Technical Memorandum No. 87 & 88
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उत्तराखंड शासन

आपार शक्तेः उत्तीर्णः गंगेयम्

Annual Report

IRRIGATION RESEARCH INSTITUTE

(An ISO 9001:2008 Certified Organisation)

Roorkee - 247 667, Uttarakhand

2016-17 &
2017-18

COSULTANCY AREAS

IRI undertakes Research and Development activities related to Irrigation and Hydro-electro Projects in the following major areas:

- **Providing efficient and economical hydraulic design for various engineering works viz.**
  - Canal works
  - Spilways
  - Power house
  - Intakes
  - Diversion Works
  - Surge Tanks
  - Sediment Excluding
  - Ejecting Devices
  - Sitting of Bridges & Barrages
  - River Training
  - Flood Protection
  - Anti-erosio Measures
- **Geotechnical Investigation, Concrete Mix Design & Materials Testing for all Civil Engineering Structures.**
- **Economical Design of Concrete Mixes using Flyash and Superplasticizers; Roller Compacted Concrete for Massive structures.**
- **Ground Water Development**
  - Conjunctive use of Sub-surface & Surface Water
  - Water Logging
  - Suitability for Canal Linings
  - Seepage from Canals & Tubewells
  - Water Logging
  - Stability due to Sub-surface flow
  - Water Suitability
  - Studies for Regeneration/ Seepage from Water Bodies
  - Artificial Recharging
- **Sedimentation Studies**
  - Capacity and Life of Reservoirs
- **Mathematical Modeling**
  - Hydrological Events
  - Sub-Surface flow
  - Surface Flow
  - Hydraulic Structures etc. (Surge Tank, Water hammer and Sedimentation Chamber)
- **Basic & Fundamental Research in the field of Water Resources and Hydropowers.**

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Editorial Committee

त्रिवेन्द्र सिंह रावत

मुख्यमंत्री, उत्तराखण्ड

उत्तराखण्ड सचिवालय
देहरादून-248001
फोन : 0135-2755177 (का.)
0135-2650433
फैक्स: 0135-2712827

संदेश

मुझे यह जानकर अत्यनत प्रसन्नता है कि सिंचाई अनुसंधान संस्थान, रुड़की द्वारा किये गये विभिन्न शोध एवं परीक्षण कार्यों की वार्षिक विवरणिका का संयुक्त प्रकाशन किया जा रहा है। सिंचाई अनुसंधान संस्थान, रुड़की का लगभग पिछले 7 दशकों से जलविज्ञान एवं अन्य सम्बन्धित क्षेत्रों के शोध एवं विकास कार्यों में विशिष्ट योगदान रहा है।

उत्तराखण्ड में जल संसाधन, नदियों एवं अन्य जल स्त्रोतों का अपूर्ण भण्डार है तथा जल विद्युत परियोजनाओं की अपार क्षमता भी उपलब्ध है। इस प्राकृतिक सम्पदा का जन कल्याण हेतु उपयोग किये जाने में राष्ट्रीय एवं अन्तर्राष्ट्रीय स्तर पर बढ़ने ऊर्जा एवं जल संकट का समाधान करने में सिंचाई अनुसंधान संस्थान, रुड़की की महत्वपूर्ण भूमिका है। संस्थान द्वारा अनेकों जलविद्युत परियोजनाओं एवं बाढ़ नियंत्रण सम्बंधी शोध अध्ययन किये जा रहें है, जो भविष्य में इस क्षेत्र में मील का पत्थर साबित हो सकते है।

प्रकाशित की जा रही विवरणिका में प्रकाशित अभियंताओं/शोध अधिकारियों के शोध कार्य भावी वैज्ञानिकों के लिए प्रेरणादायी सिद्ध होंगे, मेरी ओर से सिंचाई अनुसंधान, रुड़की द्वारा वार्षिक विवरणिका के संयुक्त प्रकाशन पर हार्दिक बधाई एवं शुभकामनाएँ।

(त्रिवेन्द्र सिंह रावत)

सतपाल महाराज
मंत्री
SATPAL MAHARAJ
Minister

उत्तराखण्ड सरकार

पर्यटन, सिंचाई, लघु सिंचाई, संस्कृति, जलागम प्रबंधन,
तीर्थाटन एवं धार्मिक मेले, बाढ़ नियंत्रण,
भारत-नेपाल उत्तराखण्ड नदी परियोजनायें
उत्तराखण्ड सरकार
Tourism, Irrigation, Minor Irrigation, Culture, Watershed Management,
Pilgrimage and Religious Fairs, Flood Control,
India-Nepal-Uttarakhand River Projects
Government of Uttarakhand

पत्रांक : मंत्री/29–संदेश/2018–19
दिनांक 25 जनवरी, 2019

संदेश

मुझे यह जानकर अत्यंत प्रसन्नता है कि सिंचाई अनुसंधान संस्थान, रुड़की वर्ष 2016–17, 2017–18 में संस्थान द्वारा कराये जा कार्यों की संयुक्त वार्षिक विवरिणका प्रकाशित कर रहा है। यह संस्थान जल–विद्युत एवं सिंचाई परियोजनाओं के निर्माण कार्यों को सम्पादित करने तथा शोध एवं विकास कार्यों सम्बन्धी अध्ययनों को सम्पन्न कराने में अग्रणी हैं। इस संस्थान द्वारा पूर्व में भी उत्तराखण्ड में निर्मित महत्वपूर्ण जल विद्युत परियोजनाओं के प्रतिरूप का अध्ययन भी किया गया है। आशा है कि ये संस्थान भविष्य में इसी प्रकार जल संवर्द्धन एवं जल प्रदूषण की समस्याओं हेतु कार्य करेगा साथ में इसके उपयोग, संरक्षण एवं प्रबंधन में महत्वपूर्ण भूमिका निभाएगा।

मैं सिंचाई अनुसंधान संस्थान, रुड़की द्वारा प्रकाशित होने वाली ''संयुक्त वार्षिक विवरणिका'' के सफल प्रकाशन हेतु अपनी शुभकामनाएं ज्ञापित करते हुए संस्थान अधिकारियों/कर्मचारियों के उज्ज्वल भविष्य की कामना करता हूँ।

(सतपाल महाराज)

कार्यालय- विधान सभा भवन, देहरादून दूरभाष : (0135) 2666377 फैक्स : (0135) 2666380 आवास-1/1 सर्कुलर रोड़, डालनवाला, देहरादून दूरभाष : (0135) 2654514, 9870990009
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Anand Bardhan, IAS,
Principal Secretary

Govt. of Uttarakhand

Department of Irrigation, Minor Irrigation, Food and Civil Supplies, Soldier Welfare & Excise.
No- 31/PS-Pr.Secy./2019
Dehradun : Date-14-10-2019
Contact-0135-2712802, 0135-2712096 (F)
E-mail: secy-irri-ua@nic.in

Message

I am indeed very happy to know that Irrigation Research Institute, Roorkee (IRI) is publishing its Combined Annual Report which contains its R&D activities carried out during the year 2016-17 & 2017-18.

IRI Roorkee is known for its significant contribution in the field of R&D activities related to Hydraulic Modeling Studies, Material Testing, Ground Water Studies and Concrete Technology etc.

I am happy that IRI Roorkee has been associated with prestigious projects like Kachchh branch canal (Gujrat), Tehri PSP (Uttarakhand), Kanhar Dam Spillway (U.P.), Triveni Ghat, Rishikesh (Uttarahand), Erach multipurpose Dam Project (U.P.), Siting of Rail bridge across river Vyanatheya and river Vasistha (Andhra Pradesh), Ramman-III H.E.P. (3x40 M.W.) Darjeeling (West Bengal), Teesta H.E.P. Stage VI (Sikkim), Lower Kopili Hydro Electric Project-120 MW (Assam), Luhri Hydroelectric Project (Stage-I), (H.P.), Lata Tapovan (Uttarakhand), Rail cum road bridge at Bogibil across river Brahmaputra (Assam), Earthen Bund along the River Ganag at Allahabad (U.P.), Diversion Tunnel of Demwe Lower HEP(Arunachal Pradesh), Power intake & Desilting chamber of Naitwar Mori H.E.P. Distt. Uttarakashi (Uttarakhand), Surge shaft of Naitwar Mori H.E.P. Distt. Uttarakashi (Uttarakhand).

Through this, I take an opportunity to wish compliment to all the Engineers and Research Officers & Entire staff for their continuous efforts in carrying out research activities at IRI, Roorkee.

I wish all the success for the joint publication of Annual Report 2016-17 &2017-18.

(Anand Bardhan)

A.K. Dinkar
Engineer-in-Chief

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Dehradun-248001
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अपार शक्तेः स्त्रोतः गंगेयम्

Message

I am pleased to know that the Irrigation Research Institute (IRI); Roorkee, which has a standing of about 64 years in the field of Hydraulic Modelling and has grown into a centre of excellence, is publishing its 88th Annual Report for year 2016-17 & 2017-18.

I would like to point out the reputation for excellence, that IRI, Roorkee has earned through working on a broad range of project types throughout India and also cutting across the borders to Africa and Nepal by taking up the model studies of dams and reservoirs, irrigation infrastructure and erosion/ sedimentation problems. In this regard, some of the important studies like that of Bogibeel Bridge, the country's longest rail-cum-road bridge in Assam, Kabu-16, Hydroelectric Project (HEP), Republic of Burundi (East Africa) and Nalgad HEP, Nepal, which have been done at IRI, Roorkee are worth special mentioning. Consequently thereof, the IRI has been recently selected for the prestigious CBIP Award 2019 in the category of "Best R&D Institute in Water Resources Sector".

I believe that the research and development activities published in the annual report will enhance the image and standard of the institute. I also appreciate the efforts of officers and employees of the institute for their dedication and untiring effort in executing the works and bring out a comprehensive report.

I would also like to place on record my heartfelt appreciation to all the officers and staff of Irrigation Research Institute for their sincere efforts in preparing this report.

I hope this 88th Annual Report of Irrigation Research Institute, Roorkee will serve as valuable source of information to all readers all over the country.

Aditya

A.K. Dinkar

Tribhuwan Singh
Chief Engineer (Design)
& Director

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Chief Engineer (Design) & Director Message

I am extremely delighted and honored to present the Annual Report of Irrigation Research Institute, Roorkee for the year 2016-17 & 2017-18. This annual report provides a glimpse of R&D activities carried out by different research units of the institute. This institute is an excellent centre in the field of testing of civil engineering construction materials, studies related to ground water studies and hydraulic model studies for various Irrigation, Hydro Projects & flood protection works of Uttarakhand & other states.

The institute has excellent research facilities for carrying out hydraulic model studies at Hydraulic Research Station, Bahadrabad. It is worth mentioning that model for major projects of national importance has been carried out at IRI, Roorkee some of which are Kachchh branch canal (Gujrat), Tehri PSP (Uttarakhand), Kanhar Dam Spillway (U.P.), Triveni Ghat, Rishikesh (Uttarahand), Erach multipurpose Dam Project (U.P.), Siting of Rail bridge across river Vyanatheya and river Vasistha (Andhra Pradesh), Ramman-III H.E.P. (3x40 M.W.) Darjeeling (West Bengal), Teesta H.E.P. Stage VI (Sikkim), Lower Kopili Hydro Electric Project-120 MW (Assam), Luhri Hydroelectric Project (Stage-I), (H.P.), Lata Tapovan (Uttarakhand), Rail cum road bridge at Bogibil across river Brahmaputra (Assam), Earthen Bund along the River Ganag at Allahabad (U.P.), Diversion Tunnel of Demwe Lower HEP(Arunachal Pradesh), Power intake & Desilting chamber of Naitwar Mori H.E.P. Distt. Uttarakashi (Uttarakhand), Surge shaft of Naitwar Mori H.E.P. Distt. Uttarakashi (Uttarakhand) etc.

Major ongoing and completed projects/activities of institute during year 2016-17 & 2017-18 are:

1. During this period 43 Research and 278 Test Reports were issued.
2. Irrigation Research Institute is working as nodal agency for implementation fo National Hydrology Project 2015-2024 funded by World Bank and sponsored by Ministry of Water Resources, River Development & Ganga Rejuvenation, Govt. of India, New Delhi for installation of RTDAS (Real Time Data Acquisition System) of DSS (Decision Support System), EWS (Early Warming System) including establishment of well equipped Water Quality Laboratory.
3. Flood Plain Zoning /Mapping of two stretches i.e. River Bhagirathi at Uttarakshi and River Ganga from Haridwar to Laksar has been carried out and handed over to Flood Plain Zoning Authority for implementation.
4. State Specific Action plain sponsored by Ministry of Water Resources, River Development and Ganga Rejuvenation, Govt. of India, New Delhi under National Water Mission is undertaken and is under preparation. Institute also organized a State Level Workshop on SSAP in the month of April 2017.
5. Vetting of Design Proposals carried out under River Morphology Project conceptualized in view of flood of 2013 is being done as Nodal Agency.

