

**MINUTES OF THE
40TH MEETING OF WORKING GROUP OF NIH
HELD AT NIH, ROORKEE, DURING JUNE 4-5, 2014**

The 40th meeting of the Working Group of NIH was held at NIH, Roorkee, during June 4-5, 2014 under the Chairmanship of Director, NIH. The list of the participants of the meeting is given in Annexure-I.

ITEM NO. 40.1: OPENING REMARKS BY THE CHAIRMAN

Er. R D Singh, Director, NIH & Chairman, WG welcomed the Working Group members and the Scientists of the Institute. The Chairman mentioned the monthly monitoring of milestones/deliverables by the Ministry of Water Resources, and suggested that the scientists should prepare the internally-funded studies in the same format as of the sponsored projects (including the provision of budget under defined heads).

The Chairman then asked Dr. Sudhir Kumar, Member-Secretary for the meeting to take up the agenda of the meeting.

ITEM No. 40.2: CONFIRMATION OF THE MINUTES OF 39TH MEETING OF THE WORKING GROUP

The 39th meeting of the Working group was held during October 21-22, 2013. The minutes of the meeting were circulated to all the members and invitees vide letter No. RMOD/39th WG/NIH/13 dated Dec, 26, 2013. As no comments were received on the circulated minutes, the minutes were confirmed.

ITEM No. 40.3: ACTION TAKEN ON THE DECISIONS/RECOMMENDATIONS OF THE PREVIOUS WORKING GROUP MEETING

Dr. Sudhir Kumar, Scientist G, gave a brief account of the actions taken on the recommendations/decisions of the 39th working group meeting.

ITEM No. 40.4: PRESENTATION AND DISCUSSION ON THE STATUS AND PROGRESS OF THE WORK PROGRAMME FOR THE YEAR 2013-14.

The Member-Secretary requested the respective Divisional Heads to present the progress of studies carried out during 2013-14 and the proposed work programme for the year 2014-15. Accordingly, the progress of various studies and sponsored projects was presented by all Scientific Divisions on their turn during two day deliberations of the Working Group. The Division wise minutes of each study/project presented during the meeting are given below:

ENVIRONMENTAL HYDROLOGY DIVISION
Work Programme 2013-14

| S.No. | Project Study | Recommendation/Suggestion |
|--------------|--|--|
| 1. | <p>Assessment of Water Quality in Hindon River Basin.</p> <p>Study Group: M. K. Sharma (PI), Omkar Singh, Rakesh Goyal & Dayanand</p> <p>DOS: 11/2011, DOC: 10/2014</p> | <p>Dr. S. K. Mittal appreciated the study and suggested to send the findings of the study to the concerned department so that common public should be aware of the water quality of their concerned area.</p> |
| 2. | <p>Development of Low Cost Media for Fluoride Removal from Drinking Water of Fluoride Affected Areas</p> <p>Study Group: Rajesh Singh (PI) & Dayanand</p> <p>DOS: 04/2011, DOC: 03/2014</p> | <p>No comments.</p> |
| 3. | <p>Applications of Nanotechnology in Water Sector</p> <p>Study Group: C. K. Jain (PI), Dinesh Mohan (JNU) & Babita Sharma</p> <p>DOS: 04/2013, DOC: 03/2014)</p> | <p>No comments.</p> |
| 4. | <p>Ground Water Quality Mapping and Surveillance for Safe Water Supply in District Hardwar and Dehradun, Uttarakhand</p> <p>Study Group: C. K. Jain (PI), Rama Mehta, S. K. Sharma, Yatveer Singh & Babita Sharma</p> <p>DOS: 04/2013, DOC: 03/2014</p> | <p>No comments.</p> |
| 5. | <p>Water Quality Modelling using Soft Computing Techniques</p> <p>Study Group: Rama Mehta (PI), C. K. Jain & Anju Choudhary</p> <p>DOS: 04/2013; DOC: 03/2014</p> | <p>Study was appreciated by members. Director, NIH and Dr. N.B.N Prasad suggested that the developed models should be validated with latest data of water quality parameters and GIS can be used to present WQI for each sample.</p> |
| 6. | <p>State-of-the-art Report on Water Quality Modelling for Each Major River and Aquifer</p> <p>Study Group: N. C. Ghosh (PI) & M. K. Sharma</p> <p>DOS: 04/2013, DOC: 09/2013</p> | <p>No comment.</p> |

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| 7. | Environmental Flow Assessment of Hemavathi River in Karnataka Study Group: D. G. Durbude (PI) & C. K. Jain DOS: 04/2013, DOC: 03/2015 | No comments. |
| 8. | Ionic Enrichment Dynamics of Glacial Sediment and Melt water of Gangotri Glacier Study Group: M. K. Sharma (PI), C. K. Jain, Renoj Thayyan, Manohar Arora, Naresh Kumar, Jatin Malhotra, Rakesh Goyal & Dayanand DOS: 11/2013, DOC: 10/2016 | Dr. M. K. Sharma informed that the study has been sponsored by DST and all the activities of the study will be continued under DST project. Dr. Ghosh appreciated the study and emphasised that the study will be a great contribution by NIH. |

Approved Work Programme for the Year 2014-15

| S.No. | Study | Study Team | Duration |
|---------------------------|---|---|--|
| Internal Studies | | | |
| 1. | Water Quality Modelling using Soft Computing Techniques (Najafgarh, Mehrauli, City and Shahadara Blocks of NCR Delhi) | Rama Mehta (PI) C. K. Jain Anju Cjoudhary | 2 Year (04/14-03/16) |
| 2. | Environmental Flow Assessment of Hemavathi River in Karnataka | D. G. Durbude (PI) C. K. Jain | 2 Years (04/13-03/15) |
| 3. | Himalayan River Water Quality Assessment in a Stretch from Gangotri to Haridwar | Rajesh Singh (PI) C. K. Jain D. G. Durbude M. K. Sharma S. P. Rai Renoj J. Thayyan J. P. Patra | 3 Years (06/14-03/17) |
| Sponsored Projects | | | |
| 1. | Ionic Enrichment Dynamics of Glacial Sediment and Melt water of Gangotri Glacier | M. K. Sharma (PI) C. K. Jain Renoj Thayyan Manohar Arora Naresh Saini Jatin Malhotra Rakesh Goyal | 3 Years (04/14-03/17) DST Sponsored. |
| 2. | Low Cost Technology for Purification of Arsenic and Microbes Contaminated Water using Nanotechnology | Vijaya Aggarwala, IITR (PI) Rama Mehta, NIH (Co-PI) | 2 Years (04/14-03/16) DST Sponsored. |

GROUND WATER HYDROLOGY DIVISION

Dr. N.C. Ghosh, Scientist-G and Head of the division presented an overview of studies and activities carried out by the Division during the period October – May, 2014. While presenting the technical activities carried out and progress made on different studies during last six months, he gave an account of scientific personnel available at the division and the consultancy projects pursued by the division. He informed that out of 6 R&D studies approved for the year 2013-14, two are in house studies, of which one study has been completed and for other one extension has been sought next six months, and 4 are sponsored studies, of which one study has been completed, one study will continue as its second phase, and other two studies will be completed as per the study timeline. Dr. Ghosh informed the Working Group members that the division faces acute shortage of scientific personnel to meet increasing R & D demands of various sectors.

The division has organized two training courses and one Indo-German Bilateral Workshop. These are: “Application of RS & GIS for Groundwater Modelling & Management” sponsored by GWD of Govt. of Rajasthan during 10-21 February, 2014, “Coastal Groundwater Development, Modeling and Management”, under HP-II (PDS) during 3-7 March, 2014, and “Indo-German Bilateral Workshop on Science Based Master Planning for Bank Filtration in India”, sponsored by Indo-German Science & Technology Centre (IGSTC), during 7-11 April, 2014 at Dresden, Germany organized jointly by NIH & HTWD, Germany. As professional scientific activities, scientists of the Division have published 15 research papers in various journals/conferences/symposia, delivered 32 lectures in various training courses and guided 08 ME/M.Tech and 07 summer trainees during the period.

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

Project Ref. Code: NIH/GWD/NIH/13-14: Estimation of specific yield and storage coefficient of aquifers

Dr. Surjeet Singh (PI) presented the progress of the study and various methods for the estimation of specific yield and storage coefficient. Dr. N. C. Ghosh explained the importance of precise estimation of specific yield and storage coefficient in estimation of groundwater resources. The PI also presented merits and demerits of various methods and techniques, their data requirements and a qualitative assessment on suitability of methods. The PI showed a calculation tool through spreadsheet for the estimation of specific yield and informed that the comparison of various techniques can be done using this tool, once the collection and processing of data are ready. The PI requested for an extension of six months to complete this study because of delay in the data collection. The Working Group members agreed with the extension of six months.

Project Ref. Code: NIH/GWD/NIH/13-14: State-of-the-Art Report on Modeling of Coastal Aquifers Vulnerable to Sea Water Ingress.

The preparation of the state-of-the-art report suggested by the Ministry of Water Resources (MoWR) has been completed. A base paper has been prepared and submitted to MoWR. WG suggested publication of metadata of the report through NIH’s website.

