT presented the progress of the study. Under this project, 43 air temperature/ Humidity (AT/RH) stations were installed along with five cross profiles covering Uttarakhand and H.P states such as 1) Dak Pathar – Rohru 2) Dak Pathar- Kharsali 3) Roorke- Jhala 4) Kotdwara – Phata 5) Kathgodam- Joshimath. 13 stand alone stations were installed in the Western Himalaya including Ladakh and Kashmir. During the reporting period, AT-RH sites in the Ladakh region was visited for data downloading. RJT discussed the distinction between the lapse rates of local valley-ridge stations compared to ridge to ridge and regional valley-ridge stations are also observed. The summer lapse rates of the monsoon regime range between 6.6 to 5.5 K/km while for Cold-arid regime it vary between 7.7 to 9.6 K/km. Highest SELR is observed for the station pair Pandrass and Gumri as well as kargi/ Gumri ranging between 11.1 to 13.5 K/km. Dr. S. P. Agarwal asked about the high lapse rate in the region which was clarified by RJT.

**PI: D. S. Rathore, Scientist “F”**

***1. Investigating water stress using hydro-meteorological and remote sensing data (Ongoing study under NHP-PDS)***

The progress of the study was presented by Mr D.S. Rathore. Mr Rathore informed that field visits were made for data collection. Reservoir, litholog and aquifer characteristics data were collected and water resources structures were visited. Request for hydrometeorological data was submitted to IMD. Rainfall data validation (outliers, homogeneity and double mass) was done and data were found to be consistent. Trend analysis for monthly and yearly data was done. No trend was observed except yearly data of Neem Ka Thana and June data of Amber, both have increasing trend. Standardized Precipitation Index (SPI)

was computed for 1- , 4- and 12-month time scales and from the SPI values drought magnitude and frequency were estimated.

Dr S.K. Jain suggested formulating water stress index as an outcome of the study. Dr S.P. Aggarwal has given some useful inputs, he explained about the meteorological and remotely sensed data based indices, time length of the remotely sensed data to be used and type of suitable remotely sensed data for indices. He informed that SPI and NDVI are meteorological and agriculture drought indices respectively. Further, comparing NDVI with long term average of NDVI (say for 15- 20 years) will be a useful indicator for agriculture drought than NDVI value itself. It was suggested that SAVI is a better index for crop stress conditions. Mr Rathore agreed and noted the suggestions.

**PI: Dr. M. Arora (MA), Scientist “D”**

***1. Modeling of Gangotri Glacier melt runoff and simulation of stream flow variation under different climate scenarios (Ongoing study)***

Dr Arora presented the progress of the study. He informed the house that the data collected for the ablation period of 2019 has been analyzed. The analysis of meteorological parameters was presented before the experts. He explained the difference in results obtained from SNOWMOD and HBV. The total volume of water from the glacier was very much in tune with the previous year values. A comparison is being made with the climate change impact on flows of Dunagiri glacier. The CORDEX outputs were used for studying the climate response and these outputs were altitude corrected.

**WORK PROGRAMME FOR THE YEAR 2019-2020**

SN	Title	Study Team	Duration	Funding (Rs. Lakhs)
<b>Completed Internal Studies</b>				
1	Development of window based software for hydrological data processing and Unit Hydrograph Analysis	D. Chalisgaonkar A. K. Lohani M. K. Goel	1 year (04/18-03/19)	
<b>Ongoing Internal Studies</b>				
1.	Hydrological process and characterization of Lesser Himalayan Catchments	M. K. Nema Sharad K. Jain Sanjay K. Jain Renoj J. Thayyen P. K. Mishra	5 years (12/14-12/19)	
2.	Developments of Water Accounts for Subarnarekha Basin Using Water Accounting Plus (WA+) Framework	P. K. Singh P. K. Mishra M. K. Goel Suman Gurjar	2 years 2018-2020	
3.	Real time flood modelling using HEC-RTS modelling framework	Vishal Kumar A. K. Lohani Sanjay K. Jain	2 years 2018-2020	
4.	Development of window based software for Flood Estimation	D. Chalisgaonkar A. K. Lohani	1 year (04/19-03/20)	