I take this opportunity to express my gratitude to various sponsors all over the country for referring their studies of proposals to the Institute. Also, I would thank to the entire staff of IRI including Research Personnel, Engineers for their commendable contribution in achieving the desired Goal and hope the Institute will continue to attain higher levels of Achievements in the coming years.

(Tribhuwan Singh)

Contents

ABOUT THE INSTITUTE

Irrigation Research Institute, Roorkee (Formerly UP IRI) was initially established as a small research unit in the year 1928 at Lucknow, the Capital of North Central Province during British era. The purpose of this unit was to carry out research and development works related to Irrigation Canal projects executed by the UP Irrigation Department. Mr. Gerald Lacey, the pro-pounder of very popular regime theory for the design of irrigation canals in alluvial soils, was the founder of the above unit. The success of this research unit boosted up the confidence of practicing engineers and hence the research activities were further expanded when the aforesaid unit was shifted to a small town at Bahadrabad in 1946, which is located on the bank of Northern Ganga Canal near Haridwar on the national highway. Later on, it became to a full-fledged research Institute in 1954 at Roorkee. The institute gradually developed as a pioneer research station of the country, which is providing facilities essentially for hydraulic model studies, testing of almost all types of civil engineering materials and basic/ applied research related to Hydroelectric Projects, civil engineering structures, flood protection, and canal works etc.

In addition, it also provides consultancy services on planning, design and constructions of canal and river valley projects to all the state governments, central government departments and private engineering organisations such as UP PWD Public Health Engineering Deptt., Haryana, U.P. State Bridge Corporation Limited, National Hydro-electric Power Corporation (NHPC), Rail India Technical and Engineering Services (RITES), Tehri Hydro Development Corporation (THDC), Hindustan Construction Company (HCC) Ltd., Satluj Jal Vidut Nigam (SJVN) Ltd., GVK Ltd. Secundrabad, Lanco Infrastructure, Dans Energy Ltd., Teesta Jal Urja Ltd. GMR Consultancy by Angelique International Pvt. Ltd, Hydel/ Irrigation Departments of Chhattisgarh, Odisha, Uttar Pradesh, Haryana, Himachal Pradesh, J&K, Gujrat, Sikkim etc.

A list of important studies carried out for different projects of national and international importance is shown under the title 'Important projects/ R&D studies' carried out in past by Irrigation Research Institute, Roorkee. Also, this institute was awarded ISO 9001:2008 certificate on 15 Dec. 2012

Important Model Studies / R & D Activities Carried Out for Different Projects by IRI Roorkee in Past:

International

- Hasan Dam (Republic of Yemen).
- Nyabarango Hydroelectric Project, Rawanda (East Africa).
- Upper Marsyandi Hydroelectric Project, (Nepal).

National

- Baglihar Hydroelectric Project J&K, (India / Pakistan).
- Nathpa Jhakri Hydroelectric Project (Himachal Pradesh).
- Karcham Wang too Hydroelectric Project (Himachal Pradesh).
- Teesta Hydroelectric Project (Sikkim).
- Tenga Dam Hydroelectric Project (Arunachal Pradesh).
- Ban Sagar Project Mirzapur (Uttar Pradesh).
- Lahchura Dam, Mahoba (Uttar Pradesh).
- Rongni Chu Hydroelectric Project (Sikkim).
- Lower Rajghat Canal Lalitpur (Uttar Pradesh).
- Rangit Hydroelectric Project (Sikkim).
- Saurashtra Branch Canal Project (Gujrat).
- Baspa Barrage (Himachal Pradesh).
- Polavaram Project (Andhra Pradesh).
- Miyar Hydroelectric Project (Distt. Lahaul & Spiti, Himachal Pradesh).
- Dibbin Hydroelectric Project (Arunachal Pradesh).
- Jorethang Loop Hydroelectric Project (Sikkim).
- Bajoli Holi Hydroelectric Project (Himachal Pradesh).
- Teesta-III Hydroelectric Project (Sikkim).
- Dam Spillway for Greater Shillong Water supply Scheme (Meghalaya).
- Tail Fall of Escape Channel of WYC Hydro Electric Project Stage-II (Haryana).
- Hydraulic design of stilling basin for Ghagra Barrage (Uttar Pradesh).
- Teesta Hydroelectric Project Stage-VI (Sikkim).
- Siting barrage and training river across river Yamuna near Tajewala (Uttar Pradesh)
- Hydraulic design of Obra Dam Spillway (Uttar Pradesh).
- Training river Great Gandak in Nepal Territory.
- Baitarani Hydroelectric project (Odisha).
- Kalisindh dam project (Rajasthan).

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- Siting barrage and training river across river Yamuna near Tajewala (Uttar Pradesh)
- Hydraulic design of Obra Dam Spillway (Uttar Pradesh).
- Training river Great Gandak in Nepal Territory.
- Baitarani Hydroelectric project (Odisha).
- Kalisindh dam project (Rajasthan).

NEW INITIATIVES

Celebration of Foundation Day 2016 of Irrigation Research Institute (IRI), Roorkee:

Unveiling the Title Board of IRI & IDO, Roorkee

Chief Guest and other Dignitaries visited the IRI ModelRoom and Unveiled the model of Tehri Dam.

Felicitation of Retired Personnel & Sponors

Release of Annual Report of Irrigatio Research Institute, Roorkee &
News Letter of Irrigation Department, Uttarakhand

ACHIEVMENTS

(1) National Hydrology Project:

The Ministry of Water Resources, River Development & Ganga Rejuvenation, Government of India, New Delhi is coordinating the implementation of **National Hydrology Project (NHP)** with the World Bank assistance. The National Hydrology Project is third phase of the Hydrology Project which was started in 1995 as **Hydrology Project – I (1995-2003)** and then continued as **Hydrology Project – II (2006 – 2014)**. The project is implemented by 47 implementing agencies covering up all the states, UTs and 10 central agencies. Uttarakhand is also involved in the Hydrology Project for the first time under NHP and **Irrigation Research Institute, Roorkee has been nominated as the Implementing agency for the entire state of Uttarakhand**.

The National Hydrology Project is a central sector scheme (100% assistance from central govt.) funded by the World Bank. The budget outlay earmarked for Uttarakhand state is Rs. 75.00 Crores for an implementing period of 8 years. The main components of the project are as follows:

1. In-situ hydro-met monitoring system and Real Time data Acquisition System (RTDAS)
2. Setting up of National Water Informatics Centre.
3. Water Resources Operation and Management System
4. Establishment of Water Resources institutions and capacity building

Activities proposed under NHP in Uttarakhand state:

- REAL TIME FLOOD FORECASTING and EARLY WARNING SYSTEM in Ganga basin only.
- To develop DECISION SUPPORT SYSTEM (DSS) of Uttarakhand. (For Ganga, Ramganga, Yamuna & Sharda river basins).
- Sediment potential assessment and water quality monitoring of different critical reaches of rivers and reservoirs of Uttarakhand.
- SWIC (State Water Informatics Centre) will be established at Roorkee.

Following instruments are proposed to be installed under NHP in Uttarakhand.

Sl. No.	Instrument Name	Purpose	Quantity (proposed)
1.	ADCP (Acoustic Doppler Current Profiler)	Discharge, Velocity, Cross-section of rivers	2
2.	Digital Rain Gauges (DRG) (Telemetry) (DRG + evap. sensor + VSAT telemetry)	Precipitation	49
3.	Snow Gauge with Telemetry / VSAT / INSAT	Snowfall	07
4.	Manual rain gauge station	Rainfall, Rainfall history	11
5.	AWLR - Radar type (Telemetry)+VSAT	To monitor, measure and record fluctuations in water level of surface water.	64
6.	Gauge plates / staff gauge	To measure the water level.	40
7.	Current Meter with accessories	Measure the velocity of stream	13

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- National Hydrology Project (NHP) is a joint project of the World Bank, MoWR, RD & GR, Govt. of India and State Govts.
- State Project Monitoring Unit (SPMU) has been set up under the Chairmanship of Principal Secretary, Irrigation, Govt of Uttarakhand to monitor the project.
- The Memorandum of Agreement (MoA) was signed between the Joint Secretary, Ministry of Water Resources, River Development & Ganga Rejuvenation, New Delhi and the Principal Secretary, Irrigation, Government of Uttarakhand on 22.11.16.

    1. The Annual Work Plan for FY 2016 - 17 & FY 2017-18 approved by the MoWR, GoI.
    2. Till FY 2017-18, a total fund of Rs. 3.126 Crore has been released by MoWR for implementation of NHP.
    3. Two no. state of art water quality laboratories are established at IRI Roorkee and Damuadunga, Haldwani.

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(1) HYDRAULIC RESEARCH UNIT – I

Hydraulic Research Unit – I mainly deals with the model studies for river training and flood protection works, siting of bridges, barrages, head regulators, silt ejectors and excluders, energy dissipaters and pump canals. Its workstation is situated at Bahadrabad. Important studies carried out by this Unit during the year are as follows:

(For Year 2016-17)

Sl. No.	R.R. No.	TITLE OF REPORT
(1)	87 RR (H_1-01)	Physical Model Studies for Observing Flow Behaviour of Kachchh Branch Canal SHP-1 at Ch. 20670 m (Gujarat).
(2)	87 RR (H_1-02)	Model Studies for Inlet-Outlet of Tehri Pumped Storage Plant Project (Uttarakhand).
(3)	87 RR (H_1-03)	Comprehensive model studies of Kanhar dam spillway (Distt. Sonbhadra U.P).
(4)	87 RR (H_1-04)	Physical Model Studies for Observing Flow Behaviour of Kachchh Branch Canal SHP-1 at Ch. 40300 m (Gujarat).
(5)	87 RR (H_1-05)	Hydraulic Model Study to Ensure Availability of Water Throughout the year at Triveni Ghat, Rishikesh (Uttarakhand).
(6)	87 RR (H_1-06)	Model Studies for Erach Multipurpose Dam Project Lalitpur, Jhansi (U.P.).

Abstract of Technical Memorandums (Research Reports)

(1) Physical Model Studies for Observing Flow Behaviour of Kachchh Branch Canal SHP-1 at Ch. 20670 m (Gujarat)

87RR (H_1-01)

Hydraulic model studies were carried out for Kachchh Branch Canal (KBC) SHP-1 at Ch. 20670 m for observing flow behaviour of power channel at off-take, tail race channel at its confluence and its allied works on a geometrically similar 1:25 scale model. The studies indicate that inflow conditions at off-take and outflow conditions at confluence are expected to be smooth in proto. No surface swirls/ rotational flow were observed in front of intake in any condition of the test. An upsurge of maximum 0.7 m and downsurge of maximum 0.4 m were observed in transient condition: 100%-0% when a discharge of 220 cumec is allowed to pass through KBC and all three machines are running at full load i.e. 100%. A maximum time of 30 minutes was observed to damp out the surge. The maximum velocity of 1.80 m/sec was observed near off-take and 2.83 m/sec near confluence of tail race channel & KBC.

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Physical Model studies for head losses and flow pattern in the inlet/outlet of Tehri Pumped Storage Plant were conducted on a physical model built to a geometrical similar model scale of 1:20. On the basis of model test results an interim report was issued vide T.M. No. 85 R.R. (H101) in April 2014. The proposal letter on revised by the sponsor and was incorporated and tested on the model. Model tests did not indicate negative pressures in all the tested conditions under turbine as well as pump mode anywhere in TRT-3 and 4. The proposal was optimized against vortices at inlet structure and also to achieve adequate flow condition in turbine mode. The optimized proposal having vertical peirs in place of slanted

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(3) Comprehensive Model studies of Kanhar dam spillway Distt. Sonbhadra (U.P).