Project Ref. Code: NIH/GWD/HP-II/10-12: Coastal Groundwater Dynamics and Management in the Saurashtra Region, Gujarat.

Dr. Anupma Sharma informed that the R & D project under HP-II (PDS) has been completed and the draft final report has been submitted to the HP-II wing of MoWR.

Dr. Sharma gave a detailed presentation on the outcome of the study including findings and recommendations. In her presentation, impact of the low rainfall in 2012 and the above average rainfall in 2013 on the water table, groundwater salinity and cropping pattern was highlighted. Hydrogeochemical analysis of the mixing of freshwater-saltwater in different seasons was explained using piper trilinear diagrams, and various indices and scatter plots. Analyses from stable isotope investigations were explained in respect of the mixing zone and groundwater recharge zones. Details pertaining to construction of fence diagram, development of conceptual model and numerical modeling exercises were presented. The problem of recurring droughts and groundwater salinity were highlighted and the conservation measures taken up by the State Government were presented. The impact of these schemes on water availability and quality was discussed using the information compiled from the socioeconomic surveys carried out in the region. Dr. Prasad and Dr. Niladri Naha enquired about the freshwater hydraulic gradient and the length of the sea coast taken up for investigation. Discussions were also held about the groundwater salinity and geological formations in the region. It was stated that long term regular monitoring needs to be taken up to check adverse impact of excessive groundwater withdrawals on groundwater quality. Members suggested that a separate presentation on the outcome of the study can be organized.

Project Ref. Code: NIH/GWD/NIH/11-14: Managed Aquifer Recharge (MAR) and Aquifer Storage Recovery (ASR)

Dr. N. C. Ghosh presented the progress of the study. He informed that, the study as per requirement of the 'Saph Pani' project has been completed and the draft report has been submitted. Dr. Ghosh gave a brief presentation on the analysis of various components conceived in the study and on the findings. The findings included, development of semi-analytical models to estimate unsteady: (i) depth of water and (ii) groundwater recharge in/from a large water body consequent to the variable inflows and outflows acting on it, very less prevailing groundwater recharge from the Taliabandha lake in Raipur city due to the presence shale and sandstone layer beneath the lakebed, and MAR-ASTR by any engineered scheme is not feasible because the aquifer formation has massive limestone. To work out alternate plan for urban storm water and wastewater management, Dr. Ghosh requested for continue the study as its second phase. WG agreed with the proposal of the division.

Project Ref. Code: EU-sponsored Project no. 282911 : Flow and Contaminant Transport Modeling of Riverbank Filtration.

Divisional Head had informed that the PI of the study, Ms. Shashi Poonam Indwar, Sc.-B is on long leave on health ground; therefore, not much progress on the study has been made. He conveyed, the study will continue and will be taken up by the PI on her joining

The work programme of the division for the year 2014-15, as recommended by the Working Group, is given at annexure-I.

Annexure-I

**WORK PROGRAMME OF GROUND WATER HYDROLOGY DIVISION
FOR THE YEAR 2014-15**

| S. No. & Reference Code | Project | Project Team | Duration & Status | Funding Source |
|---|--|--|---|--|
| 1. NIH/GWD/N IH/13-14 | Estimation of specific yield and storage coefficient of aquifers | Surjeet Singh (PI) N.C. Ghosh (Co-PI) Sumant Kumar | 1 year (04/13 – 10/14) Status: Continuing, & extended for six months. | NIH |
| Sponsored | | | | |
| 2. EU- sponsored Project no. 282911 | Saph Pani - Enhancement of natural water systems and treatment methods for safe and sustainable water supply in India” | Project Coordinator & P.I. : N. C. Ghosh Other Team Members V. C. Goyal, C. K. Jain, Sudhir Kumar, B. Chakravorty, A. K. Lohani Anupma Sharma, Surjeet Singh, Sumant Kumar Shashi Poonam Indwar | 36 months (Oct., 2011- Sept.,2014) Status: Continuing & expected to be completed by 30 th September, 2014. | European Union under 7 th - Framework Programme |
| 3. NIH/GWD/N IH/11-14 | Management of Aquifer Recharge (MAR) and Aquifer Storage Recovery (ASR) | Sumant Kumar (PI) Rajan Vatsa, N.C. Ghosh, C.P. Kumar, Surjeet Singh, Sanjay Mittal | 3 years (04/11 – 03/15) Status: Second phase will Continue | Saph Pani Project, after Sept., 2014 NIH's internal funding. |
| 4. EU- sponsored Project no. 282911 | Flow and Contaminant Transport Modeling of Riverbank Filtration | Shashi Poonam Indwar (PI), N.C. Ghosh, Anupma Sharma, Rajan Vatsa, Sanjay Mittal | 2 ½ years (04/12 – 09/14) Status: Continuing | Saph Pani Project, after Sept., 2014 NIH's internal funding. |

HYDROLOGICAL INVESTIGATIONS DIVISION

| S. No | Title of Study/Project, Study Team, Date of Start (DOS) and Date of Completion (DOC) | Status and Recommendations/Suggestions |
|-------------------------|---|--|
| INTERNAL STUDIES | | |
| 1. | <p>Assessment of Sensitivity of Open Water Evaporation to Increase in Temperature for Different Climatic Regions of India</p> <p>S. D. Khobragade (PI), C. P. Kumar, Manohar Arora, A. R. Senthil Kumar</p> <p>DOS: 04/2012, DOC: 03/2014</p> | <p style="text-align: center;">Status: Completed</p> <p style="text-align: center;">There were no specific suggestions.</p> |
| 2. | <p>Water Quality, Hydrogeology and Isotopic Investigations in SW Punjab</p> <p>M. S. Rao (PI), C. P. Kumar, Gopal Krishan</p> <p>DOS: 07/2012, DOC: 06/2014 (extended upto 06/15)</p> | <p style="text-align: center;">Status: On-going Study</p> <p>The Working Group agreed to extend the study by one year, as requested by PI.</p> |
| 3. | <p>Water Availability Studies for Sukhna Lake, Chandigarh</p> <p>S. D. Khobragade (PI), C. P. Kumar, Sudhir Kumar, A. R. Senthil Kumar, P. K. Garg, V. K. Agarwal</p> <p>DOS: 04/2013, DOC: 03/2015</p> | <p style="text-align: center;">Status: On-going Study</p> <p style="text-align: center;">There were no specific suggestions.</p> |
| 4. | <p>Isotope Studies for the Identification of Different Aquifer Groups and their Dynamics in Upper Yamuna River Plains</p> <p>Sudhir Kumar (PI), C. K. Jain, S. P. Rai, S. D. Khobragade, P. K. Garg, B. C. Joshi, Tejdeep Singh</p> <p>DOS: 07/2013, DOC: 06/2015</p> | <p style="text-align: center;">Status: On-going Study</p> <p>No specific comments. PI was asked to publish the findings at the earliest.</p> |
| 5. | <p>Estimation of Radon Concentration in Waters and Identification of Paleo-groundwater in Part of Punjab Located in Satluj River Basin using Isotopes</p> <p>S. K. Verma (PI), S. P. Rai (Co-PI), M. S. Rao, C. P. Kumar, Mohar Singh</p> <p>DOS: 10/2013, DOC: 09/2015</p> | <p style="text-align: center;">Status: On-going Study</p> <p style="text-align: center;">There were no specific suggestions.</p> |

| S. No | Title of Study/Project, Study Team, Date of Start (DOS) and Date of Completion (DOC) | Status and Recommendations/Suggestions |
|---------------------------|--|--|
| 6. | <p>Sub-marine Groundwater Discharge and Sea-water Intrusion in Coastal Aquifers of East Coast, India</p> <p>M. S. Rao (PI)</p> <p>DOS: 06/2014, DOC: 05/2016</p> | <p>New Study</p> <p><i>Comment:</i> The Working Group appreciated the efforts of NIH in taking up Radon measurements based technology to map submarine groundwater discharge and seawater intrusion.</p> <p><i>Suggestions:</i> Although the project submitted is very ambitious but not workable in the present submitted form due to (i) the collaborative partners not yet finalized, (ii) major funding required to accomplish the objectives, and (iii) time lines not fixed. It was therefore suggested to prepare the project document after conducting a brain storming session and then to submit the project to DST for funding. Till it gets approved by DST, this may be taken up as a pilot project using NIH funds for a limited time and limited coast length. For the pilot project, the title may be modified and re-submitted.</p> |
| 7. | <p>Monitoring Isotopes in Air Moisture in Parts of Himalayas (Himachal Pradesh & Uttarakhand) for investigating the Cloud Condensation</p> <p>M. S. Rao (PI), C. P. Kumar, Gopal Krishan</p> <p>DOS: 06/2014, DOC: 05/2016</p> | <p>New Study</p> <p>There were no specific suggestions.</p> |
| SPONSORED PROJECTS | | |
| 8. | <p>National Program on Isotope Fingerprinting of Waters of India (IWIN)</p> <p>M. S. Rao (PI), Sudhir Kumar, S. P. Rai, S. K. Verma, P. K. Garg, Gopal Krishan</p> <p>DOS: 07/2007, DOC: 12/2013</p> | <p>Status: Completed</p> <p>There were no specific suggestions.</p> |