		M. K. Goel		
<b>Ongoing Sponsored Studies</b>				
1.	Mass and Energy balance of Phuche and Khardung glaciers, Ladakh range	Renoj J. Thayyen Farooq Azam P.G. Jose A.P. Dimri	3 years (03/16-02/19) Extended up to March 2020	SERB (65.14)
2.	Development of a project website and hydrological database in Upper Ganga Basin <b>(Sub-project – 1)</b>	M. K. Goel M. Arora; A. K. Lohani D. S. Rathore; D. Chalishaonkar; A. R. S. Kumar; S. Singh; P. Mani; A. Sarkar; M. K. Nema; P. K. Mishra	5 years (01/16-12/20)	DST (52.15)
3.	Real-time snow cover information system for Upper Ganga basin <b>(Sub-project – 2)</b>	D. S. Rathore D. Chalishaonkar V. S. Jeyakanthan L. N. Thakural	5 years (01/16-12/20)	DST (48.83)
4.	Glacial Lakes & Glacial Lake Outburst Flood (GLOF) in Western Himalayan Region <b>(Sub-project – 3)</b>	Sanjay K. Jain A. K. Lohani Sudhir Kumar P. Thakur (IIRS)	5 years (01/16-12/20)	DST (36.79)
5.	Assessment of downstream impact of Gangotri glacier system at Dabrani and future runoff variations under climate change scenarios <b>(Sub-project – 4)</b>	Renoj J. Thayyen Sanjay K. Jain Sharad K. Jain P. K. Mishra M. Arora AP Dimri (JNU)	5 years (01/16-12/20)	DST 51.43 (NIH) + 28.29 (JNU)
6.	Observation and modelling of various hydrological processes in a small watershed in Upper Ganga basin <b>(Sub-project – 5)</b>	Sharad K. Jain Renoj J. Thayyen Sanjay K. Jain Surjeet Singh M. K. Nema; P. K. Mishra; P. K. Agarwal AP Dimri (JNU)	5 years (01/16-12/20)	DST (54.07)
7.	Water Census and Hotspot analysis in selected villages in Upper Ganga basin <b>(Sub-project – 11)</b>	P. K. Mishra M. K. Nema Renoj J. Thayyen P. Kumar	5 years (01/16-12/20)	DST (90.99)
8.	Dynamics of Himalayan Ecosystem and its impact under changing climate scenario-Western Himalaya	Renoj J. Thayyen P. K. Mishra	3 years (03/17-03/19) Extended up to March 2020	NMHS- MoEF (58.76 lakh)
9.	Measurements and Modeling of	M K Nema	3 years	MOES

	Evapotranspiration and other Hydrological Processes in Lesser Himalayas	Renoj J. Thayyen Sharad K. Jain Sanjay K. Jain P. K. Mishra AP Dimri (JNU)	(2016-19) Extended up to December 2020	(Rs. 98 Lakh)
10.	Sustaining Himalayan Water Resources in a Changing Climate (SusHi-Wat)	Sanjay K. Jain (PI) Sharad K. Jain CSP Ojha (PI, IITR)	3 years (2016-2020)	MOES- NERC, Newton - Bhabha project (11.59 Lakh)
11.	Investigating Water Stress using Hydro-meteorological and Remote Sensing data	D. S. Rathore L. N. Thakural Sanjay Kumar B. Venkatesh M. K. Jose T. Chandramohan	3 years 2017-2020	PDS under NHP (50.23 Lakh)
12.	Seasonal Characterization of Gangotri Glacier melt runoff and simulation of streamflow variation under different climate scenarios	M. Arora Sanjay K. Jain	3 years 2018-2021	NIH/ DST
<b>New Internal/ Sponsored Studies</b>				
1.	Snow and glacier contribution and impact of climate change in Teesta river basin in Eastern Himalaya	Sanjay K. Jain P. K. Singh M. Arora Renoj J. Thayyen A. K. Lohani Vishal Kumar Suman Gurjar	3 years (11/19-11/22)	NMHS- MoEF (143 Lakh)
2	Assessment of seasonal variations in Hydrology and Cryosphere of upper Ganga Basin	Renoj J. Thayyen A. P. Dimri (JNU) Sanjay K. Jain	3 years (11/19-11/22)	NRDM S-DST (46.39 Lakh)
3	Permafrost mapping and characterisation of Ladakh Region	Renoj J. Thayyen A. P. Dimri (JNU) G. Jeelani (KU) V. Agnihotri (GBPNI)	3 years (11/19-11/22)	NMHS- MoEF (197 Lakh)