87RR (H_t-03)

Hydraulic Physical Model studies were conducted on a distorted comprehensive model built to 1:100 horizontal scale and 1:60 vertical scale (discharge scale 1:46475.8) for Kanhar dam Spillway of Kanhar Dam Project, Distt. Sonbhadra, Uttar Pradesh. After model studies it is found that the hydraulic behavior of proposed wing wall is satisfactory. In free flow condition, when minimum 10% gates (02 nos.) are inoperative, a maximum length of trajectory is observed as 80.0m from end of bucket at 21861 cumec discharge and maximum height of trajectory is 23.5m from river bed while length

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List of Test Reports of Hydraulic Research Unit-I: (For Year 2016-17)

Various Studies were carried out during the year are:

Sl. No.	Title of the Report	TM No.
1	Quality control works of renovation works of Rishikesh Railway Feeder Road and Rishikesh Bhaniyawala Road in Rishikesh with Bituminous Concrete at plant and site.	TM No. 86 - TR {(H1-11)(100-I1)}
2		TM No. 87 - TR {(H1-11)(100-I2)}
3		TM No. 87 - TR {(H1-11)(100-F)}
4		TM No. 87 - TR {(H1-11)(99-I1)}
5		TM No. 87 - TR {(H1-11)(99-I1)}
6		TM No. 87- TR {(H1-11)(99-I1)}
7	Renovation work of Jamalpur Jiyapota motor road by Bituminous Concrete in Haridwar.	TM No. 87 - TR {(H1-11)(67-I4)}
8		TM No. 87 - TR {(H1-11)(67-I5)}
9	California Bearing Ratio (CBR) test for road construction work form village Kalewala to Uttar Pradesh border via Ladhewala in Jwalapur, Haridwar.	TM No. 87 - TR {(H1-13)
10	Quality Control Works of Renovation work of Motichoor Railway feeder Road with Interlocking Tiles in Haridwar.	TM No. 87 - TR {(H1-10)(98-I2)}
11	Testing of Construction work of I T Park Industrial Area Dehradun.	TM No. 87 - TR {(H1-01)
12	Testing of Interlocking Tiles	TM No. 87 - TR {(H1-02)

For Year 2017-18

Various Studies were carried out during the year are:

Sl. No.	R.R. No.	TITLE OF REPORT
(1)	88 RR (H_1-01)	Physical Model Studies for Proposed Earthen Bund along the River Ganga at Allahabad
(2)	88 RR (H_1-03)	Final Report on Further Physical Model Study for Flow Conditions of Kachchh Branch Canal SHP-2 at Ch. 40300 m.

(1) Physical Model Studies for Observing Flow Behaviour of Kachchh Branch Canal SHP-1 at Ch. 20670 m (Gujarat)

87RR (H_t-01)

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Various Studies were carried out during the year are:

Sl. No.	R.R. No.	TITLE OF REPORT
(1)	87 RR (H_2-01)	Hydraulic model studies for syphon aqueduct at Km. 23.950 of Rapti Main Canal –Bhaisahi Drain (UP).
(2)	87 RR (H_2-02)	Model studies for syphon aqueduct at Km14.600 of Rapti Main Canal –Bhakhla Drain (UP).
(3)	87 RR (H_2-03)	Model Study for Desilting Chamber of Rammam-III Hydro-Electric Project (3X40 MW) Darjeeling, West Bengal.
(4)	87 RR (H_2-04)	Hydraulic model studies for syphon aqueduct at Km. 30.750 of Rapti Main

Abstract of Technical Memorandums (Research Reports)

220 cumec is allowed to pass through KBC and all three machines are running at full load i.e. 100%. A maximum time of 30 minutes was observed to damp out the surge. The maximum velocity of 1.80 m/sec was observed near off-take and 2.83 m/sec near confluence of tail race channel & KBC.

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(2) Physical Model Studies for Inlet-Outlet of

(For Year 2017-18)

Various studies were carried out by this Unit during the year are as follows:

Sl. No.	R.R. No.	TITLE OF REPORT
(1)	88 RR (H_2-01)	Hydraulic Model Studies for Surge Shaft of Lower Kopili Hydro Electric Project - 120 MW (Assam).
(2)	88 RR (H_2-02)	Flume Model Studies of Luhri Hydroelectric Project (Stage-I), Himachal Pradesh.
(3)	88 RR (H_2-03)	Hydraulic Model Studies for 120 MW Lower Kopili Hydro Electric Project (Assam).
(4)	88 RR (H_2-04)	Model studies for Diversion Tunnel of Demwe Lower HEP (Arunachal Pradesh).
(5)	88 RR (H_2-05)	Compilation and Analysis of Observations Recorded at Meteorological Observatory, Hydraulics Research Unit-II, Bahadrabad during Year 2017.

Abstract of Technical Memorandums (Research Reports)

Tehri Pumped Storage Plant Project (Uttarakhand)

87RR (H_1-02)

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87RR (H_1-02)

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condition in turbine mode. The optimized proposal having vertical peirs in place of slanted piers, lowering of end weir from El. 601.0 to El. 598.0 and provision of anti vortex beams (4500X1500X500 mm^3) with top at El. 612.0 m. with the provision of these beams vortex/votices were not observed under any tet condition during pump mode. The head losses observed in different conditions are given in table 18 and 36. The TEL as observed on the model under different operating conditions of TRT 3 and TRT 4.

(3) Comprehensive Model studies of Kanhar dam spillway Distt. Sonbhadra (U.P).

(1) Physical Model Studies for Observing Flow Behaviour of Kachchh Branch Canal SHP-1 at Ch. 20670 m (Gujarat)

87RR (H_1-01)

Hydraulic model studies were carried out for Kachchh Branch Canal (KBC) SHP-1 at Ch. 20670 m for observing flow behaviour of power channel at off-take, tail race channel at its confluence and its allied works on a geometrically similar 1:25 scale model. The studies indicate that inflow conditions at off-take and outflow conditions at confluence are expected to be smooth in proto. No surface swirls/ rotational flow were observed in front of intake in any

condition of the test. An upsurge of maximum 0.7 m and downsurge of maximum 0.4 m were observed in transient condition: 100%-0% when a discharge of 220 cumec is allowed to pass through KBC and all three machines are running at full load i.e. 100%. A maximum time of 30 minutes was observed to damp out the surge. The maximum velocity of 1.80 m/sec was observed near off-take and 2.83 m/sec near confluence of tail race channel & KBC.

(2) Physical Model Studies for Inlet-Outlet of Tehri Pumped Storage Plant Project (Uttarakhand)

87RR (H_1-02)

Physical Model studies for head losses and flow pattern in the inlet/outlet of Tehri Pumped Storage Plant were conducted on a physical model built to a geometrical similar model scale of 1:20. On the basis of model test results an interim report was issued vide T.M. No. 85 R.R. (H101) in April 2014. The proposal letter on revised by the sponsor and was incorporated and tested on the model. Model tests did not indicate negative pressures in all the tested conditions under turbine as well as pump mode anywhere in TRT-3 and 4.

The proposal was optimized against vortices at inlet structure and also to achieve adequate flow condition in turbine mode. The optimized proposal having vertical peirs in place of slanted piers, lowering of end weir from El. 601.0 to El. 598.0 and provision of anti vortex beams (4500X1500X500 mm^3) with top at El. 612.0 m. with the provision of these beams vortex/votices were not observed under any tet condition during pump mode. The head losses observed in different conditions are given in table 18 and 36. The TEL as observed on the model under different operating conditions of TRT 3 and TRT 4.

(3) Comprehensive Model studies of Kanhar dam spillway Distt. Sonbhadra (U.P).

87RR (H_1-03)

Hydraulic Physical Model studies were conducted on a distorted comprehensive model built to 1:100 horizontal scale and 1:60 vertical scale (discharge scale 1:46475.8) for Kanhar dam Spillway of Kanhar Dam Project, Distt. Sonbhadra, Uttar Pradesh. After model studies it is found that the hydraulic behavior of proposed wing wall is satisfactory. In free flow condition, when minimum 10% gates (02 nos.) are inoperative, a maximum length of trajectory is observed as 80.0m from end of bucket

(1) Physical Model Studies for Observing Flow Behaviour of Kachchh Branch Canal SHP-1 at Ch. 20670 m (Gujarat)

87RR (H_1-01)

(For Year 2016-17)

Various Studies were carried out during the year are as follows:

Sl. No.	R.R. No.	TITLE OF REPORT
(1)	87 RR (H_3-02)	Physical Model studies for De-silting Arrangement of Teesta, H.E. Project, Stage-VI (Sikkim).
(2)	87 RR (H_3-03)	Model studies for Barrages of Teesta, H.E. Project, Stage-VI (Sikkim).
(3)	87 RR (H_3-04)	Model studies for rail cum Road Bridge at Bogibil across river Brahmaputra (Assam) on the basis of Post Flood 2015.
(4)	87 RR (H_3-05)	Model Studies for Siting of Rail Bridge across River Vyanatheya (Andhra Pradesh) on post flood 2014.
(5)	87 RR (H_3-06)	Model Studies for Siting of Rail Bridge across River Gowthami (Andhra Pradesh) on post flood 2014.
(6)	87 RR (H_3-07)	Model Studies for Siting of Rail Bridge across River Vasistha (Andhra Pradesh) on post flood 2014.

Abstract of Technical Memorandums (Research Reports)

Hydraulic model studies were carried out for Kachchh Branch Canal (KBC) SHP-1 at Ch. 20670 m for observing flow behaviour of power channel at off-take, tail race channel at its confluence and its allied works on a geometrically similar 1:25 scale model. The studies indicate that inflow conditions at off-take and outflow conditions at confluence are expected to be smooth in proto. No surface swirls/ rotational flow were observed in front of intake in any condition of the test. An upsurge of maximum 0.7 m and downsurge of maximum 0.4 m were observed in transient condition: 100%-0% when a discharge of 220 cumec is allowed to pass through KBC and all three machines are running at full load i.e. 100%. A maximum time of 30 minutes was observed to damp out the surge. The maximum velocity of 1.80 m/sec was observed near off-take and 2.83 m/sec near confluence of tail race channel & KBC.

(2) Physical Model Studies for Inlet-Outlet of Tehri Pumped Storage Plant Project (Uttarakhand)

87RR (H_1-02)

Physical Model studies for head losses and flow pattern in the inlet/outlet of Tehri Pumped Storage Plant were conducted on a physical model built to

a geometrical similar model scale of 1:20. On the basis of model test results an interim report was issued vide T.M. No. 85 R.R. (H101) in April

(1) Physical Model Studies for Observing Flow Behaviour of Kachchh Branch Canal SHP-1 at Ch. 20670 m (Gujarat)

87RR (H_1-01)

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was observed to damp out the surge. The maximum velocity of 1.80 m/sec was observed near off-take and 2.83 m/sec near confluence of tail race channel & KBC.

(2) Physical Model Studies for Inlet-Outlet of Tehri Pumped Storage Plant Project (Uttarakhand)

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(3) Comprehensive Model studies of Kanhar dam spillway Distt. Sonbhadra (U.P).

87RR (H_1-03)

Hydraulic Physical Model studies were conducted on a distorted comprehensive model

built to 1:100 horizontal scale and 1:60 vertical scale (discharge scale 1:46475.8) for Kanhar dam Spillway of Kanhar Dam Project, Distt. Sonbhadra, Uttar Pradesh. After model studies it is found that the hydraulic behavior of proposed wing wall is satisfactory. In free flow condition, when minimum 10% gates (02 nos.) are inoperative, a maximum length of trajectory is

(1) Physical Model Studies for Observing Flow Behaviour of Kachchh Branch Canal SHP-1 at Ch. 20670 m (Gujarat)

87RR (H_1-01)

Hydraulic model studies were carried out for Kachchh Branch Canal (KBC) SHP-1 at Ch. 20670 m for observing flow behaviour of power channel at off-take, tail race channel at its confluence and its allied works on a geometrically similar 1:25 scale model. The studies indicate that inflow conditions at off-take and outflow conditions at confluence are expected to be smooth in proto. No surface swirls/ rotational flow were observed in front of intake in any condition of the test. An upsurge of maximum 0.7 m and downsurge of maximum 0.4 m were observed in transient condition: 100%-0% when a discharge of 220 cumec is allowed to pass through KBC and all three machines are running at full

load i.e. 100%. A maximum time of 30 minutes was observed to damp out the surge. The maximum velocity of 1.80 m/sec was observed near off-take and 2.83 m/sec near confluence of tail race channel & KBC.

(2) Physical Model Studies for Inlet-Outlet of Tehri Pumped Storage Plant Project (Uttarakhand)

87RR (H_1-02)

Physical Model studies for head losses and flow pattern in the inlet/outlet of Tehri Pumped Storage Plant were conducted on a physical model built to a geometrical similar model scale of 1:20. On the basis of model test results an interim report was issued vide T.M. No. 85 R.R. (H101) in April 2014. The proposal letter on revised by the sponsor and was incorporated and tested on the model. Model tests did not indicate negative pressures in all the tested conditions under turbine as well as pump mode anywhere in TRT-3 and 4. The proposal was optimized against vortices at inlet structure and also to achieve adequate flow condition in turbine mode. The optimized proposal having vertical peirs in place of slanted piers, lowering of end weir from El. 601.0 to El. 598.0 and provision of anti vortex beams (4500X1500X500 mm^3) with top at El. 612.0 m. with the provision of these beams vortex/votices were not observed under any tet condition during pump mode. The head losses observed in different conditions are given in table 18 and 36. The TEL as observed on the model under different operating conditions of TRT 3 and TRT 4.