| S. No. | Title of Study/Project, Study Team, Date of Start (DOS) and Date of Completion (DOC) | Status and Recommendations/Suggestions |
|--------|--|--|
| 9. | <p>Groundwater Dynamics of Bist-Doab Area, Punjab using Isotopes</p> <p>M. S. Rao (PI), Sudhir Kumar, S. K. Verma, P. K. Garg, Gopal Krishan, CGWB Officials</p> <p>DOS: 10/2008, DOC: 03/2014</p> | <p>Status: Completed</p> <p>There were no specific suggestions.</p> |
| 10. | <p>Groundwater Management in Over-Exploited Blocks of Chitradurga and Tumkur Districts of Karnataka</p> <p>Sudhir Kumar (PI), J. V. Tyagi, S. P. Rai, Anupma Sharma, B. K. Purandara, C. Rangaraj</p> <p>DOS: 10/2008, DOC: 03/2014</p> | <p>Status: Completed</p> <p>There were no specific suggestions.</p> |
| 11. | <p>The Use of Environmental Isotopes to Assess Sustainability of Intensively Exploited Aquifer Systems in North Eastern Parts of Punjab, India</p> <p>M. S. Rao (PI), C. P. Kumar, S. P. Rai</p> <p>DOS: 09/2012, DOC: 08/2015</p> | <p>Status: On-going Study</p> <p>There were no specific suggestions.</p> |
| 12. | <p>The Structure and Dynamics of Groundwater Systems in Northwestern India under Past, Present and Future Climates</p> <p>S. P. Rai (PI), M. S. Rao, Surjeet Singh, S. K. Verma, C. P. Kumar, Sudhir Kumar, V. K. Agarwal, Rajeev Gupta, S. L. Srivastava, Vishal Gupta, Mohar Singh</p> <p>DOS: 06/2012, DOC: 05/2015</p> | <p>Status: On-going Study</p> <p>There were no specific suggestions.</p> |
| 13. | <p>Review of Groundwater Resources in the Indo-Gangetic Basin: A Case Study on Resilience of Groundwater in the Punjab to Withdrawal and Environmental Change</p> <p>M. S. Rao (PI), C. P. Kumar, Gopal Krishan</p> <p>DOS: 02/2013, DOC: 09/2014</p> | <p>Status: On-going Study</p> <p>There were no specific suggestions.</p> |

| S. No. | Title of Study/Project, Study Team, Date of Start (DOS) and Date of Completion (DOC) | Status and Recommendations/Suggestions |
|-----------------------------|---|--|
| 14. | <p>Assessment of Baseflow and its Impact on Water Quality in the Part of Satluj River in India using Environmental Isotopes and Age Dating Techniques</p> <p>S. P. Rai (PI), R. V. Kale, M. S. Rao, C. P. Kumar, Sudhir Kumar, V. K. Agarwal, Vishal Gupta, Mohar Singh</p> <p>DOS: 10/2012, DOC: 09/2015</p> | <p>Status: On-going Study</p> <p>There were no specific suggestions.</p> |
| 15. | <p>Integration of Isotope Hydrology in Aquifer Mapping Efforts in India: A Pilot Study of Upper Yamuna Plains</p> <p>Sudhir Kumar (PI), S. P. Rai, S. D. Khobragade, C. K. Jain, P. K. Garg</p> <p>DOS: 05/2013, DOC: 04/2015</p> | <p>Status: On-going Study</p> <p>No specific comments. PI was asked to publish the findings at the earliest.</p> |
| CONSULTANCY PROJECTS | | |
| 16. | <p>Integrated Hydrological Investigations of Sukhna Lake, Chandigarh for its Conservation and Management</p> <p>S. D. Khobragade (PI), C. P. Kumar, R. D. Singh, S. P. Rai, C. K. Jain, V. K. Agarwal</p> <p>DOS: 07/2011, DOC: 06/2013</p> | <p>Status: Project completed</p> |
| 17. | <p>Pre-dredging and Post-dredging Bathymetric Survey of Ramgarh Tal Lake, Gorakhpur, UP</p> <p>S. D. Khobragade (PI), C. P. Kumar, R. D. Singh, V. K. Agarwal</p> <p>DOS: 11/2012, DOC: 04/2013 (Pre-dredging)</p> | <p>Status: Pre-dredging part of Project completed</p> |
| | | |

| S. No. | Title of Study/Project, Study Team, Date of Start (DOS) and Date of Completion (DOC) | Status and Recommendations/Suggestions |
|--------|---|--|
| 18. | Assessment of Impact of Coal Mining from Mahan Coal Block on Groundwater Recharge and Sedimentation in Rihand Reservoir and to Suggest Appropriate Measures to Mitigate the Identified Impacts Sudhir Kumar (PI), Sanjay Kumar Jain, J. V. Tyagi, Surjeet Singh, S. D. Khobragade, R. K. Jaiswal, P. K. Garg DOS: 04/2013, DOC: 09/2013 | Status: Project completed |
| 19. | Hydrogeological Study for Dewatering of Jhamarkotra Mines, Distt. Udaipur Sudhir Kumar (PI) DOS: 05/2013, DOC: 04/2016 | Status: On-going Project |
| 20. | Impact Assessment of Ash Pond on the Groundwater Quality in the Surrounding Villages of NTPC Simhadri through Stable Isotopic Studies Sudhir Kumar (PI) DOS: 07/2013, DOC: 06/2014 | Status: On-going Project |
| 21. | Identification of Source and Locations of Leakage/Seepage from Kaushalya Dam, Haryana S. P. Rai (PI) DOS: 08/2013, DOC: 01/2014 | Status: Project completed |

**WORK PROGRAM OF HYDROLOGICAL INVESTIGATIONS DIVISION
FOR THE YEAR 2013-2014**

| S. No. | Study | Team | Duration/ Status |
|-------------------------|--|--|--|
| INTERNAL STUDIES | | | |
| 1 | Assessment of Sensitivity of Open Water Evaporation to Increase in Temperature for Different Climatic Regions of India | S. D. Khobragade (PI) C. P. Kumar Manohar Arora A. R. Senthil Kumar | 2 years (04/12-03/14) Continuing Study |

| S. No. | Study | Team | Duration/ Status |
|---------------------------|--|---|---|
| 2 | Water Quality, Hydrogeology and Isotopic Investigations in SW Punjab | M. S. Rao (PI) C. P. Kumar Gopal Krishan | 2 years (07/12-06/14) Continuing Study |
| 3 | Water Availability Studies for Sukhna Lake, Chandigarh | S. D. Khobragade (PI) C. P. Kumar Sudhir Kumar A. R. Senthil Kumar P. K. Garg V. K. Agarwal | 2 years (04/13-03/15) <u>New Study</u> |
| 4 | Isotope Studies for the Identification of Different Aquifer Groups and their Dynamics in Upper Yamuna River Plains | Sudhir Kumar (PI) C. K. Jain S. P. Rai S. D. Khobragade P. K. Garg B. C. Joshi (CGWB, Lucknow) Tejdeep Singh (CGWB, Chandigarh) | 2 years (07/13-06/15) New Study |
| 5 | Estimation of Radon Concentration in Waters and Identification of Paleo-groundwater in Part of Punjab Located in Satluj River Basin using Isotopes | S. K. Verma (PI) S. P. Rai (Co-PI) M. S. Rao C. P. Kumar Mohar Singh | 2 years (10/13-09/15) New Study |
| SPONSORED PROJECTS | | | |
| 6 | National Program on Isotope Fingerprinting of Waters of India (IWIN) | M. S. Rao (PI) Sudhir Kumar S. P. Rai S. K. Verma P. K. Garg Gopal Krishan | 6 years 6 months (07/07-12/13) Continuing Study |
| 7 | Groundwater Dynamics of Bist-Doab Area, Punjab using Isotopes | M. S. Rao (PI) Sudhir Kumar S. K. Verma P. K. Garg Gopal Krishan CGWB Officials | 5 years 6 months (10/08-03/14) Continuing Study |
| 8 | Groundwater Management in Over-Exploited Blocks of Chitradurga and Tumkur Districts of Karnataka | Sudhir Kumar (PI) J. V. Tyagi S. P. Rai Anupma Sharma B. K. Purandara C. Rangaraj | 5 years 6 months (10/08-03/14) Continuing study |