**RESEARCH MANAGEMENT AND OUTREACH DIVISION (RMOD)**

SN	Title of Project/Study, Study Team	Status and Recommendations/Suggestions
1.	<p><b>Study on effect of climate change on sediment yield to Pong reservoir.</b>  <b>Team:</b> A. R. Senthil kumar, J. V. Tyagi, S. D. Khobragade and Manohar Arora            DOS: Apr 2015, DOC: June 2019</p>	<p>The methodology and final results of the study were presented by Dr A. R. Senthil kumar (PI). There were no specific comments from the working group members.</p>
2.	<p><b>Conservation of ponds in Ibrahimpur- Masahi Village and performance evaluation of natural treatment system</b>   <b>Team:</b> Omkar Singh, V C Goyal, Rajesh Singh, Digambar Singh, Subhash Kichlu, Rajesh Agarwal, Rakesh Goel &amp; N R Allaka  <b>Partner Organization:</b> Prof. Laurence Carvalho &amp; Team, Centre for Ecology &amp; Hydrology (United Kingdom).            DOS: Apr 2018, DOC: March 2020</p>	<p>Sh. Omkar Singh (PI) informed that regular water and wastewater sampling is continued from both ponds (CW-NTS pond at Ibrahimpur Masahi and control pond at Masahi Kala). The CEH-UK team also periodically visited the ponds for collecting samples of pond water, wastewater and specific parameters (methane, planktons, etc.). The data related to water quality as observed by NIH has been compiled. The results from CEH-UK will be provided during their forthcoming visit in Dec 2019.</p>
3.	<p><b>Bathymetric survey of identified ponds in the districts of Muzaffarnagar, Meerut, Ghaziabad and Baghpat (UP) for development of water management plan</b>  <b>Team:</b> Digambar Singh (PI), Omkar Singh, Rohit Sampatrao Sambare, N R Allaka            DOS: Apr 2018-Mar 2020</p>	<p>This study was not presented in the meeting.</p>
4.	<p><b>Hydrological modelling in Bhagirathi basin up to Tehri dam and assessment of climate change impact</b>  <b>Team:</b> A R Senthil kumar, J. V. Tyagi, M. K. Goel, S. D. Khobragade, P. C. Nayak, Manohar Arora and Digambar Singh            DOS: July 2016, DOC: June 2021 (NMSHE)</p>	<p>The methodology and present status of the study were presented by Dr. A. R. Senthil kumar (PI). There were no specific comments from the working group members.</p>
5.	<p><b>Development of water allocation plan of watershed in Kanker district, Chhattisgarh</b>  <b>Team:</b> A. R. Senthil kumar, Jyoti P Patil, T R Nayak and Rajesh Agarwal            DOS: Apr 2018, DOC: March 2020</p>	<p>This study was not presented in the meeting.</p>
6.	<p><b>Vulnerability Assessment to Climate Change in Chhattisgarh</b>  <b>Team:</b> Dr Jyoti P Patil and Ms Meeta Gupta, JRF            DOS: July 2017, DOC: June 2019</p>	<p>This study is completed and final report was submitted by the PI.</p>
7.	<p><b>Rejuvenation of village ponds for identified villages in Muzaffarnagar and Meerut districts</b>   <b>Investigators:</b> V C Goyal, Omkar Singh, Rajesh Singh, Digambar Singh</p>	<p>The overview of the project was given by Dr. V. C. Goyal (PI). The technical progress of the study was presented by Er. Omkar Singh, Sc. F. The final status regarding civil work of pond rejuvenation work carried out through NPCC was presented. The progress on field</p>

	<p><b>Scientific/Technical Staff:</b> Subhash Kichlu, Rajesh Agarwal, Rakesh Goel, N. R. Allaka, N. G. Shrivastava, Nihal Singh, Kalzang Mathus, Sandeep Yadav, Subhash Vyas</p> <p>DOS: April 2017, DOC: March 2020 DoWR, RD &amp; GR (MoJS, GoI)-Through INCSW</p>	<p>investigations related to WQ, WW and sludge/soil properties, etc. were presented in the meeting. There were no specific comments from working group members. Prof. S.S. Grewal (PAU, Ludhiana) appreciated pond rejuvenation efforts of NIH and desired to extend the works in other states, if feasible (viz. Punjab).</p>
8.	<p><b>Rejuvenation of Village Ponds in Identified Villages of Baghpat, Ghaziabad and Meerut Districts of Uttar Pradesh</b> <b>Investigators:</b> Omkar Singh, Rajesh Singh, V. C. Goyal, Digambar Singh <b>Scientific/Technical Staff:</b> Subhash Kichlu, Rajesh Agarwal, Rakesh Goel, N. R. Allaka, N. G. Shrivastava, Nihal Singh, Kalzang Mathus, Sandeep Yadav, Subhash Vyas DOS: Jan. 2018, DOC: Dec. 2020 DoWR, RD &amp; GR (MoJS, GoI)-Through Plan</p>	<p>The overview of the project was given by Dr. V. C. Goyal. The technical progress of the study was presented by Er. Omkar Singh (PI). The final status regarding civil work of pond rejuvenation work carried out through NPCC was presented. The progress on field investigations related to WQ, WW and sludge/soil properties, etc. were presented in the meeting. There were no specific comments from working group members.</p>
9.	<p><b>Innovation Centre for Eco-Prudent Wastewater Solutions (IC-EcoWS)</b> DST (GoI), Cost: Rs. 5.1 Crore V.C. Goyal (PI), Omkar Singh, Rajesh Singh, Jyoti P. Patil, Rohit Sampatrao Sambare <b>Partners:</b> NIH, MNIT-Jaipur, IIT-Bombay, IRMA-Ahmedabad DOS: Apr 2019-Mar 2024</p>	<p>The overview of the project was given by Dr. V. C. Goyal (PI). The PI informed that the Institute has organised an “Inception cum Need Assessment Workshop for the project” during 8-9 August 2019 at NIH Roorkee. The PI further informed that procurement of equipment has also been initiated.</p>