(3) Comprehensive Model studies of Kanhar dam spillway Distt. Sonbhadra (U.P).

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(1) Physical Model Studies for Observing Flow Behaviour of Kachchh Branch Canal SHP-1 at Ch. 20670 m (Gujarat)

87RR (H_1-01)

Hydraulic model studies were carried out for Kachchh Branch Canal (KBC) SHP-1 at Ch. 20670 m for observing flow behaviour of power channel at off-take, tail race channel at its confluence and its allied works on a geometrically similar 1:25 scale model. The studies indicate that inflow conditions at off-take and outflow conditions at confluence are expected to be smooth in proto. No surface swirls/ rotational flow were observed in front of intake in any condition of the test. An upsurge of maximum 0.7 m and downsurge of maximum 0.4 m were observed in transient condition: 100%-0% when a discharge of 220 cumec is allowed to pass through KBC and all three machines are running at full load i.e. 100%. A maximum time of 30 minutes was observed to damp out the surge. The maximum velocity of 1.80 m/sec was observed near off-take and 2.83 m/sec near confluence of tail race channel & KBC.

(2) Physical Model Studies for Inlet-Outlet of Tehri Pumped Storage Plant Project (Uttarakhand)

87RR (H_1-02)

Physical Model studies for head losses and flow pattern in the inlet/outlet of Tehri Pumped Storage Plant were conducted on a physical model built to a geometrical similar model scale of 1:20. On the

basis of model test results an interim report was issued vide T.M. No. 85 R.R. (H101) in April 2014. The proposal letter on revised by the sponsor and was incorporated and tested on the model. Model tests did not indicate negative

(For Year 2017-18)

Various Studies were carried out during the year are as follows:

Sl. No.	R.R. No.	TITLE OF REPORT
(1)	88 RR (H_3-02)	Model study for Reservoir sedimentation and flushing of Lata Tapovan HEP across river Dhauliganga in distt. Chamoli.
(2)	88 RR (H_3-03)	Model Studies for rail cum road Bridge at Bogibil across river Brahmaputra (Assam) on the basis of Post Flood 2016.
(3)	88 RR (H_3-04)	Model Studies for performance of Stilling Basin & Reservoir flushing of Teesta H.E.P., Stage-VI (500 MW) Sikkim.
(4)	88 RR (H_3-05)	Hydraulic Model study for composite model of power intake & Desilting chamber of Naitwar Mori H.E.P., Distt. Uttarakashi (Uttarakhand).
(5)	88 RR (H_3-06)	Model Studies for Surge shaft of Naitwar Mori H.E.P. Distt. Uttrakakashi (Uttrakhand).

(1) Physical Model Studies for Observing Flow Behaviour of Kachchh Branch Canal SHP-1 at Ch. 20670 m (Gujarat)

87RR (H_1-01)

Hydraulic model studies were carried out for Kachchh Branch Canal (KBC) SHP-1 at Ch. 20670 m for observing flow behaviour of power channel at off-take, tail race channel at its confluence and its allied works on a geometrically similar 1:25 scale model. The studies indicate that inflow conditions at off-take

and outflow conditions at confluence are expected to be smooth in proto. No surface swirls/ rotational flow were observed in front of intake in any condition of the test. An upsurge of maximum 0.7 m and downsurge of maximum 0.4 m were observed in transient condition: 100%-0% when a discharge of 220 cumec is allowed to pass through KBC and all three machines are running at full load i.e. 100%. A maximum time of 30 minutes was observed to damp out the surge. The maximum velocity of 1.80 m/sec was observed near off-take and 2.83 m/sec near confluence of tail race channel & KBC.

(2) Physical Model Studies for Inlet-Outlet of Tehri Pumped Storage Plant Project (Uttarakhand)

87RR (H_1-02)

Physical Model studies for head losses and flow

pattern in the inlet/outlet of Tehri Pumped Storage Plant were conducted on a physical model built to a geometrical similar model scale of 1:20. On the basis of model test results an interim report was issued vide T.M. No. 85 R.R. (H101) in April 2014. The proposal letter on revised by the sponsor and was incorporated and tested on the model. Model tests did not indicate negative pressures in all the tested conditions under turbine as well as pump mode anywhere in TRT-3 and 4. The proposal was optimized against vortices at inlet structure and also to achieve adequate flow condition in turbine mode. The optimized proposal having vertical peirs in place of slanted piers, lowering of end weir from El. 601.0 to El. 598.0 and provision of anti vortex beams (4500X1500X500 mm^3) with top at El. 612.0 m. with the provision of these beams vortex/votices were not observed under any tet condition during pump mode. The head losses observed in different conditions are given in table 18 and 36. The TEL as observed on the model under different operating conditions of TRT 3 and TRT 4.

(3) Comprehensive Model studies of Kanhar dam spillway Distt. Sonbhadra (U.P).

87RR (H_1-03)

Hydraulic Physical Model studies were

(1) Physical Model Studies for Observing Flow Behaviour of Kachchh Branch Canal SHP-1 at Ch. 20670 m (Gujarat)

87RR (H_1-01)

Hydraulic model studies were carried out for Kachchh Branch Canal (KBC) SHP-1 at Ch. 20670 m for observing flow behaviour of power channel at off-take, tail race channel at its confluence and its allied works on a geometrically similar 1:25 scale model. The studies indicate that inflow conditions at off-take and outflow conditions at confluence are expected to be smooth in proto. No surface swirls/ rotational flow were observed in front of intake in any condition of the test. An upsurge of maximum 0.7 m and downsurge of maximum 0.4 m were observed in transient condition: 100%-0% when a discharge of 220 cumec is allowed to pass through KBC and all three machines are running at full

load i.e. 100%. A maximum time of 30 minutes was observed to damp out the surge. The maximum velocity of 1.80 m/sec was observed near off-take and 2.83 m/sec near confluence of tail race channel & KBC.

(2) Physical Model Studies for Inlet-Outlet of Tehri Pumped Storage Plant Project (Uttarakhand)

87RR (H_1-02)

Physical Model studies for head losses and flow pattern in the inlet/outlet of Tehri Pumped Storage Plant were conducted on a physical model built to a geometrical similar model scale of 1:20. On the basis of model test results an interim report was issued vide T.M. No. 85 R.R. (H101) in April 2014. The proposal letter on revised by the sponsor and was incorporated and tested on the model. Model tests did not indicate negative pressures in all the tested conditions under turbine as well as pump mode anywhere in TRT-3 and 4.

The proposal was optimized against vortices at inlet structure and also to achieve adequate flow condition in turbine mode. The optimized proposal having vertical peirs in place of slanted piers, lowering of end weir from El. 601.0 to El. 598.0 and provision of anti vortex beams (4500X1500X500 mm^3) with top at El. 612.0 m. with the provision of these beams vortex/votices were not observed under any tet condition during pump mode. The head losses observed in different conditions are given in table 18 and 36. The TEL as observed on the model under different operating conditions of TRT 3 and TRT 4.

(3) Comprehensive Model studies of Kanhar dam spillway Distt. Sonbhadra (U.P).

87RR (H_1-03)

(1) Physical Model Studies for Observing Flow Behaviour of Kachchh Branch Canal SHP-1 at Ch. 20670 m (Gujarat)

87RR (H_1-01)

Hydraulic model studies were carried out for Kachchh Branch Canal (KBC) SHP-1 at Ch. 20670 m for observing flow behaviour of power channel at off-take, tail race channel at its confluence and its allied works on a geometrically similar 1:25 scale model. The studies indicate that inflow conditions at off-take and outflow conditions at confluence are expected to be smooth in proto. No surface swirls/ rotational flow were observed in front of intake in any condition of the test. An upsurge of maximum 0.7 m and downsurge of maximum 0.4 m were observed in transient condition: 100%-0% when a discharge of 220 cumec is allowed to pass through KBC and all three machines are running at full load i.e. 100%. A maximum time of 30 minutes was observed to damp out the surge. The maximum velocity of 1.80 m/sec was observed near off-take and 2.83 m/sec near confluence of tail race channel & KBC.

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View of EHDA Laboratory

(For Year 2016-17)

Various studies were carried out during the year are:

Sl. No.	R.R. No	TITLE OF REPORT
(1)	87 RR (GW_2-02)	Hydraulic Performance of Pressure Release Value.

Abstract of Technical Memorandums (Research Reports)

(1) Hydraulic performance of pressure release value.

87RR (GW_2-02)

PVC Pressure Release Valve "OMMA" Brand-make was received from M/s Shankarnarayana Construction (P) Limited for testing their hydraulic performance. The test results are PRV adheres well to prevent the back leakage. However it is suggested that the design can be improved further by decreasing the space between interlocking grooves.

(For Year 2017-18)

Various studies were carried out during the year are :

Sl. No.	R.R. No	TITLE OF REPORT
(1)	88 RR (GW_2-02)	Hydraulic Performance of Pressure Release Value.
(2)	88 RR (GW_2-03)	Hydraulic Performance of Pressure Release Value.
(3)	88 RR (GW_2-04)	Hydraulic Performance of Pressure Release Value.

Abstract of Technical Memorandums (Research Reports)

(1) Hydraulic performance of pressure release value.

88RR (GW_2-02)

PVC Pressure Release Valve "OMMA" Brand-make was received from M/s Capital United International LLC, Muscat, Oman for testing their hydraulic performance. The test results are shown in Table No. 1 and 2. The sensitivity and discharging capacity parameters seems prominent and far better. The PRV adheres well to prevent the back leakage.

(2) Hydraulic performance of pressure release value.

88RR (GW_2-03)

PVC Pressure Release Valve "OMMA" Brand-make was received from THDC INDIA LIMITED (A Joint Venture of Govt. of India and Govt. of UP) Dhukwan SHEP, Near Sukwan-Dhukwan Dam, Babina, Jhansi (UP)-284401 for testing their hydraulic performance. The test results are shown in Table No. 1 and 2. The sensitivity and discharging capacity parameters seems prominent and far better. The PRV adheres well to prevent the back leakage.

(3) Hydraulic performance of pressure release value.

88RR (GW_2-04)

PVC Pressure Release Valve "OMMA" make was received from M/s Delta Mechcons (I) Limited, 1x660 MW Harduaganj Thermal Power Station Extension-II, Harduaganj, Aligarh (U.P.) for testing the hydraulic performance. The test results of Pressure Release Valve for testing Sensitivity, Discharge Capacity and Back-Leakage are obtained.

(6) BASIC RESEARCH UNIT

(i) Sub Unit-I (Computer Centre)

Basic Research Unit is, generally, responsible for the maintenance of Computer Center of the Institute, organizing computer courses for officers and staff of Irrigation Department. In addition, the division has facility to measure discharge in lined / unlined canals. Presently many computers and peripherals devices are available in the computer center to meet the present day challenges. The computer Centre has also facilities for A_0 size digital scanner and colored printer.

(1) Hydraulic performance of pressure release value.

88RR (GW_2-02)

PVC Pressure Release Valve "OMMA" Brand- make was received from M/s Capital United International LLC, Muscat, Oman for testing their hydraulic performance. The test results are shown in Table No. 1 and 2. The sensitivity and discharging capacity parameters seems prominent and far better. The PRV adheres well to prevent the back leakage.

(2) Hydraulic performance of pressure release value.

88RR (GW_2-03)

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(3) Hydraulic performance of pressure release value.

88RR (GW_2-04)

PVC Pressure Release Valve "OMMA" make was received from M/s Delta Mechcons (I) Limited, 1x660 MW Harduaganj Thermal Power Station Extension-II, Harduaganj, Aligarh (U.P.) for testing the hydraulic performance. The test results of Pressure Release Valve for testing Sensitivity, Discharge Capacity and Back-Leakage are obtained.

(6) BASIC RESEARCH UNIT

(i) Sub Unit-I (Computer Centre)

Basic Research Unit is, generally, responsible for the maintenance of Computer Center of the Institute,

(1) Hydraulic performance of pressure release value.

88RR (GW_2-02)

PVC Pressure Release Valve "OMMA" Brand- make was received from M/s Capital United International LLC, Muscat, Oman for testing their hydraulic performance. The test results are shown in Table No. 1 and 2. The sensitivity and discharging capacity parameters seems prominent and far better. The PRV adheres well to prevent the back leakage.

(2) Hydraulic performance of pressure release value.