| S. No. | Study | Team | Duration/ Status |
|-----------------------------|--|--|---|
| 9 | The Use of Environmental Isotopes to Assess Sustainability of Intensively Exploited Aquifer Systems in North Eastern Parts of Punjab, India | M. S. Rao (PI) C. P. Kumar S. P. Rai | 3 years (09/12-08/15) Continuing Study |
| 10 | The Structure and Dynamics of Groundwater Systems in Northwestern India under Past, Present and Future Climates | S. P. Rai (PI) M. S. Rao Surjeet Singh S. K. Verma C. P. Kumar Sudhir Kumar V. K. Agarwal Rajeev Gupta S. L. Srivastava Vishal Gupta Mohar Singh | 3 years (06/12-05/15) Continuing Study |
| 11 | Review of Groundwater Resources in the Indo-Gangetic Basin: A Case Study on Resilience of Groundwater in the Punjab to Withdrawal and Environmental Change | M. S. Rao (PI) C. P. Kumar Gopal Krishan | One year 8 months (02/13-09/14) Continuing Study |
| 12 | Assessment of Baseflow and its Impact on Water Quality in the Part of Satluj River in India using Environmental Isotopes and Age Dating Techniques | S. P. Rai (PI) R. V. Kale M. S. Rao C. P. Kumar Sudhir Kumar V. K. Agarwal Vishal Gupta Mohar Singh | 3 years (10/12-09/15) Continuing Study |
| 13 | Integration of Isotope Hydrology in Aquifer Mapping Efforts in India: A Pilot Study of Upper Yamuna Plains | Sudhir Kumar (PI) S. P. Rai S. D. Khobragade C. K. Jain P. K. Garg | 2 years (05/13-04/15) New Study |
| CONSULTANCY PROJECTS | | | |
| 14 | Integrated Hydrological Investigations of Sukhna Lake, Chandigarh for its Conservation and Management | S. D. Khobragade (PI) C. P. Kumar R. D. Singh S. P. Rai C. K. Jain V. K. Agarwal | 2 years (07/11-06/13) Continuing Study |
| 15 | Pre-dredging and Post-dredging Bathymetric Survey of Ramgarh Tal Lake, Gorakhpur, UP | S. D. Khobragade (PI) C. P. Kumar R. D. Singh V. K. Agarwal | For Pre-dredging Survey 6 months (11/12-04/13) Continuing Study |

| S. No. | Study | Team | Duration/ Status |
|--------|--|---|--|
| 16 | Assessment of Impact of Coal Mining from Mahan Coal Block on Groundwater Recharge and Sedimentation in Rihand Reservoir and to Suggest Appropriate Measures to Mitigate the Identified Impacts | Sudhir Kumar (PI) Sanjay Kumar Jain J. V. Tyagi Surjeet Singh S. D. Khobragade R. K. Jaiswal P. K. Garg | 6 months (04/13-09/13) New Study |
| 17 | Hydrogeological Study for Dewatering of Jhamarkotra Mines, Distt. Udaipur | Sudhir Kumar (PI) | 3 years (05/13-04/16) New Study |
| 18 | Impact Assessment of Ash Pond on the Groundwater Quality in the Surrounding Villages of NTPC Simhadri through Stable Isotopic Studies | Sudhir Kumar (PI) | 1 year (07/13-06/14) New Study |
| 19 | Identification of Source and Locations of Leakage/Seepage from Kaushalya Dam, Haryana | S. P. Rai (PI) | 6 months (08/13-01/14) New Study |

**WORK PROGRAM OF HYDROLOGICAL INVESTIGATIONS DIVISION
FOR THE YEAR 2014-2015**

| S. No. | Study | Team | Duration/ Status |
|-------------------------|--|--|--|
| INTERNAL STUDIES | | | |
| 1 | Water Quality, Hydrogeology and Isotopic Investigations in SW Punjab | M. S. Rao (PI) C. P. Kumar Gopal Krishan | 3 years (07/12-06/15) Continuing Study |
| 2 | Water Availability Studies for Sukhna Lake, Chandigarh | S. D. Khobragade (PI) C. P. Kumar Sudhir Kumar A. R. Senthil Kumar P. K. Garg V. K. Agarwal | 2 years (04/13-03/15) Continuing Study |

| S. No. | Study | Team | Duration/ Status |
|---------------------------|--|--|--|
| 3 | Isotope Studies for the Identification of Different Aquifer Groups and their Dynamics in Upper Yamuna River Plains | Sudhir Kumar (PI) C. K. Jain S. P. Rai S. D. Khobragade P. K. Garg B. C. Joshi (CGWB, Lucknow) Tejdeep Singh (CGWB, Chandigarh) | 2 years (07/13-06/15) Continuing Study |
| 4 | Estimation of Radon Concentration in Waters and Identification of Paleo-groundwater in Part of Punjab Located in Satluj River Basin using Isotopes | S. K. Verma (PI) S. P. Rai (Co-PI) M. S. Rao C. P. Kumar Mohar Singh | 2 years (10/13-09/15) Continuing Study |
| 5 | Sub-marine Groundwater Discharge and Sea-water Intrusion in Coastal Aquifers of East Coast, India | M. S. Rao (PI) | 2 years (06/14-05/16) New Study |
| 6 | Monitoring Isotopes in Air Moisture in Parts of Himalayas (Himachal Pradesh & Uttarakhand) for investigating the Cloud Condensation | M. S. Rao (PI) C. P. Kumar Gopal Krishan | 2 years (06/14-05/16) New Study |
| SPONSORED PROJECTS | | | |
| 7 | The Structure and Dynamics of Groundwater Systems in Northwestern India under Past, Present and Future Climates | S. P. Rai (PI) M. S. Rao Surjeet Singh S. K. Verma C. P. Kumar Sudhir Kumar V. K. Agarwal Rajeev Gupta S. L. Srivastava Vishal Gupta Mohar Singh | 3 years (06/12-05/15) Continuing Study |
| 8 | The Use of Environmental Isotopes to Assess Sustainability of Intensively Exploited Aquifer Systems in North Eastern Parts of Punjab, India | M. S. Rao (PI) C. P. Kumar S. P. Rai | 3 years (09/12-08/15) Continuing Study |
| 9 | Assessment of Baseflow and its Impact on Water Quality in the Part of Satluj River in India using Environmental Isotopes and Age Dating Techniques | S. P. Rai (PI) R. V. Kale M. S. Rao C. P. Kumar Sudhir Kumar V. K. Agarwal Vishal Gupta Mohar Singh | 3 years (10/12-09/15) Continuing Study |

| S. No. | Study | Team | Duration/ Status |
|-----------------------------|--|--|--|
| 10 | Review of Groundwater Resources in the Indo-Gangetic Basin: A Case Study on Resilience of Groundwater in the Punjab to Withdrawal and Environmental Change | M. S. Rao (PI) C. P. Kumar Gopal Krishan | One year 8 months (02/13-09/14) Continuing Study |
| 11 | Integration of Isotope Hydrology in Aquifer Mapping Efforts in India: A Pilot Study of Upper Yamuna Plains | Sudhir Kumar (PI) S. P. Rai S. D. Khobragade C. K. Jain P. K. Garg | 2 years (05/13-04/15) Continuing Study |
| CONSULTANCY PROJECTS | | | |
| 12 | Hydrogeological Study for Dewatering of Jhamarkotra Mines, Distt. Udaipur | Sudhir Kumar (PI) | 3 years (05/13-04/16) Continuing Study |
| 13 | Impact Assessment of Ash Pond on the Groundwater Quality in the Surrounding Villages of NTPC Simhdri through Stable Isotopic Studies | Sudhir Kumar (PI) | 1 year (07/13-06/14) Continuing Study |
| 14 | Isotopic Characterization of Groundwater of District Raigarh, Chhattisgarh | S. P. Rai (PI) | 6 months (04/14-09/14) New Study |
| 15 | Hydrogeological Studies for Ash Pond of 2 X 525 MW Maithon Power Limited and an Abandoned Coal Mine, District Dhanbad, Jharkhand | Sudhir Kumar (PI) | 3 months (06/14-08/14) New Study |

SURFACE WATER HYDROLOGY DIVISION

Dr. Rakesh Kumar, Scientist, “G” and Head, Surface Water Hydrology Division presented a summary of the studies being carried out by Surface Water Hydrology Division along with number of research papers published/accepted for publication/ communicated as well as other research and technical activities carried out by the division. The progress of studies was then presented by the respective P.Is. of the studies. The details are as under.

1. HYDROLOGICAL STUDIES FOR UPPER NARMADA BASIN

Mr. Jagadish Prasad Patra, PI of the study presented the completed study. The objectives with brief methodology are presented. Major work carried out including data collection, river cross-section survey, water availability analysis, rainfall-runoff analysis, rainfall and flood frequency analysis, estimation of PMF, Dam break flood simulation etc were discussed in details during

the presentation. Finally, the developed flood inundation maps for various return periods flood and dam break flood are also presented. The Member of the working group appreciated the results and interaction with the dam authority during the study as the results might be helpful to them in preparing emergency action plan etc.

2. STATE-OF-THE-ART REPORT ON SOIL EROSION AND SEDIMENT TRANSPORT MODELLING

Dr. J.V. Tyagi presented the study and informed the house that the National Water Mission document of National Action Plan on Climate Change (NAPCC) has recommended for building a Universal Soil Loss model depicting erosion and sediment transport etc. Before taking up the model development, the action plan of the activity envisages preparation of a state-of-the-art report on soil erosion and sediment transport modeling and the work was entrusted to NIH. In the light of this background, he explained that the objective of the state-of-the-art report is to provide a resource on soil erosion and sediment transport modelling for the use of potential model developers and model users to guide their erosion modelling applications at catchment scale. Dr. Tyagi further informed that the report has been completed and explained the salient contents of the report. There were no comments on the study.