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.

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**ANNEXURE-I**

**List of Working Group Members who attended the 49<sup>th</sup> WG meeting**

1.	Dr. S.K. Jain, Director, NIH	Chairman
2.	Dr. A K Das, IMD, New Delhi	Member
3.	Er. S S Shrimali, ICAR-IISWC, Dehradun	Member
4.	Dr. D P Dobhal, WADIA, Dehradun	Member
5.	Dr. S P Aggarwal, IIRS, Dehradun	Member
6.	Sh. Man Singh, WTC, ICAR-IARI, New Delhi	Member
7.	Dr. Bhishm Kumar, IAEA (Retd.), Roorkee	Member
8.	Dr. S S Grewal, Chandigarh	Member
9.	Dr. Sadhana Malhotra, Mindspace, Dehradun	Member
10.	Dr. Anil Guatam, PSI, Dehradun	Member
11.	Dr. Rakesh Kumar, Sc. G & Head SWH Division, NIH	Member
12.	Dr. J V Tyagi, Sc.G & Head EH Division, NIH	Member
13.	Dr. Sudhir Kumar, Sc. G & Head HI Division, NIH	Member
14.	Dr. Sanjay K. Jain, Sc. G & Head WRS Division, NIH	Member
15.	Dr. V C Goyal, Sc. G & Head, RMO Division, NIH	Member-Secretary

**Scientists from NIH**

	<b>EH Division</b>		<b>SWH Division</b>
1	Dr. M.K. Sharma, Sc.D	18	Dr. A.K. Lohani, Sc.G
2	Dr. Rajesh Singh, Sc.C	19	Dr. R.P. Pandey, Sc.G
3	Dr. Pradeep Kumar, Sc.C	20	Dr. Sanjay Kumar, Sc.E
4	Sh. Rajesh K. Nema, Sc.B	21	Dr. Archana Sarkar, Sc.D
5	Ms. Anjali, Sc.B	22	Dr. L.N. Thakural, Sc.C
	<b>GWH Division</b>	23	Sh. J.P. Patra, Sc.C
6	Dr. Anupama Sharma, Sc.E	24	Dr. Ashwini A. Ranade, Sc.C
7	Dr. Surjeet Singh, Sc.E	25	Sh. Sunil Gurrapu, Sc.C
8	Mrs. Suman Gurjar, Sc.C	26	Sh. N K Bhatnagar, Sc.B
9	Dr. Gopal Krishan, Sc.C		<b>WRS Division</b>
10	Sh. Nitesh Patidar, Sc.B	27	Dr. M.K. Goel, Sc.G
	<b>HI Division</b>	28	Smt. Deepa Chalisgaonkar, Sc. G
11	Dr. M.S. Rao, Sc.E	29	Er. D.S. Rathore, Sc.F
12	Dr. Santosh M Pingale, Sc.C	30	Dr. Renoj J. Thayyen, Sc.E
13	Sh. Hukam Singh, Sc.B	31	Dr. Manohar Arora, Sc.D
	<b>RMO Division</b>	32	Dr. P K Singh, Sc.D
14	Er. Omkar Singh, Sc.F	33	Er. Manish Nema, Sc.C
15	Dr. A R Senthil Kumar, Sc.F	34	Dr. P K Mishra, Sc.C
16	Sh. Digamber Singh, Sc.C	35	Dr. Vishal Singh, Sc.C
17	Sh. Rohit S. Sambare, Sc.B	36	Sh. P K Agarwal, Sc.B