Core Cutting of Bituminous Pavement

Quality Control Works of Roads in Haridwar

For (Year 2016-17)

Various studies were carried out by this division during the year are:-

Sl.No.	R.R. No.	TITLE OF REPORT
(1)	87 RR (B_1 - 02)	Capacity Survey of Haripura Reservoir.

Abstract of Technical Memorandums (Research Reports)

(1) Capacity Survey of Haripura Reservoir.

87 RR (B_1-02)

In the year 1967 an earthen dam was constructed on the river Bhakhra, Khazia & Nihal, a tributary of river Ram Ganga & a reservoir thus formed for increasing irrigation capacity of district Udham Singh Nagar of Uttarakhand state. The design capacity of the reservoir is 28.32 MCM at an elevation 242.32m, (1000.00 MCF at an elevation 795.00F) dead storage capacity is 0.72 MCM at an elevation 236.22m (25.50 MCF at an elevation775.00F) and the live storage capacity of the reservoir is 27.60 MCM (974.50 MCF).Capacity survey of this reservoir after monsoon period of the year 2015 was referred to I.R.I.Roorkee. The capacity survey results show

that the present capacity of reservoir is 17.71

(1) Capacity Survey of Haripura Reservoir.

87 RR (B_1-02)

In the year 1967 an earthen dam was constructed on the river Bhakhra, Khazia & Nihal, a tributary of river Ram Ganga & a reservoir thus formed for increasing irrigation capacity of district Udham Singh Nagar of Uttarakhand state. The design capacity of the reservoir is 28.32 MCM at an elevation 242.32m, (1000.00 MCF at an elevation 795.00F) dead storage capacity is 0.72 MCM at an elevation 236.22m (25.50 MCF at an elevation775.00F) and the live storage capacity of the reservoir is 27.60 MCM (974.50 MCF).Capacity survey of this reservoir after monsoon period of the year 2015 was referred to I.R.I.Roorkee. The capacity survey results show that the present capacity of reservoir is 17.71 MCM at an elevation 242.32 m (625.43 MCF at an elevation 795.00F), dead storage capacity is 0.20 MCM at an elevation 236.22m (6.99 MCF at an elevation 775.00F) and the live storage capacity is 17.51 MCM (618.44 MCF).The storage capacity has been decreasing at a rate 8.79 ha-m/100sq.km/year by sediment deposition. Total reduction in capacity of reservoir comes out 37.46% (10.61 MCM or 374.57 MCF) in 41 years of its operation.

List of Test Report of Highway Laboratory : (For Year 2017-18)

Various Studies were carried out during the year are:

Sl. No.	Title of the Report	T.M. No.
1	Construction works of Sitapur Jamalpur kalan Jiyapota Motor Road	87-TR(B-02)
2	Compressive Strength of CC Cores of Dobra- Chanthi Suspension Bridge in Tehri Garhwal, Uttarakhand	88-TR(B-01)
3	Construction Work of Air Strip in Chinyalisaur (Uttarkashi)	88-TR(B-02)
4	Construction Works of Dhakrani Canal Bypass Service Road in Vikasnagar (Dehradun)	88-TR(B-03)

(7) MATERIAL TESTING UNIT – I

The Material Testing Unit – I deals with the study of design of concrete mix including roller compacted concrete, high performance concrete and fiber reinforced concrete for construction of dams and other structures. This division mainly deals in the following areas:-

(i) Design of concrete mix including roller compacted concrete, high performance concrete and fiber reinforced concrete for construction of dams and other structures.

(ii) Statistical laboratory is engaged in performing the statistical analysis of hydro-meteorological data.

(iii)Laboratory tests for determining the suitability of physical properties of different types of construction materials.

(a) Coarse and Fine aggregate i.e. sieve analysis, specific gravity, crushing value, impact value, soundness, flakiness index, elongation index and abrasion value etc.

(1) Capacity Survey of Haripura Reservoir.

87 RR (B_1-02)

In the year 1967 an earthen dam was constructed on the river Bhakhra, Khazia & Nihal, a tributary of river Ram Ganga & a reservoir thus formed for increasing irrigation capacity of district Udham Singh Nagar of Uttarakhand state. The design capacity of the reservoir is 28.32 MCM at an elevation 242.32m, (1000.00 MCF at an elevation 795.00F) dead storage capacity is 0.72 MCM at an elevation 236.22m (25.50 MCF at an elevation775.00F) and the live storage capacity of the reservoir is 27.60 MCM (974.50 MCF).Capacity survey of this reservoir after monsoon period of the year 2015 was referred to I.R.I.Roorkee. The capacity survey results show that the present capacity of reservoir is 17.71 MCM at an elevation 242.32 m (625.43 MCF at an elevation 795.00F), dead storage capacity is 0.20 MCM at an elevation 236.22m (6.99 MCF at an elevation 775.00F) and the live storage capacity is 17.51 MCM (618.44 MCF).The storage capacity has been decreasing at a rate 8.79 ha-m/100sq.km/year by sediment deposition. Total reduction in capacity of reservoir comes out 37.46% (10.61 MCM or 374.57 MCF) in 41 years of its operation.

(7) MATERIAL TESTING UNIT – I

The Material Testing Unit – I deals with the study of design of concrete mix including roller compacted

Abstract of Technical Memorandums (Research Reports)

(1) Design of Concrete Mix for 75 KLD & 150 KLD Capacity Sewage Treatment Plant at Devprayag, (Uttarakhand).

87RR (MT_1-01)

This study was sponsored to design the concrete mixes for the concrete grades $A_{20}M_{30}$ at slump (100±10) mm on the basis of 28 compressive strength for 75 KLD & 150 KLD Capacity Sewage Treatment Plant at Devprayag, Uttarakhand by Project Manager, Construction & Maintenance Unit (Ganga), Uttarakhand Peyjal Nigam, Srinagar, Garhwal. Study of concrete mix design for above grade of concrete was carried out on 150mm size cube specimen. Ordinary Portland Cement43-grade (Ultratech Cement), Coarse Aggregate (Crushed), Fine Aggregate (Crushed) and High-Performance Admixture *Muraplast FK 61* were used in the study of concrete mix design.

(2) Design of Concrete Mix for 65m & 45m Span RCC Bridges at Didihat, (Pithoragarh).

87RR (MT_1-02)

This study was sponsored to design the concrete mixes for the concrete grades $A_{20}M_{35}$ at slump (100±5) mm on the basis of 28 compressive strength for 65m & 45m span RCC bridges at Didihat, Pithoragarh by Executive Engineer, Rural Works Department, PMGSY, Didihat, Pithoragarh. Study of concrete mix design for above grade of concrete was carried out on 150mm size cube specimen. Ordinary Portland cement, 43-grade (Birla Uttam Cement), Coarse Aggregate (Crushed), Fine Aggregate (Crushed) and High-Performance, High Range Water Reducing & Retarding Admixture *Conplast SP430G8* were used in the study of concrete mix design.

(3) Design of Concrete Mix for Providing, Laying, Joining, Testing & Commissioning of Sewer Network including replacement of existing Sewer in Roorkee Town.

87RR (MT_1-03)

This study was sponsored to design the concrete mixes for the concrete grades $A_{20}M_{20}$ at slump (50±5) mm on the basis of 28 compressive strength for Providing, Laying, Joining, Testing & Commissioning of Sewer Network including replacement of existing Sewer in Roorkee Town by Project In-charge, Bhugan Infracon Pvt. Ltd., C-1, Ugati Lakeview Flats, Nr. AUDA Lake, Science City Road, Sola, Ahmedabad. Study of concrete mix design for above grade of concrete

(1) Design of Concrete Mix for 75 KLD & 150 KLD Capacity Sewage Treatment Plant at Devprayag, (Uttarakhand).

87RR (MT_1-01)

This study was sponsored to design the concrete mixes for the concrete grades $A_{20}M_{30}$ at slump (100±10) mm on the basis of 28 compressive strength for 75 KLD & 150 KLD Capacity Sewage Treatment Plant at Devprayag, Uttarakhand by Project Manager, Construction & Maintenance Unit (Ganga), Uttarakhand Peyjal Nigam, Srinagar, Garhwal. Study of concrete mix design for above grade of concrete was carried out on 150mm size cube specimen. Ordinary Portland Cement43-grade (Ultratech Cement), Coarse Aggregate (Crushed), Fine Aggregate (Crushed) and High-Performance Admixture *Muraplast FK 61* were used in the study of concrete mix design.

(2) Design of Concrete Mix for 65m & 45m Span RCC Bridges at Didihat, (Pithoragarh).

87RR (MT_1-02)

This study was sponsored to design the concrete mixes for the concrete grades $A_{20}M_{35}$ at slump (100±5) mm on the basis of 28 compressive strength for 65m & 45m span RCC bridges at Didihat, Pithoragarh by Executive Engineer, Rural Works Department, PMGSY, Didihat, Pithoragarh. Study of concrete mix design for above grade of concrete was carried out on 150mm size cube specimen. Ordinary Portland cement, 43-grade (Birla Uttam Cement), Coarse Aggregate (Crushed), Fine Aggregate (Crushed) and High-Performance, High Range Water Reducing & Retarding Admixture *Conplast SP430G8* were used in the study of concrete mix design.

(3) Design of Concrete Mix for Providing, Laying, Joining, Testing & Commissioning of Sewer Network including replacement of existing Sewer in Roorkee Town.

87RR (MT_1-03)

This study was sponsored to design the concrete mixes for the concrete grades $A_{20}M_{20}$ at slump (50±5) mm on the basis of 28 compressive strength for Providing, Laying, Joining, Testing & Commissioning of Sewer Network including replacement of existing Sewer in Roorkee Town by Project In-charge, Bhugan Infracon Pvt. Ltd., C-1, Ugati Lakeview Flats, Nr. AUDA Lake, Science City Road, Sola, Ahmedabad. Study of concrete mix design for above grade of concrete was carried out on 150mm size cube specimen. Ordinary Portland cement, 43-grade (ACC Cement), Corse Aggregate (Crushed), Fine Aggregate (Crushed) were used in the study of concrete mix design.

(4) Design of Concrete Mix for Providing, Laying, Joining, Testing & Commissioning of Sewer Network including replacement of existing Sewer in Roorkee Town.

87RR (MT_1-04)

This study was sponsored to design the concrete mixes for the concrete grades $A_{20}M_{20}$ at slump (50±5) mm on the basis of 28 compressive strength for Providing, Laying, Joining, Testing & Commissioning of Sewer Network including replacement of existing Sewer in Roorkee Town by Project In-charge, Bhugan Infracon Pvt. Ltd., C-1, Ugati Lakeview Flats, Nr. AUDA Lake, Science City Road, Sola, Ahmedabad. Study of concrete mix design for above grade of concrete was carried out on 150mm size cube specimen. Ordinary Portland Cement, 43-grade (Ultratech cement), Coarse Aggregate (Crushed), Fine Aggregate (Crushed) were used in the study of concrete mix design.

(5) Design of Concrete Mix for Providing, Laying, Joining, Testing & Commissioning of Sewer Network including replacement of existing Sewer in Roorkee Town.