3. SUSPENDED SEDIMENT FLUX MODELLING IN THE LARGEST SUB-BASIN OF BRAHMAPUTRA

Mrs Archana Sarkar, PI of the study presented the background, objectives, methodology and results of the completed study. Mrs Sarkar informed that the study area is the Subansiri River basin, the biggest northern tributary of Brahmaputra River within India which originates in Tibet, contains snow-fed tributaries and glaciers and has a huge hydropower potential for the country. She informed the house that Hydrological modeling studies in Brahmaputra basin” is one of the thrust areas of “12th further informed Subansiri River promises stupendous hydropower potential (22 projects having potential of 15,191 MW already proposed/in progress) for the country, therefore, accurate assessment of sediment flux is of prime importance. Mrs Sarkar presented various ANN models developed for the study, i.e., three groups of ANN models for daily sediment yield modelling and four groups of ANN models for both ten-daily as well as monthly sediment yield modelling. Within each group, three models each have been considered based on lagged variables. Mrs Sarkar informed that as per the results obtained, it was evident that daily ANN models performed best when past time step suspended sediment

Concentration data was considered as input but in case of monthly models, the performance was best with only rainfall and temperature as the input data. Therefore, it was concluded from the study that daily ANN models are useful for short term forecasting whereas monthly ANN models are more suitable for studying the impact of climate change on sediment flux. Working group members noted the results of the study. Five Year Plan” of the institute.

4. SEDIMENTATION STUDIES FOR PONG RESERVOIR, HIMACHAL PRADESH (2012-2015)

Dr. A. R. Senthil kumar, PI of the project, presented the objectives, methodology and progress of the study for the period from November 2013 to May 2014 and overall progress in brief. He presented the development of sediment yield model for pong dam using ANN and the simulation of sediment yield for future 25, 50, 75 and 100 years using the generated series of rainfall and flow volume. He presented the uncertainty analysis of the rainfall and flow volume of 10%, 50% and 90% dependable series for future 25, 50, 75 and 100 years. He also presented the status of determination of bandwidth of optimal weights of ANN model by boots trap method. Shri R K Khanna, CWC suggested to have contacts with officers of CWC as they are dealing with the reservoir sedimentation.

5. STUDY OF HYDRO-METEOROLOGICAL DROUGHTS FOR CHITRAKOOT DISTRICT OF BUNDELKHAND REGION IN INDIA

Dr Rakesh Kumar, Head, Surface Water Hydrology Division reported the progress of studies in brief and invited Dr R.P. Pandey, PI of the project, to presented details of activities carried out in respect of ongoing study for the period after last working group meeting. Dr Pandey reported that the study site had faces acute drinking water shortages during summer months and this problem was very severe during drought years in the recent past i.e. 2004-2008. The major objective of the study is to quantify water scarcity during droughts and to identify possible options for augmenting water supply and minimizing crop loss due to droughts. The PI further reported that the data processing & analysis and preparation of base maps have been completed. He further informed that the long-term monthly rainfall data for 1901-2010 and daily rainfall and other meteorological records for 1969-2011 were collected and analyzed for rainfall departure, probability distribution of annual and seasonal rainfall, dryspell analysis and estimation of supplemental water requirement for dry-spell periods for kharif season crops have been completed and same was presented in the meeting. It was informed that a new methodology has been devised for regular drought monitoring using rainfall data. The method has been compared with Standardized Precipitation Index (SPI) and Effective Drought Index (EDI). The method provides comparable assessment of onset of drought and its progression. Further, it was informed that the same methodology has been incorporated in the DSS (P) for identification of onset of drought events and quantification of their severity. The results of the method applications were demonstrated in the meeting. The PI informed that the flow measurement records for Paisuni river are not available. Therefore, MIKE Basin NAM Model has been used to estimate flow series using Tons flow data for its calibration. The River Tons is flowing adjoining to the Pasuni river and have nearly identical topographic features. It was reported that the study area has been grouped in to different clusters depending on the physiography, location, potential source of water supply and population. It was informed that the interim Report of this study would be submitted in June 2014.

6. QUANTITATIVE ASSESSMENT OF UNCERTAINTIES IN RIVER DISCHARGE ESTIMATION

Dr. Sanjay Kumar presented the study on “Quantitative assessment of uncertainties in river discharge estimation”. He explained the background and objectives of the study and mentioned that study is a part of the systemic review of uncertainty clause of the ISO 9123 document. He explained the methodology based on ISO documents GUM (Guide to the expression of uncertainty in measurement), HUG (Hydrometric uncertainty guidance) and presented the progress made in the study. He mentioned that a NWIP (New Work Implementation Plan) has been submitted along with a working draft of the uncertainty clause of the above ISO document. He informed that draft document is uploaded on the ISO web site for comments and review from experts.

7. EVALUATION AND MODELING OF HYDROLOGICAL SUPPORT SYSTEM FOR WATERSHEDS OF GARHWAL, UTTARAKHAND HILLS

Dr. Avinash Agarwal also presented the study entitled “Evaluation and modeling of hydrological support system for watersheds of Garhwal, Uttarakhand hills”. It was informed that this study has been submitted to DST for possible funding. Some prelim works on classification and relative classification of spring by four methods were presented. Springshed delineation and the area of springshed for the springs were identified and presented. Working group accepted the study progress.

8. ESTIMATION OF WATER BALANCES FOR INTEGRATED WATER RESOURCES MANAGEMENT IN YERRAKALVA PILOT BASIN, A.P.

Dr. J.V. Tyagi proposed the new study for the year 2014-15 under the thrust area of Integrated Water Resources Management (IWRM). It was informed that NIH has taken up Pilot Basin Studies (PBS) for IWRM in Yerrakalva river basin in coastal Andhra Pradesh under 12th five-year plan program. The program involves detailed studies on various components of the hydrologic cycle including water balance study of the basin. The components of water balance of a basin are influenced by climate, the physical characteristics of the basin such as morphology, land use and soil. Therefore, understanding the relationship between these physical parameters and hydrological components are very essential for integrated water resources management and long term sustainability of water resources in the basin. Dr. Tyagi explained that the SWAT, one of the most recent models developed by the USDA, will be used to analyse and quantify the water balance of the Yerrakalva river basin. The model has been chosen as SWAT is an integrated river basin scale, physically based, continuous-time, long-term simulation, distributed model. Also, its suitability to different parts of the world has been well established. The hydrologic cycle as simulated by SWAT is based on the water balance equation. Model outputs all water balance components (surface runoff, evaporation, lateral flow, recharge, percolation etc.) at the level of each sub-watershed and are available at daily, monthly or annual time steps. The study was approved by the working group.

9. STATUS REPORT ON “IMPACT OF ANTHROPOGENIC AND CLIMATE CHANGE ON SEDIMENT LOAD OF RIVERS”

Mrs Archana Sarkar, PI of the study presented the background, objectives, methodology and expected deliverables of the new study. Mrs Sarkar informed that the sediment load of a river represents a key component of its hydrology, and in turn exerts an important influence on its aquatic ecology, its morphology and the exploitation of its water resources. She further informed the house that changes in the sediment loads of rivers can therefore have wide-ranging environmental and social and economic implications. She also informed about the growing evidence (reported by various authors for different rivers of the world) that the sediment loads of many rivers of the world, especially Asian rivers have changed significantly in recent years due to many reasons, including anthropogenic as well as climate change impact). Mrs Sarkar emphasized on the need to carry out a comprehensive up to date review of all such studies and prepare a status report. Working Group members noted the objectives of the study and appreciated the proposal. Dr. Sharad K. Jain suggested that Dr. Jaivir Tyagi has recently completed a status report on, “Soil erosion and sediment transport modelling” and the PI may consult Dr. Tyagi for carrying out the proposed study.

10. STUDY OF RAINFALL PATTERNS AND COMPARISON OF RAINFALL DATA FROM DIFFERENT SOURCES FOR UTTARAKHAND STATE

Mrs Archana Sarkar, PI of the study presented the background, objectives, methodology and expected deliverables of the new study. Mrs Sarkar informed that the study area is the Uttarakhand State, often referred to as the "Land of the Gods" due to the many holy Hindu temples and pilgrimage centres found throughout the state which observed a massive flood disaster in June 2013. Mrs Sarkar informed the house that a good knowledge of local rainfall-regime is crucial for planning and management of domestic, urban as well as industrial water use, irrigation and crop practices besides forecasting and management of extreme events like floods and droughts. She further informed that in view of the recent flood disaster in the Uttarakhand state, it becomes all the more important to carry out a scientific analysis of the rainfall regime of the region. Mrs Sarkar also informed that a comparative accuracy assessment of various data sources of rainfall viz, Rain gauges, satellite sensors (TRMM), and high resolution gridded re-analysis rainfall (APHRODITE) is of prime importance as the rainfall data from these data sources are further provided to hydrological models to produce forecasts. Mrs Sarkar proposed to carry out the trend analysis of historical rainfall data by parametric and non-parametric methods. Mrs Sarkar informed that this study would conclude by providing discussion about the accuracy of TRMM satellite rainfall data and APHRODITE rainfall data with respect to the observed rain gauge data. Dr Sharad Jain enquired if similar comparison study has been carried out for Himalayan region and Mrs Sarkar informed that such study has been carried out for Nepal Himalayas. Working group members noted the objectives, methodology and expected deliverables of the study and appreciated the proposal.