87RR (MT_1-05)

This study was sponsored to design the concrete mixes for the concrete grades $A_{20}M_{20}$ at slump (50±5) mm on the basis of 28 compressive strength for Providing, Laying, Joining, Testing & Commissioning of Sewer Network including replacement of existing Sewer in Roorkee Town

List of Test Reports of Material Testing Unit-I:

Various Studies were carried out during the year are:

Sl.No.	Title of Test Report	TM No.
1.	Physical properties of cement sample received from Construction & Maintenance Unit (Ganga). Uttarakhand Pay Jal Nigam, Srinagar.	87-TR(MT_1-01)
2.	Testing of bricks received from T. P. H. Division-2, Dehradun.	87-TR(MT_1-02)
3.	Testing of materials for Laying of Rising Main Rodibelwala I Well to Brampuri C.W.R in Haridwar under AKM-16..	87-TR(MT_1-03I_1)
4.	Testing of materials for Maintenance works of Bridges in Haridwar under AKM-2016.	87-TR(MT_1-04F)
5.	Testing of c. c. cubes received from Nagar Panchayat Lakshar.	87-TR(MT_1-05)
6.	Repair of Sarswati Nala at Triveni Ghat, Rishikesh under AKM-2016.	87-TR(MT_1-06)
7.	Bus parking khara sharot bypass marg, Rishikesh under AKM-2016.	87-TR(MT_1-07)
8.	Testing of material for Bus parking khara sharot bypass marg, Rishikesh under AKM-2016.	87-TR(MT_1-07I_3)
9.	Providing Peyjal in Motichoor, Saptsarover & Bhupatwala Sectors under AKM-2016.	87-TR(MT_1-08)
10.	Providing Peyjal in Haridwar & Jwalapur Sectors under AKM-2016..	87-TR(MT_1-09)
11.	Providing Peyjal in Rodi, Mansa Devi & Har ki Paudi Sectors under AKM-2016.	87-TR(MT_1-10)
12.	Providing Peyjal in Bahadrabad Sectors under AKM-2016.	87-TR(MT_1-11)
13.	Providing Peyjal in Kankhal Sectors under AKM-2016.	87-TR(MT_1-12)
14.	Providing Peyjal in Mayapur Sectors under AKM-2016.	87-TR(MT_1-13)
15.	Construction of Infilteration Well at Gauri Shankar Dweep, Haridwar under AKM-2016.	87-TR(MT_1-14)
16.	Final Status Report for Laying & Joining of Rising Main and Construction of Pump House for Dheerwali Parking under AKM-2016.	87-TR(MT_1-15)
17.	Final Status Report for Rising Main from Infiltratiom Well Muni Ki Reti to Vithal Ashram C.W.R Rishikesh under AKM-2016.	87-TR(MT_1-16)
18.	Replacement of Out Fall Gravity Sewer 600mm dia.D.I.K-9 Pipe from Master Manhole near Petrol Pump to Koyal Grand on Rishikesh-Haridwar Road under AKM-2016.	87-TR(MT_1-17)
19.	Construction of Repeater Centre at Anjnamai Mandir, Haridwar under AKM-2016.	87-TR(MT_1-18)
20.	Construction of Transit Camp/Barrack for CPMF at Ranipur, Haridwar under AKM-2016.	87-TR(MT_1-19)

Sl.No.	Title of Test Report	TM No.
21.	Construction of Briefing Hall Cum Training Centre at Haridwar under AKM-2016.	87-TR(MT_1-20)
22.	Construction of Pre-Fabricated Hut and Watch Tower in Haridwar under AKM-2016.	87-TR(MT_1-21)
23.	Construction of Barrack for 20 Jawans at Neelkanth Dham under AKM-2016.	87-TR(MT_1-22)
24.	Construction of 100-100 Bedded Barracks for Female & Male Police Jawans at Haridwar under AKM-2016.	87-TR(MT_1-23)
25.	Construction of Barrack for 25 Police Jawans at Mayapur, Haridwar under AKM-2016.	87-TR(MT_1-24)
26.	Construction of Mess block over Berrack at Dhalwala, Rishikesh under AKM-2016.	87-TR(MT_1-25)
27.	Construction of Berrack for 10 police Jawans at Bhadrakali Rishikesh under AKM-2016.	87-TR(MT_1-26)
28.	Construction of Stable block at Haridwar under AKM-2016.	87-TR(MT_1-27)
29.	Maintenance works of U.T.C. Bus Stand, Haridwar under AKM-2016.	87-TR(MT_1-28)
30.	Maintenance works of U.T.C. Bus Stand, Roorkee under AKM-2016.	87-TR(MT_1-29)
31.	Maintenance works of C.C. Road from Tourist Bungalow to Union Bank in Ward no.2 under AKM-2016.	87-TR(MT_1-30)
32.	Maintenance works of C.C. Road from Kailash Gate to Ganga Resort under AKM-2016.	87-TR(MT_1-31)
33.	Maintenance works of C.C. Road from in Ward no. 2 from Premvarni Ashram to Rishikesh Heritage Ashram via Mateshwari Hospital under AKM-2016.	87-TR(MT_1-32)
34.	Final Status Report for maintenance works of C.C. Road from in Ward no. 2 from Laxman Jhula main road Cottage no. 84 to Ganga line main Road under AKM-2016.	87-TR(MT_1-33)
35.	Construction of C.C. Road from Laxman Jhula under AKM-2016.	87-TR(MT_1-34)
36.	Construction of C.C. Road from Laxman Jhula under AKM-2016.	87-TR(MT_1-35)
37.	Maintenance works of foot path from NH.74 to Chandi Devi Mandir, Haridwar under AKM-2016.	87-TR(MT_1-36)
38.	Maintenance works of foot path from kali Mandir to Chandi Devi Mandir, Haridwar under AKM-2016.	87-TR(MT_1-37)
39.	Testing of Steel bars, bricks and coarse & fine aggregate received from Unit 25 Construction & Design Services, U. P. Jal Nigam Ganga Jawahar Colony Aligarh.	87-TR(MT_1-38)
40.	Testing of c. c. cubes received from Construction Division, U. P. Jal Nigam, Hapur.	87-TR(MT_1-39)
41.	Testing of c. c. cubes received from Construction Division, U. P. Jal Nigam, Hapur.	87-TR(MT_1-40)
42.	Painting & Colouring of Pump House and OHT of Mela Area under AKM-2016.	87-TR(MT_1-41)

Sl.No.	Title of Test Report	TM No.
43.	Laying Rising Main and Distribution at Pandewali (Jwalapur) for Strengthing of Haridwar Water Supply under AKM-2016.	87-TR(MT_1-42)
44.	Maintenance Works of Hydrant and Chambers under AKM-2016.	87-TR(MT_1-43)
45.	Repair/ Replace of Pipe Line in Tapovan W/S Scheme under AKM-2016.	87-TR(MT_1-44)
46.	Repair/ Replace of Pipe Line at Yatra Bus Stand, Rishikesh under AKM-2016.	87-TR(MT_1-45)
47.	Providing & Fixing of Sluice Valves and Construction Chambers in Rishikesh under AKM-2016.	87-TR(MT_1-46)
48.	Maintenance & Painting of 34 Toilets in Haridwar under AKM-2016.	87-TR(MT_1-47)
49.	Maintenance & Painting of Pre- Constructed Toilets in Rishikesh under AKM-2016.	87-TR(MT_1-48)
50.	Levelling, Dressing and Demarcation Work etc.under AKM-2016.	87-TR(MT_1-49)
51.	Painting of CCR Tower Maintenanced Work of Lift under AKM-2016.	87-TR(MT_1-50)
52.	Laying & Joining of Rising Main Brahmpurri CWR from Rodibelwala Infiltration Well under AKM-2016.	87-TR(MT_1-51)
53.	Physical properties of cement sample received from Construction Wing, Uttrakhand. PeyJal Sanshadan Vikash and Nirman Nigam, Dehradun.	87-TR(MT_1-52)
54.	Testing of Steel bars, bricks and coarse & fine aggregate received from Construction Wing, Uttrakhand. PeyJal Sanshadan Vikash and Nirman Nigam, Dehradun.	87-TR(MT_1-53)
55.	Construction of Steel Girder Pile Bridge Upon Mayapur Escape Channel and Ganga River Between Daksh Dweep under AKM-2016.	87-TR(MT_1-54)
56.	Construction of 1.5 Lane Semi Permanent Steel Girder Bridge near Vishwa Kalyan Ashram in Haridwar under AKM-2016.	87-TR(MT_1-55)
57.	Construction of 1.5 Lane Semi Permanent Steel Girder Bridge near Jagjeetpur in Haridwar under AKM-2016.	87-TR(MT_1-56)
58.	Construction of 2l nos. Temporary Crate Bridges in Haridwar under AKM-2016.	87-TR(MT_1-57)
59.	Construction of Temporary Crate Bridge over Mayapur Escape Channel near Bastiram Pathshala at Bairagi Camp Haridwar under AKM-2016.	87-TR(MT_1-58)
60.	Construction of 01 no.Temporary Crate Bridge from Pantdweep Parking to Shamshan Ghat, in Haridwar under AKM-2016.	87-TR(MT_1-59)
61.	Construction of Media Platform at Har ki Paudi Malveya Dweep, Haridwar under AKM-2016.	87-TR(MT_1-60)
62.	Testing of Steel bars and coarse & fine aggregate received from Urban Works Unit, U.P. Jal Nigam, Muzaffarnagar.	87-TR(MT_1-61)
63.	Testing of Steel bars, bricks and coarse & fine aggregate received from Construction Unit, Uttrakhand. PeyJal Sanshadan Vikash and Nirman Nigam, Rishikesh.	87-TR(MT_1-62)

Sl.No.	Title of Test Report	TM No.
64.	Testing of c. c. cubes received from Construction & Maintenance Unit (Ganga). Uttarakhand Pay Jal Nigam, Srinagar.	87-TR(MT_1-63)
65.	Testing of coarse aggregate received from Construction & Maintenance Unit (Ganga). Uttarakhand Pay Jal Nigam, Srinagar.	87-TR(MT_1-64)
66.	Testing of material for repair of Permanent C. C. & E.M.D marg Panthdeep Sector, Haridwar under AKM-16	87-TR(MT_1-65I_1)
67.	Testing of materials for Painting and Maintenance of Multipurpose building in Devprayag under AKM-2016.	87-TR(MT_1-66I_1)
68.	Testing of materials for Laying of Chequered Tiles in Bazar and other Roots, Devprayag under AKM-2016.	87-TR(MT_1-67I_1)
69.	Testing of materials for construction of Truss and Tin Shade in Raghunath Temple and other roots, Devprayag under AKM-2016.	87-TR(MT_1-68I_1)
70.	Physical properties of cement samples received from Research Officer, Hydraulics research Uint-1, I.R.I. Roorkee.	87-TR(MT_1-69)
71.	Testing of Bricks received from Construction Division, U. P. Jal Nigam, Hapur.	87-TR(MT_1-70)
72.	Physical properties of cement sample received from Urban Works Unit, U.P. Jal Nigam, Muzaffarnagar.	87-TR(MT_1-71)
73.	Physical properties of cement sample received from Construction Unit, Uttrakhand. PeyJal Sanshadan Vikash and Nirman Nigam, Rishikesh.	87-TR(MT_1-72)
74.	Construction of Permanent C.C. Road in Pantdweep & Gauri Shankar Sectors, Haridwar under AKM-2016.	87-TR(MT_1-65)
75.	Painting and Maintenance Works of Multipurpose Building (Barat Ghar) in Ward-4, Nagar panchayat, Devprayag under AKM-2016.	87-TR(MT_1-66)
76.	Laying Chequerred Tiles in Footpath & Courtyard, Nagar panchayat, Devprayag under AKM-2016.	87-TR(MT_1-67)
77.	Construction of Tin Shed with Truss over Raghunath Mandir and other Roads, Devprayag under AKM-2016.	87-TR(MT_1-68)
78.	Testing of steel bars and coarse & fine aggregate received from Construction Division, U. P. Jal Nigam, Muzaffarnagar.	87-TR(MT_1-73)
79.	Testing of bricks received from KEC/WATERLEAU (JV), 44-Civil Lines, Roorkee.	87-TR(MT_1-74)
80.	Testing of steel bars and coarse & fine aggregate received from Construction Division, U. P. Jal Nigam, Muzaffarnagar.	87-TR(MT_1-75)
81.	Physical properties of cement sample received from Construction Division, U. P. Jal Nigam, Muzaffarnagar.	87-TR(MT_1-76), 87-TR(MT_1-77)
82.	Testing of steel bars and coarse & fine aggregate received from Construction Division, U. P. Jal Nigam, Muzaffarnagar.	87-TR(MT_1-78)
83.	Testing of steel bars received from Unit-9, Construction & Design Services, UP Jal Nigam, Saharanpur.	87-TR(MT_1-79)
84.	Physical properties of cement sample received from Construction Division, U. P. Jal Nigam, Muzaffarnagar.	87-TR(MT_1-80)

Sl.No.	Title of Test Report	TM No.
85.	Physical properties of cement sample received from R.W.D., P.M.G.S.Y., Didihat Pithoragarh.	87-TR(MT_1-81)
86.	Testing of core received from Haridwar Roorkee Development Authority, Haridwar.	87-TR(MT_1-82)
87.	Physical properties of cement samples received from M/S Bhugan Infracon, Pvt. Ltd, C-1, Ugati Lakeview Flats, Nr. AUDA Lake, Science City Road, Sola, Ahmedabad.	87-TR(MT_1-83)
88.	Testing of bricks and cement mortar collected from site through Sri Ramkumar Advisor (Engg.) State Planning Commission Dehradun.	87-TR(MT_1-84)
89.	Testing of steel bars, Coarse & Fine aggregate received from Construction Division, U.P. Jal Nigam, Muzaffarnagar.	87-TR(MT_1-85)
90.	Testing of steel bars, Coarse & Fine aggregate received from Construction Division, U.P. Jal Nigam, Muzaffarnagar.	87-TR(MT_1-86)
91.	Physical properties of cement sample received from M/S Abeima S.A. and Satya Builders 540-A.J. House, Marol- Maroshi Road, Marol, Andheri (East)., Mumbai.	87-TR(MT_1-87)
92.	Physical properties of cement sample received from Construction Division, U.P. Jal Nigam, Muzaffarnagar.	87-TR(MT_1-88)
93.	Testing of Bricks, Coarse & Fine aggregate received from Executive Engineer, Lower Division, Eastern Yamuna Canal, Shamli.	87-TR(MT_1-89)
94.	Physical properties of cement sample received from M/S Abeima S.A. and Satya Builders 540-A.J. House, Marol- Maroshi Road, Marol, Andheri (East).,Mumbai.	87-TR(MT_1-90)
95.	Testing of steel bars received from Unit-46, Construction and Design Services U.P. Jal Nigam, Baghpath.	87-TR(MT_1-91)
96.	Testing of steel bars received from Unit-46, Construction and Design Services U.P. Jal Nigam, Baghpath.	87-TR(MT_1-92)
97.	Physical properties of cement sample received from Executive Engineer, Lower Division, Eastern Yamuna Canal, Shamli.	87-TR(MT_1-93)
98.	Testing of concrete, mortar, cement & coarse and fine aggregate received from Irrigation Division, Nareindra Nagar, Tehri Gharwal.	87-TR(MT_1-94)
99.	Testing of steel bars, c.c. cubes, bricks, cement & coarse and fine aggregate received from Construction Unit, Uttrakhand PeyJal Sanshadan Vikash and Nirman Nigam, Rishikesh.	87-TR(MT_1-95)
100.	Testing of steel bars, bricks, coarse and fine aggregate received from Construction Unit, Uttrakhand PeyJal SanshadanVikash and Nirman Nigam, Rishikesh.	87-TR(MT_1-96)
101.	Testing of steel bars, bricks, coarse and fine aggregate received from Construction Unit, Uttrakhand PeyJal Sanshadan Vikash and Nirman Nigam, Rishikesh.	87-TR(MT_1-97)
102.	Testing of steel bars received from Executive Engineer, Lower Division, Eastern Yamuna Canal, Shamli.	87-TR(MT_1-98)

Sl.No.	Title of Test Report	TM No.
103.	Physical properties of cement sample received from Construction Unit, Uttrakhand PeyJal Sanshadan Vikash and Nirman Nigam, Rishikesh.	87-TR(MT_1-99, 100,101&103)
104.	Testing of steel bars, bricks, coarse and fine aggregate received from Construction Unit, Uttrakhand PeyJal SanshadanVikash and Nirman Nigam, Rishikesh.	87-TR(MT_1-102)
105.	Testing of steel bars, bricks, c.c.cubes, coarse and fine aggregate received from Rural Construction Department, Division Haridwar.	87-TR(MT_1-104)
106.	Testing of steel bars, bricks and coarse & fine aggregate received from Construction Unit, Uttrakhand PeyJal Sanshadan Vikash and Nirman Nigam, Chamba, Tehri Garhwal.	87-TR(MT_1-105)
107.	Physical properties of cement sample received from Construction Unit, Uttrakhand PeyJal Sanshadan Vikash and Nirman Nigam, Chamba, Tehri Garhwal.	87-TR(MT_1-106)
108.	Physical properties of cement sample received from Rural Construction Department, Division Haridwar.	87-TR(MT_1-107)
109.	Testing of c.c. cubes received from Senior Section Engineer (W), Northern Railway, Laksar.	87-TR(MT_1-108)
110.	Testing of steel bars received from Unit-46, Construction & Design Services, U.P. jal Nigam, Baghpat.	87-TR(MT_1-109)
111.	Testing of bricks and fine aggregate received from Construction Unit-37, Room No. -315, Gangotri Bhawan, World Bank Office, Haridwar Road, Roorkee.	87-TR(MT_1-110)
112.	Physical properties of cement sample received from Construction Unit-37, Room No. -315, Gangotri Bhawan, World Bank Office, Haridwar Road, Roorkee.	87-TR(MT_1-111)

For (Year 2017-18)

Various studies were carried out by this division during the year are:

Sl.No.	R.R. No.	TITLE OF REPORT
(1)	88 RR (MT_1 - 01)	Design of concrete mix for Construction of Primary Education Directorate Building in Nanoorkheda, Dehradun.
(2)	88 RR (MT_1 - 02)	Design of concrete mix for Construction of 65m SPAN R.C.C. Integral Bridge in District Pithoragarh.
(3)	88 RR (MT_1 - 03)	Design of concrete mix for Construction of 42m SPAN Bridge on Bhagirathi River in District Uttarkashi.

(1) Design of concrete mix for Construction of Primary Education Directorate Building in Nanoorkheda, Dehradun.

88RR (MT_1-01)

This study was sponsored to design the concrete mixes for the concrete grades $A_{20}M_{30}$ at slump (100±10)mm on the basis of 28 compressive strength for 75 KLD & 150 KLD Capacity Sewage Treatment Plant at Devprayag, Uttarakhand by Project Manager, Construction & Maintenance Unit (Ganga), Uttarakhand Peyjal Nigam, Srinagar, Garhwal. Study of concrete mix design for above grade of concrete was carried out on 150mm size cube specimen. Ordinary Portland Cement 43-grade (Ultratech Cement), Corse Aggregate (Crushed), Fine Aggregate (Crushed) and High-Performance Admixture *Muraplast FK 61* were used in the study of concrete mix design.

(2) Design of concrete mix for Construction of 65m SPAN R.C.C. Integral Bridge in District Pithoragarh.

88RR (MT_1-02)

This study was sponsored to design the concrete mixes for the concrete grades A20M35 at slump (100±5) mm & (75±5) mm on the basis of 28 compressive strength for Construction of 65 m span RCC integral bridge in Distt. Pithoragarh (Uttarakhand) by Executive Engineer, Rural Works Department, PMGSY, Didihat, Pithoragarh. Study of concrete mix design for above grade of concrete was carried out on 150 mm size cube specimen. Ordinary Portland cement, 43-grade (Birla Uttam Cement), Corse Aggregate (Crushed), Fine Aggregate (Crushed) and High-Performance, High Range Water Reducing & Retarding Admixture `Conplast SP430G8` were used in the study of concrete mix design.

(3) Design of concrete mix for Construction of 42m SPAN Bridge on Bhagirathi River in District Uttarkashi.

88RR (MT_1-03)

This study was sponsored to design the concrete mixes for the concrete grades $A_{20}M_{30}$ at slump (70±10) mm on the basis of 28 compressive strength for Construction of 42 m span bridge on Bhagirathi River in District Uttarkashi.(U.K.) by Executive Engineer, Provincial Division, P.W.D., Uttarakashi. Study of concrete mix design for above grade of concrete was carried out on 150mm small size cube specimen. Ordinary Portland cement, 43-grade (Ultratech Cement), Corse Aggregate (Crushed), Fine Aggregate (Natural) and Retarding Superplasticizing Admixture `SikaPlast 5202 NS' were used in the study of concrete mix design.

List of Test Report of Material Testing Unit-I:

Various Studies were carried out during the year are:

Sl.No.	Title of Test Report	TM No.
1.	Testing of steel bars Unit-46 Construction & Design Services U.P. Jal Nigam, Baghpat.	88-TR(MT_1-01)
2.	Testing of C.C. Cubes received from Construction Unit, Uttarakhand Pey Jal Sansadhan Vikas & Nirman Nigam, Dehradun.	88-TR(MT_1-02)
3.	Testing of steel bars, C.C. Cubes, Bricks, Coarse & Fine Aggregate received from, Rural Construction Department Division, Haridwar.	88-TR(MT_1-03)
4.	Testing of steel bars received from Construction Unit, U.P. Jal Nigam, Saharanpur.	88-TR(MT_1-04)
5.	Testing of steel bars, C.C. Cubes, Bricks, Coarse & Fine Aggregate received from, Rural Construction Department Division, Haridwar	88-TR(MT_1-05)

Sl.No.	Title of Test Report	TM No.
6.	Physical properties of cement samples received from, Rural Construction Department Division, Haridwar	88-TR(MT_1-06)
7.	Physical properties of cement samples received from, Rural Construction Department Division, Haridwar	88-TR(MT_1-07)
8.	Testing of Steel bars, Bricks, Coarse & Fine Aggregate received from, Construction Division, U. P. Jal Nigam, Muzaffarnagar.	88-TR(MT_1-08)
9.	Testing of C.C. Cubes received from Construction Unit, Uttarakhand Pay Jal Sansadhan Vikas & Nirman Nigam, Dehradun.	88-TR(MT_1-09)
10.	Physical properties of cement samples received from, Shri Laxmi Crusher Pvt. Ltd., Jwalapur, Haridwar.	88-TR(MT_1-10)
11.	Physical properties of cement samples received from Construction Division, U. P. Jal Nigam, Muzaffarnagar.	88-TR(MT_1-11)
12.	Testing of C.C. Cubes received from Construction Unit, Uttarakhand Pay Jal Sansadhan Vikas & Nirman Nigam, Dehradun.	88-TR(MT_1-12)
13.	Testing of C.C. Cubes received from Construction Unit, Uttarakhand Pay Jal Sansadhan Vikas & Nirman Nigam, Dehradun.	88-TR(MT_1-13)
14.	Testing of C.C. Cubes received from Construction Unit, Uttarakhand Pay Jal Sansadhan Vikas & Nirman Nigam, Dehradun.	88-TR(MT_1-14)
15.	Testing of C.C. Cubes received from Rural Construction Department Division, Haridwar.	88-TR(MT_1-15)
16.	Testing of C.C. Cubes received from Construction Unit, Uttarakhand Pay Jal Sansadhan Vikas & Nirman Nigam, Dehradun.	88-TR(MT_1-16)
17.	Testing of C.C. Cubes received from Construction Unit, Uttarakhand Pay Jal Sansadhan Vikas & Nirman Nigam, Dehradun.	88-TR(MT_1-17)
18.	Testing of Steel bars, Bricks, Coarse & Fine Aggregate received from, Construction Unit-37 U.P. Project Corporation Ltd., Roorkee.	88-TR(MT_1-18)
19.	Testing of Steel bars, C.C. Cubes, Bricks, Coarse & Fine Aggregate received from Temporary Construction Unit (Khel), Uttarakhand Pay Jal Sansadhan Vikas & Nirman Nigam, Dehradun.	88-TR(MT_1-19)
20.	Testing of Steel bars, Coarse & Fine Aggregate received from Construction Division, U.P. Jal Nigam, Muzaffarnagar.	88-TR(MT_1-20)
21.	Physical properties of cement sample received from Construction Unit-37, U.P. Project Corporation Ltd., Roorkee.	88-TR(MT_1-21)
22.	Testing of C.C. Cubes received from Rural Construction Department, Division, Haridwar.	88-TR(MT_1-22)
23.	Physical properties of cement samples received from Temporary Construction Unit (Khel), Uttarakhand Pay Jal Sansadhan Vikas & Nirman Nigam, Dehradun.	88-TR(MT_1-23)
24.	Physical properties of cement samples received from Construction Unit Uttarakhand Pay Jal Sansadhan Vikas & Nirman Nigam, Dehradun.	88-TR(MT_1-24)
25.	Testing of steel bars received from Construction Unit, U.P. Jal Nigam, Saharanpur.	88-TR(MT_1-25)
26.	Testing of C.C. Cubes received from Construction Unit. Uttarakhand Pay Jal Sansadhan Vikas & Nirman Nigam, Dehradun.	88-TR(MT_1-26)
27.	Testing of Steel bars, Bricks, Coarse & Fine Aggregate received from, Construction Division, U. P. Jal Nigam, Muzaffarnagar.	88-TR(MT_1-27)