11. MONITORING AND MODELLING OF STREAMFLOW FOR THE GANGOTRI GLACIER

Dr. Manohar Arora, PI of the study presented the study. He explained that the objectives of the study are: continuous observations of meteorological, hydrological and suspended sediment data for the melt season to determine monthly and seasonal specific water and sediment yield from the study glacier; to study the melt water storage and drainage characteristics of the glacier and to simulate daily streamflow using a conceptual hydrological model using observed meteorological and hydrological data; modeling the role of glacier in catchment runoff variation; modeling the catchment runoff variation under different climatic scenarios. The study involves collection and analysis of hydro-meteorological and discharge data of the glacier site. The second step is to develop and apply a snow melt model for streamflow generation and identification of different runoff components. The third step is to model role of glacier in catchment runoff variation and catchment runoff variation under different scenarios. The Department of Science and Technology has sponsored this study. This is the first year and the investigations were started on 17th May 2014. The study will be conducted for long term. The Himalayan glaciers are poorly monitored. There is very little or sparse data of Himalayan Glaciers The collected data will be used for climate change studies. The results of the study will be disseminated by DST.

12. EFFECT OF CLIMATE CHANGE ON EVAPORATION AT POINT SCALE

Mr. Digambar Singh, Sc B, PI of the study proposed the new study for duration of three year with objectives of to develop evaporation model by empirical and soft computing techniques; to downscale the data of temperature, rainfall and humidity from GCM model; to determine the effect of climate variables on evaporation by using the downscaled data. It is informed that the Multiple Linear regression (MLR) and soft computing techniques would be applied to model the evaporation with rainfall, temperature and humidity as input vectors. The weather generators, considering the future carbon emissions, radiation and effects of green house gases, have been developed to generate the time series by fitting a distribution to the times series and by using the properties of distribution of the times series. The different scenarios of climatic conditions may be obtained from SDSM (Statistical DownScaling Model) from UK/PRECIS from IITM, Pune. The best models developed by soft computing techniques to simulate the evaporation from historical values of rainfall, maximum and minimum temperature and humidity at the site can be utilized to generate the evaporation from the generated values of rainfall and maximum and minimum temperature and humidity for different climatic scenarios as mentioned above. The falling and rising values of evaporation from the different climate scenarios would give an idea to the official dealing with the planning of cropping pattern.

13. HYDROLOGICAL MODELLING OF BRAHMANI BAITARANI RIVER BASIN USING EWATER SOURCE PLATFORM

Mr. Jagadish Prasad Patra, PI of the study proposed the new study for duration of three year. The objectives, present state of art, brief description of study area and methodologies are presented. The members enquired possibility of external funding for the project. It is informed that the work has been assigned by Ministry to NIH and at present the model is provided to NIH from Ministry and no other cost is to be funded by NIH.

14. APPLICATION OF DSS (P) FOR INTEGRATED WATER RESOURCES DEVELOPMENT AND MANAGEMENT

Dr. Surjeet Singh (Co-PI) presented the progress of the study as Dr. Lohani was on leave. He presented the rainfall-runoff modeling using Mike 11 NAM model for the Arpa sub-basin and the status of data collection from the Chhattisgarh State as well as the future plan of action of the study. No comments/suggestions were made.

WORK PROGRAMME OF SURFACE WATER HYDROLOGY DIVISION FOR THE YEAR 2014-15

| S. No. & Ref. Code | Title | Study Team | Duration |
|--------------------------|---|--|---|
| Internal Studies | | | |
| 1. NIH/SWD/NIH/11-14 | Hydrological studies for upper Narmada basin. | J. P. Patra Rakesh Kumar Pankaj Mani T. R. Sapra | 3 Years (April 2011 to March 2014) |
| 2. NIH/SWHD/NIH/13-14 | State-of-the-Art Report on Soil Erosion and Sediment Transport Modelling | J.V. Tyagi | 1 year (April 2013 to March 2014) |
| 3. NIH/SWD/NIH/13-14 | Suspended Sediment Flux Modelling in the largest sub-basin of Brahmaputra | Archana Sarkar Rakesh Kumar | 1 year (April 2013 to March 2014) |
| 4. NIH/SWD/NIH/12-15 | Sedimentation Studies for Pong Reservoir, Himachal Pradesh | A. R. Senthil kumar Manohar Arora Suhas D Khobragade Avinash Agarwal Sanjay Jain | 3 years (April 2012 to March 2015) |
| 5. NIH/SWD/NIH/12-15 | Study Of Hydro-Meteorological Droughts For Chitrakoot Bundelkhand Region In India | R.P. Pandey | 3 years (April 2012 to March 2015) |
| 6. NIH/SWD/NIH/13-16 | Quantitative assessment of uncertainties in river discharge estimation | Sanjay Kumar Sharad Jain | 3 Years (April 2013 to March 2016) |
| 7. NIH/SWD/NIH/13-16 | Evaluation and modeling of hydrological support system for watersheds of Garhwal, Uttarakhand hills. | Avinash Agarwal Manohar Arora RK Nema | 3 Years (November 2013 to October 2016) |
| 8. NIH/SWD/NIH/14-15 | Estimation of Water Balance for Integrated Water Resources Management in Yerrakalva Pilot Basin, A.P. | J.V.Tyagi YRS Rao, | 1 year (April 2014 to March 2015) |
| 9. NIH/SWD/NIH/14-15 | Status Report on "Impact of Anthropogenic and Climate Change on Sediment Load of Rivers" | Archana Sarkar | 1 year (April 2014 to March 2015) |

| | | | |
|------------------------------|---|---|---|
| 10. NIH/SWD/NI H/14-16 | Study of Rainfall Patterns and Comparison of Rainfall Data from different Sources for Uttarakhand State | Archana Sarkar N.K. Bhatnagar Vaibhav Garg, Sc C, IIRS, Dehradun Rakesh Kumar | 2 years (April 2014 to March 2016) |
| 11. NIH/SWD/NI H/14-17 | Monitoring and modelling of streamflow for the Gangotri Glacier | Manohar Arora Rakesh Kumar | 3years (May 2014 to March 2017) |
| 12. NIH/SWD/NI H/14-17 | Effect of climate change on evaporation at point scale | Digambar Singh A. R. Senthil kumar Manohar Arora | 3years (June 2014 to March 2017) |
| 13. NIH/SWD/NI H/14-17 | Hydrological Modelling of Brahmani Baitarani River Basin using eWater Source Platform | J.P.Patra Rakesh Kumar Pankaj Mani | 3years (April 2014 to March 2017) |
| 14. NIH/SWD/NI H/13-15 | Application of DSS(P) for Integrated Water Resources Development and Management | A.K. Lohani Surjeet Singh Rahul Jaiswal | 2 year (April 13- March 15) |

WATER RESOURCES SYSTEM DIVISION

The head of the division, Dr. Sharad K Jain, Scientist G made a brief presentation about the various research activities carried out by the division since the last working group meeting. He also informed about the scientific strength of the division, completed and ongoing internal research studies, sponsored and consultancy studies taken up by the division, and the trainings courses organized by the scientists of the division. After that PI of each study presented their studies. The highlights of these are as follows.

Title: Cryospheric system studies and runoff modeling of Ganglass catchment, Leh, Ladakh Range

Dr. Thayyen presented this completed internal study. He informed that the study has revealed the sharp vertical hydrological gradient in the cold-arid system. He emphasised that the Temperature-Lapse rate is the most critical parameter in the snow melt runoff model. Generally standard environmental lapse rate ranging from 6.5 to 8.9 °C per 1000 m is used for snow melt modeling. The study found that the Slope Environmental Lapse Rate (SELR) have significant seasonal variation linked with the moisture influx to the region. During summer months, SELR between 3500 to 4700 m a.s.l was consistently ranged between 10 to 15 °C per 1000 m espousing the cold-arid conditions. It was informed that the runoff modeling has been performed using the WinSRM model.

Title: Trend and variability analysis of Rainfall and Temperature in Himalayan region

The study was presented by Sh. L. N. Thakural. The objectives of the study are to create the database for Rainfall and Temperature variables for the Himalayan region and to carry out statistical analysis to detect trend and variability in these variables in the Himalayan region, India. The parametric (Linear regression) and non-parametric (Mann-Kendall and Sen's

estimator of Slope) approaches are being used to determine the trends in the time series data of these meteorological variables. Results of analysis for the hydro meteorological data in the Western Himalayan region covering the states of Jammu & Kashmir and Himachal Pradesh along with the results of trend and variability carried out for the observational sites in the western Himalayan region were presented. There were no specific comments.

Title: *NIH_Basin-A WINDOWS based model for water resources assessment in a river basin*

Dr. M. K. Goel (MKG) presented the progress for the study. MKG informed that since the last working group, efforts have been made to make some modifications in model methodology which included: a) incorporation of relationships for approximation of EAC tables for a reservoir, b) incorporation of rule-curve based operation analysis for reservoir systems, c) incorporation of hydropower simulation analysis, and d) simplification of groundwater representation in the model. MKG informed that various existing options in the model have been preserved and new modifications have been added as additional options. A draft report detailing various modifications has been submitted. Further, some similar softwares are under review so that relevant possible options could be incorporated in the existing model. MKG informed that though the framework of WINDOWS interface has been finalized, the detailed forms for various options would be developed after completing the planned modifications. Mr. Kishore Kumar (KK) asked whether a User Manual would be prepared for the software. MKG informed that a detailed manual would be prepared and help files would be attached for various modules for easiness in model application.

Title: *Web GIS based snow cover information system for Indus basin.*

The study was presented by Co-PI Shri L. N. Thakural. The objective of the study is to develop methodology for snow cover mapping using MODIS data and publish snow cover information for Indus basin on web/intranet using GIS server. In this study, snow cover was mapped using MODIS MOD09A2 data for year 2008 in ILWIS and QGIS software for the seven sub-basins of Indus. The downloaded data were in HDF format and having sinusoidal map projection. Sub basin wise statistics was computed for snow cover. The statistics of the snow cover for the entire sub basin was presented. Sh. Kishore Kumar enquired when will this information be loaded on the web? Mrs. Deepa Chalisgaonkar replied that presently it is working on LAN of the institute. It will be installed on the website of the institute after the completion of the study.

Title: *Assessment of Water Footprint of the National Capital Territory (NCT) of India*

Mrs. Deepa presented the study. She informed that the water footprint of an area is defined as the volume of water needed for the production of the goods and services consumed by the inhabitants of that area. She informed that the methodology used in this study is largely based on earlier studies supported by Water Footprint Network, the previous methodologies are integrated and upgraded where ever possible. Sri R K Khanna enquired whether the tanker water supply has been considered or not. Mrs Deepa replied that all the sources of water supply

by DJB have been considered. Shri Kamal Kishore and Shri N K Shama mentioned that the study would be useful. Working group noted the progress of the study.

Title: Impact of climate and land use change on floods of various return periods (TR)

Dr. Sanjay Kumar presented the status of the on-going study on topic impact of climate and land use change on floods of various return periods. He explained the objectives, methodology and the results achieved so far. Dr. Sanjay Kumar presented the NWP model and its merit over GCM and also discussed the percentage deviations in floods of various return periods for two different climatic scenarios, i.e. one increasing the highest flood series by twenty percent and in other decreasing at the lowest flood series. He presented briefly the expected outcome, results in regards to the objectives, the uncertainty band in return period flood and the land use in Mahanadi basin. There were no questions from the members.

Title: Assessing Climate Change Impact across KBK (Kalahandi-Bolangir-Koraput) region of Odisha

The status of the study was presented by Shri P.K. Mishra. He informed about the progress made in the study since inception as well as during last six months. Shri Mishra informed that trend for three variables viz. rainfall, temperature (mean, minimum, maximum), and potential evapotranspiration (PET) have been investigated. He presented the results and inferences drawn from the trend analysis of the rainfall data, temperature data, and potential evapotranspiration data for the KBK region. Dr. Sreemati Gupta suggested to explore the spatial (district-wise) correlation for the rainfall, temperature and PET as per the trend emerging from the study. Shri Mishra also informed that major data has already been collected from different sources/ agencies. He further informed that the digitization work has been completed for the SOI toposheets (21 nos.) and the soil map (04 nos.).

Title: Glacier change and glacier runoff variation in the upper Satluj river basin

Dr. Sanjay K Jain, presented the background and objectives of the study as well as the progress made so far. He informed that three sub-basins of Upper Satluj basin have been taken for this study. The maps of these sub-basins have been prepared in GIS. Glacier change detection in two-sub basins have been carried out using temporal satellite data while for the third sub-basin (Spiti), glacier change detection is in progress. The meteorological and discharge data have been collected. Er. N K Sharma asked about the reasons of glacier retreat. Dr. Jain said that analysis of temperature and snow water equivalent data is under progress and then correlation between these with glacier change will be studied. He informed that as per the literature survey the main reason of retreat is temperature rise.

Title: Variability of the Hydro-climatic variables in Punjab Plains of lower Satluj

The progress of the study was presented by Mr. Manish Kumar Nema. The presentation contained the background of the study, study area details, data availability, methodology to be used and some preliminary results of the rainfall trends over the Lower Satluj region. The results

support the rising trends of the rainfall in the study area in annual and monsoon season with a significant level of 95%. No specific comments and suggests were made pertaining to study.

SPONSORED STUDIES

Title: Glaciological studies of Phuche Glacier, Ladakh Range.

The progress of the study was presented by Dr Renoj J Thayyen. He explained about the importance of the response of small glaciers in the Cold-Arid climate system of the Trans-Himalaya to the prevailing climate and huge knowledge gap in our understanding of factors influencing glacier response to the climate change and its consequences. He then focused on the winter and summer mass balance of Phuche and Khardung glaciers which are under study. He informed the group that during the four years of study (2010-2013), Phuche glacier experienced two slightly positive mass balance years interspersed with two significant negative mass balance years. Khardung glacier experienced consistent mass loss with a remarkable cumulative mass loss of (-) 2690 mm w.e. during these four years.

NEW PROPOSALS

Title: Hydrological modeling of a part of Satluj basin using SWAT Model

Mr. P. K. Agarwal presented the new study before the working group. No comments were received. However, Dr. Sharad K. Jain pointed out that Shri Manish Nema is already working on the same basin and has collected considerable data for the same. To avoid duplicity of data collection, Shri Manish Nema will share the data, maps and other information available with him and will be a part of this study. The project proposal was approved by the working group.

Title: Decision Support System for Water Resources Planning in Upper Bhima basin, Maharashtra

In the absence of the PI, Mr D. S. Rathore, Dr M. K. Goel made a presentation of this new study. He informed that in this study, it is planned to use MIKE HYDRO systems and DSS 4.0 software for detailed analysis of water resources in Upper Bhima basin up to Ujjani dam. He informed that detailed database of the study area was developed in HP-II project and now it is envisaged to use the database with new software system with following objectives: 1) Rainfall-runoff modeling and estimation of water availability in the basin, 2) Multi-reservoir operation in the basin for project complexes, 3) Drought prediction 4) Water quality modeling in the basin, 5) Conjunctive use operation in command area and 6) River basin simulation for climatic change scenarios. In response to some queries from Dr N.B.N. Prasad and Mr Kishore Kumar, MKG informed that in addition to the available analytical capabilities of the present DSS system, various modules can be written in the DSS in scripting language in accordance with the analysis requirement. Such algorithms would be developed, if required, for the analysis in the present study.

Title: Catchment scale evaluation of cold-arid cryospheric system Hydrology, Ganglass catchment, Ladakh

As the second phase of the project entitled “Cryospheric system studies and runoff modeling of Ganglass catchment, Leh, Ladakh Range” Dr Renoj J Thayyen presented a new research study. During the presentation he talked about the objectives, study area, social implications of the projects. He informed that the major objective of the study is to understand the cryospheric systems dynamics through a Benchmark glacier catchment strategy that has already implemented in the upper Ganglass catchment. He informed that this study will use the database available and upgrading it along with following objectives: 1) To improve the understanding of the climate forcing on cold-arid cryospheric system, 2) To improve the understanding of the melt water generation process and the role of permafrost, 3) To improve the understanding of various runoff components under different surface snow conditions, 4) To study the temporal variations in isotopic characteristics of winter base flow and summer flow of the perennial reach.

The approved work plan for the division for 2014-15 is given in Table 1.

WORK PROGRAMME FOR THE YEAR 2014-2015

| S. N. | Title | Study Team | Duration | Funding (Rs. Lakhs) |
|---------------------------------|---|---|----------------------------|----------------------------|
| Ongoing Internal Studies | | | | |
| 1. | Trend and variability analysis of rainfall and temperature in Himalayan region | L. N. Thakural Sanjay Kumar Sanjay K. Jain Sharad K. Jain Tanveer Ahmed | 3 years (10/11-09/14) | NIH |
| 2. | NIH_Basin – A WINDOWS based model for water resources assessment in a river basin | M. K. Goel Sharad K. Jain Deepa Chalisgaonkar Prabhash K. Mishra | 2 Years (04/13-03/15) | NIH |
| 3. | Web GIS based snow cover information system for the Indus Basin | D. S. Rathore Deepa Chalisgaonkar L. N. Thakural Tanveer Ahmed | 2 Years (04/13-03/15) | NIH |
| 4. | Assessment of Water Footprint of the National Capital Territory (NCT) of India | Deepa Chalisgaonkar Sharad K. Jain M. K. Nema P. K. Mishra | 2 Years (04/13-03/15) | NIH |
| 5. | Impact of Climate and Land Use Change on Floods of Various Return Periods | P. K. Bhunya Sanjay Kumar D S Rathore | 2 Years (04/13-03/15) | NIH |
| 6. | Assessing climate change impact across KBK region of Odisha | P. K. Mishra Sharad K. Jain Sanjay K. Jain P. K. Bhunya | 2 Years (04/13-03/15) | NIH |
| 7. | Glacier change and glacier runoff variation in the upper Satluj river basin | Sanjay K. Jain Sharad K. Jain Renoj J. Theyyan | 2.5 Years (10/13-03/16) | NIH |
| 8. | Variability of the Hydro-climatic | M. K. Nema | 2 Years | NIH |

| | | | | |
|--------------------------------------|--|---|------------------------------|--|
| | variables in Punjab Plains of lower Satluj | Sharad K. Jain | (11/13-10/15) | (11.34) |
| Sponsored Studies | | | | |
| 1. | Glaciological studies of Phuuche Glacier, Ladakh Range, India | Renoj J. Theyyan M K Goel S P Rai | 5 Years 1/10-12/14 | DST (56.00) |
| 2. | Ganga River Basin Environment Management Plan | Sharad K Jain N. C. Ghosh Sanjay K. Jain M. K. Goel | 2 Years 07/12-06/14 | IIT Kanpur (12.00) |
| 3. | Assessment of Environmental flow for Himalayan River | Sharad K. Jain Pradeep Kumar P. K. Agarwal P. K. Mishra | 1 Year 07/14-07/15 | MOES (9.95) (Funds are expected shortly) |
| Proposed New Internal Studies | | | | |
| 1. | Hydrologic Modelling of a part of Satluj Basin using SWAT Model | P. K. Agarwal Sharad K. Jain M. K. Goel Sanjay K. Jain MK Nema Tanveer Ahmed | 2 -3/4 Years (06/14-3/17) | NIH (23.00) |
| 2. | Decision Support System for Water Resources Planning in Upper Bhima basin, Maharashtra | D. S. Rathore M. K. Goel, R.P. Pandey Sanjay Kumar Surjeet Singh | 2 years (07/14-06/16) | NIH (34.00) |
| 3. | Catchment scale evaluation of cold-arid cryospheric system Hydrology, Ganglass catchment, Ladakh | Renoj J. Theyyan S P Rai | 3 years (04/14-03/17) | NIH (20.00) |

**RESEARCH MANAGEMENT AND OUTREACH DIVISION (RMOD)
WORK PROGRAMME FOR YEAR 2014-2015**

| S.N. | Title of Project/Study, Study Team, Start/Completion Dates | Status and Recommendations/Suggestions |
|------|---|---|
| 1. | Pilot Basin Studies (PBS) at six identified sites, jointly with the RCs and CFMSs (Joint Study) NIH HQs: V C Goyal (Leader), Omkar Singh, R V Kale NIH RCs/CFMSs: RC-Belgaum, RC-Jammu, RC-Kakinada, RC-Sagar, CFMS-Guwahati, CFMS-Patna DOS: Apr 2012; DOC: Mar 2015 | Status: Inception report (2013-14) submitted. Chairman suggested that this study may be re-structured during 2014-15 in view of priority of the MOWR. |
| 2. | Water Conservation and Management in Ibrahimpur Masahi Village of Hardwar District (Uttarakhand) Team: Omkar Singh, V.C. Goyal, C.K. Jain, J.V. Tyagi and Sanjay K. Jain | Status: Interim Report (2013-14) submitted. Dr N B Narasimha Prasad wanted to know about basis for per capita water requirement used for the rural areas in |

| | | |
|----|---|--|
| | DOS: Apr 2013; DOC: March 2015 | this study. The PI responded that the data used in the study is based on the norms of Ministry of Drinking Water & Sanitation (GoI). |
| 3. | Integrating hydrology, climate change and IWRM with livelihood issues: Development of methodology and a DSS for water-scarce Bundelkhand region in India (Sponsored under INDIA-IIASA Programme of TIFAC) Team (NIH): Dr. V. C. Goyal (PI), Dr T Thomas (Co-PI), Dr. R. V. Kale (Co-PI) Nodal Coordinator : Dr (Mrs.) K Vijaya Lakshmi, DA, New Delhi Dr Sandeep Goyal, MAPCOST, Govt. of MP International Collaborators: IIASA, Austria DOS: Aug 2013; DOC: Jan 2016 | Status: on-going study No specific comments. |
| 4. | Participatory development of structure for IWRM Framework in identified sub-basins under Pilot Basin Studies (PBS) program (New Study) Team: V C Goyal (PI), Omkar Singh and R V Kale DOS: July 2014 DOC: June 2015 | The Chairman suggested that this study will be finalized after discussion with PI of the study. |
| 5. | Customization of WEAP model for application in Ur river watershed in Tikamgarh district of Bundelkhand region. (Under TIFAC Project) Team: R V Kale (PI), T Thomas- RC Bhopal, Jyoti Patil, Rajesh Agarwal DOS: Apr 2014 DOC: Sep 2015 | Status: New Study No specific comments. |

Sponsored Projects

1. Integrating hydrology, climate change and IWRM with livelihood issues: Development of methodology and a DSS for water-scarce Bundelkhand region in India, **Funded by TIFAC, Government of India under INDIA-IIASA Programme of TIFAC**

Period: Aug 2013-Dec 2016 (30 months) Budget: Rs 56.64 lakh

Team from NIH:

V C Goyal (PI), T Thomas (Co-PI), R V Kale (Co-PI)

Nodal Coordinators from other partners:

Dr (Mrs) K Vijaya Lakshmi, DA, New Delhi
Dr Sandeep Goyal, MAPCOST, Govt. of MP (India)

International Collaborators: IIASA, Austria

2. Development of a DSS for Hydrology and Watershed Management in Neeranchal Project, **To be funded by Dept. of Land Resources (GoI) under a World Bank supported project**

Period: Jun/Jul 2014-May 2019 Budget: Rs 30 Crore approx.

Partners: NIH; IIT Delhi; WTC Delhi; NRSC Hyderabad

The Working Group noted the progress of the studies undertaken by all divisions. Further the members requested NIH to take up the following items in future.

- NIH should conduct training courses on EIA and IWRM.
- A comprehensive data base should be prepared.
- Institute should study the rock-water and soil-water chemistry
- The Institute should prepare the brochure reflecting its capabilities of taking up the various consultancy projects. The brochure should be uploaded on Institute website and widely circulated to various governmental and nongovernmental organizations.

Dr. Sudhir Kumar, Scientist G, HI Division 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 attended the 40th WG meeting**

| | | |
|-----|---|----------|
| 1. | Er. R.D. Singh, Director, NIH | Chairman |
| 2. | Dr. S.K. Jain, Sc. G & Head WRS Division, NIH | Member |
| 3. | Dr.(Mrs) Sreemati Gupta, Supdt. Geologist, GSI, Faridabad | Member |
| 4. | Dr. Kishore Kumar, NIC, New Delhi | Member |
| 5. | Dr. S.K. Bartarya, WIHG, Dehradun | Member |
| 6. | Dr. S.K. Mittal, CSIO, Chandigarh | Member |
| 7. | Dr. N.B. Narasimha Prasad, Ex. Dir., CWDRM, Kozhikode | Member |
| 8. | Sh. Niladri Naha, State Water Invest. Dir., Kolkata | Member |
| 9. | Er. R K Khanna, Chief Engineer (Retd.), CWC, New Delhi | Member |
| 10. | Sh. N.K. Sharma, SE, IRI, Roorkee | Member |
| 11. | Dr. N.C. Ghosh, Sc. G & Head GWH Division, NIH | Member |
| 12. | Dr. Rakesh Kumar, Sc.G & Head SWH Division, NIH | Member |
| 13. | Dr. C.K. Jain, Sc. G & Head EH Division, NIH | Member |
| 14. | Sh. C.P. Kumar, Sc. F & Head HI Division, NIH | Member |

Scientists from National Institute of Hydrology, Roorkee

1. Dr. Sudhir Kumar, Sc. G
2. Dr. J.V. Tyagi, Sc.G
3. Dr. Sanjay Jain, Sc.F
4. Dr. Avinash Agarwal, Sc.F
5. Dr. M.K. Goel, Sc.F
6. Smt. D.Chalosgaoonkar, Sc.F
7. Dr. R.P. Pandey, Sc.F
8. Er. Omkar Singh, Sc.E
9. Dr. S.P. Rai, Sc.D
10. Dr.A R Senthil Kumar, Sc.D
11. Dr. Anupama Sharma, Sc.D
12. Dr. Sanjay Kumar, Sc.D
13. Dr. Surjeet Singh, Sc.D
14. Dr. R.D. Mehta, Sc.D
15. Sh. S.K. Verma, Sc.D
16. Dr. Renoj J. Thayyen, Sc.D
17. Smt. Archana Sarkar, Sc.C
18. Dr. Manohar Arora, Sc.C
19. Dr. M.K. Sharma, Sc.C
20. Sh. P.K. Garg, Sc.B
21. Sh.Rajan Vatsa, Sc.B
22. Sh. Digamber Singh, Sc.B
23. Dr. Ravindra Vitthal Kale, Sc.B
24. Sh. J.P. Patra, Sc.B
25. Dr. Rajesh Singh, Sc.B
26. Sh. L.N. Thakural, Sc.B
27. Sh. P.K. Mishra, Sc.B
28. Sh. Manish Nema, Sc.B
29. Sh. Tanveer Ahmad, Sc.B
30. Sh. P.K. Agrawal, Sc.B