Sl.No.	Title of Test Report	TM No.
28.	Physical properties of cement samples received from Construction Division, U. P. Jal Nigam, Muzaffarnagar.	88-TR(MT_1-28)
29.	Testing of C.C. Cubes received from Construction Unit. Uttarakhand Pay Jal Sansadhan Vikas & Nirman Nigam, Dehradun.	88-TR(MT_1-29)
30.	Testing of Coarse aggregate received from Construction Division, U. P. Jal Nigam, Muzaffarnagar.	88-TR(MT_1-30)
31.	Testing of steel bars received from Basic Research Unit, I.R.I, Roorkee.	88-TR(MT_1-31)
32.	Physical properties of cement samples received from Construction Division, U. P. Jal Nigam, Muzaffarnagar.	88-TR(MT_1-32)
33.	Physical properties of cement samples received from Rural Work Department P.M.G.S.Y, Pithoragarh.	88-TR(MT_1-33)
34.	Testing of steel bars, C.C. Cubes, Bricks, Coarse & Fine aggregate received from, Rural Construction Division, Haridwar.	88-TR(MT_1-34)
35.	Testing of steel bars, Coarse & Fine aggregate received from, Urban Works Unit, U. P. Jal Nigam, Muzaffarnagar.	88-TR(MT_1-35)
36.	Physical properties of cement samples received from Urban Work Unit, U. P. Jal Nigam Muzaffarnagar.	88-TR(MT_1-36)
37.	Testing of C.C. Cubes received from Rural Construction Department Division, Haridwar.	88-TR(MT_1-37)
38.	Testing of steel bars, Coarse & Fine aggregate received from, WAPCOS Limited, Bhupatwala Haridwar.	88-TR(MT_1-38)
39.	Physical properties of cement samples received from WAPCOS Limited, Bhupatwala Haridwar.	88-TR(MT_1-39)
40.	Physical properties of cement samples received from WAPCOS Limited, Bhupatwala Haridwar.	88-TR(MT_1-40)
41.	Testing of steel bars, Coarse & Fine aggregate received from, WAPCOS Limited, Bhupatwala Haridwar.	88-TR(MT_1-41)
42.	Testing of Steel bars, received from, Construction Unit, U. P. Jal Nigam, Saharanpur.	88-TR(MT_1-42)
43.	Testing of Bricks, Coarse aggregate received from, Urban Work Unit, U. P. Jal Nigam Muzaffarnagar.	88-TR(MT_1-43)
44.	Testing of C.C. Cubes received from Construction Unit. Uttarakhand Pay Jal Sansadhan Vikas & Nirman Nigam, Dehradun.	88-TR(MT_1-44)
45.	Testing of C.C. Cubes received from Construction Unit. Uttarakhand Pay Jal Sansadhan Vikas & Nirman Nigam, Dehradun.	88-TR(MT_1-45)
46.	Testing of Steel bars, Coarse & Fine Aggregate received from, Temporary Construction Unit (Khel), Uttarakhand Pay Jal Sansadhan Vikas & Nirman Nigam, Dehradun.	88-TR(MT_1-46)
47.	Testing of Steel bars,Coarse & Fine Aggregate received from, Temporary Construction Unit (Khel), Uttarakhand Pay Jal Sansadhan Vikas & Nirman Nigam, Dehradun.	88-TR(MT_1-47)
48.	Testing of C.C. Cubes received from, Temporary Construction Unit (Khel) Uttarakhand, Pay Jal Sansadhan Vikas & Nirman Nigam, Dehradun.	88-TR(MT_1-48)
49.	Testing of steel bars, Coarse & Fine Aggregate received from, WAPCOS Limited, Bhupatwala, Haridwar.	88-TR(MT_1-49)

Sl.No.	Title of Test Report	TM No.
50.	Testing of steel bars, C.C. Cubes, Coarse & Fine Aggregate received from, WAPCOS Limited, Bhupatwala, Haridwar.	88-TR(MT_1-50)
51.	Testing of C.C. Cubes received from Rural Construction Division, Haridwar.	88-TR(MT_1-51)
52.	Testing of steel bars, C.C. Cubes, Bricks, Coarse & Fine aggregate received from, Construction Unit-37, U.P. Project Corporation Ltd., Roorkee.	88-TR(MT_1-52)
53.	Physical properties of cement samples received from Construction Unit-37, U.P. Project Corporation Ltd., Roorkee.	88-TR(MT_1-53)
54.	Physical properties of cement samples received from Construction Unit-37, U.P. Project Corporation Ltd., Roorkee.	88-TR(MT_1-54)
55.	Testing of C.C. Cubes received from Construction Unit, Uttarakhand Pay Jal Sansadhan Vikas & Nirman Nigam, Dehradun.	88-TR(MT_1-55)
56.	Testing of steel flats received from Basic Research Unit, I.R.I, Roorkee.	88-TR(MT_1-56)
57.	Testing of C.C. Cubes received from Bridge & Roof Co. (India) Ltd., New Delhi.	88-TR(MT_1-57)
58.	Testing of C.C. Cubes received from Construction Unit, Uttarakhand Pay Jal Sansadhan Vikas & Nirman Nigam, Dehradun.	88-TR(MT_1-58)
59.	Physical properties of cement samples received from Construction Unit-37, U.P. Project Corporation Ltd., Roorkee.	88-TR(MT_1-59)
60.	Physical properties of cement samples received from Urban Work Unit, U. P. Jal Nigam, Muzaffarnagar.	88-TR(MT_1-60)
61.	Physical properties of cement samples received from, Rural Construction Department Division, Haridwar.	88-TR(MT_1-61)
62.	Physical properties of cement samples received from Construction Unit-37, U.P. Project Corporation Ltd., Roorkee.	88-TR(MT_1-62)
63.	Physical properties of cement samples received from WAPCOS Limited, Bhupatwala, Haridwar.	88-TR(MT_1-63)
64.	Physical properties of cement samples received from WAPCOS Limited, Bhupatwala Haridwar.	88-TR(MT_1-64)
65.	Testing of steel bars, Bricks, Coarse & Fine Aggregate received from, Construction Unit-37, U.P. Project Corporation Ltd., Roorkee.	88-TR(MT_1-65)
66.	Physical properties of cement samples received from Temporary Construction Unit (Khel), Uttarakhand Pay Jal Sansadhan Vikas & Nirman Nigam, Dehradun.	88-TR(MT_1-66)
67.	Physical properties of cement samples received from Temporary Construction Unit (Khel), Uttarakhand Pay Jal Sansadhan Vikas & Nirman Nigam, Dehradun.	88-TR(MT_1-67)
68.	Testing of C.C. Cubes, Coarse & Fine Aggregate received from, WAPCOS Limited, Bhupatwala, Haridwar.	88-TR(MT_1-68)
69.	Physical properties of cement samples received from WAPCOS Limited, Bhupatwala, Haridwar.	88-TR(MT_1-69)
70.	Testing of Steel bars, C.C. Cubes, Coarse & Fine aggregate received from, WAPCOS Limited, Bhupatwala, Haridwar.	88-TR(MT_1-70)
71.	Testing of steel bars, Bricks, Coarse & Fine aggregate received from, Construction Unit-37, U.P. Project Corporation Ltd., Roorkee.	88-TR(MT_1-71)

Sl.No.	Title of Test Report	TM No.
72.	Testing of steel bars, Bricks, Coarse & Fine aggregate received from, Construction Unit-37, U.P. Project Corporation Ltd., Roorkee.	88-TR(MT_1-72)
73.	Testing of Steel bars, received from, Construction Unit, U. P. Jal Nigam, Saharanpur.	88-TR(MT_1-73)
74.	Testing of Coarse Aggregate received from, Irrigation Division, Kedarnath (Agastyamuni).	88-TR(MT_1-74)
75.	Testing of steel bars, Bricks, Coarse & Fine Aggregate received from, received from Construction Unit, Uttarakhand Pay Jal Sansadhan Vikas & Nirman Nigam, Rishikesh.	88-TR(MT_1-75)
76.	Testing of C.C. Cubes received from Bridge & Roof Co. (India) Ltd. New Delhi.	88-TR(MT_1-76)
77.	Testing of C.C. Cubes received from Bridge & Roof Co. (India) Ltd., New Delhi.	88-TR(MT_1-77)
78.	Testing of c. c. Paver Blocks received from Rural Construction Department Division, Haridwar.	88-TR(MT_1-78)
79.	Physical properties of cement samples received from Construction Unit, Uttarakhand Pay Jal Sansadhan Vikas & Nirman Nigam, Rishikesh.	88-TR(MT_1-79)
80.	Testing of C.C. Cubes received from, Temporary Construction Unit (Khel), Uttarakhand Pay Jal Sansadhan Vikas & Nirman Nigam, Dehradun.	88-TR(MT_1-80)
81.	Testing of C.C. Cubes received from, Temporary Construction Unit (Khel), Uttarakhand Pay Jal Sansadhan Vikas & Nirman Nigam, Dehradun.	88-TR(MT_1-81)
82.	Testing of Steel bars, C.C. Cubes, Coarse & Fine Aggregate received from, WAPCOS Limited, Bhupatwala Haridwar.	88-TR(MT_1-82)
83.	Physical properties of cement samples received from WAPCOS Limited, Bhupatwala, Haridwar.	88-TR(MT_1-83)
84.	Physical properties of cement samples received Provincial Divison,P.W.D, Uttarkashi.	88-TR(MT_1-84)
85.	Testing of C.C.Cubes, Coarse & Fine aggregate received from, WAPCOS Limited, Bhupatwala Haridwar.	88-TR(MT_1-85)
86.	Testing of Bricks, Coarse & Fine aggregate received from Construction & Maintenance Unit (Ganga) Uttarakhand Pey Jal Nigam, Haridwar.	88-TR(MT_1-86)
87.	Testing of Bricks, Coarse aggregate received from, Urban Work Unit, U.P.Jal Nigam, Muzaffarnagar.	88-TR(MT_1-87)
88.	Testing of steel bars received from Construction Unit U.P. Jal Nigam, Saharanpur.	88-TR(MT_1-88)
89.	Testing of Steel bars, C.C.Cubes, Coarse & Fine aggregate received from, WAPCOS Limited, Bhupatwala Haridwar.	88-TR(MT_1-89)
90.	Testing of Steel C.C.Cubes, Coarse & Fine aggregate received from, WAPCOS Limited, Bhupatwala Haridwar.	88-TR(MT_1-90)
91.	Testing of Steel C.C.Cubes, Coarse & Fine aggregate received from, WAPCOS Limited, Bhupatwala Haridwar.	88-TR(MT_1-91)
92.	Physical properties of cement samples received from WAPCOS Limited, Bhupatwala Haridwar.	88-TR(MT_1-92)

Sl.No.	Title of Test Report	TM No.
93.	Physical properties of cement samples received from WAPCOS Limited, Bhupatwala Haridwar.	88-TR(MT_1-93)
94.	Physical properties of cement samples received from Construction & Maintenance Unit (Ganga) Uttarakhand Pey Jal Nigam, Haridwar.	88-TR(MT_1-94)
95.	Physical properties of cement samples received from WAPCOS Limited, Bhupatwala, Haridwar.	88-TR(MT_1-95)
96.	Physical properties of cement samples received from WAPCOS Limited, Bhupatwala Haridwar.	88-TR(MT_1-96)
97.	Testing of C.C.Cubes, Coarse & Fine aggregate received from, Irrigation Divison, Kedarnath (Agustyamuni)	88-TR(MT_1-97)
98.	Physical properties of cement samples received from WAPCOS Limited, Bhupatwala, Haridwar.	88-TR(MT_1-98)
99.	Physical properties of cement samples received from WAPCOS Limited, Bhupatwala, Haridwar.	88-TR(MT_1-99)
100.	Physical properties of cement samples received from Urban Work Unit, U.P.Jal Nigam, Muzaffarnagar.	88-TR(MT_1-100)
101.	Physical properties of cement samples received from Construction Unit. Uttarakhand Pey Jal Sansadhan Vikas & Nirman Nigam. Dehradun.	88-TR(MT_1-101)
102.	Testing of Steel bars , Bricks, Coarse & Fine aggregate received from, Construction Unit. Uttarakhand Pey Jal Sansadhan Vikas & Nirman Nigam. Dehradun	88-TR(MT_1-102)
103.	Testing of Steel Bars, C.C.Cubes, Bricks, Coarse & Fine aggregate received from, Construction Unit. Uttarakhand Pey Jal Sansadhan Vikas & Nirman Nigam Chamba, Tehri Garhwal.	88-TR(MT_1-103)
104.	Testing of C.C.Cubes, received from, Irrigation Divison, Kedarnath (Agustyamuni).	88-TR(MT_1-104)
105.	Testing of Steel Bars, C.C.Cubes, Coarse & Fine aggregate received from, WAPCOS Limited, Bhupatwala Haridwar.	88-TR(MT_1-105)
106.	Testing of C.C.Cubes, received from, Irrigation Divison, Kedarnath (Agustyamuni).	88-TR(MT_1-106)
107.	Testing of C.C.Cubes, received from, Irrigation Divison, Kedarnath (Agustyamuni).	88-TR(MT_1-107)
108.	Testing of C.C.Cubes, received from, Irrigation Divison, Kedarnath (Agustyamuni).	88-TR(MT_1-108)
109.	Testing of Steel Bars, received from, P.M.G.S.Y Irrigation Divison,New Tehri.	88-TR(MT_1-109)
110.	Physical properties of cement samples received from WAPCOS Limited, Bhupatwala Haridwar.	88-TR(MT_1-110)
111.	Physical properties of cement samples received from WAPCOS Limited, Bhupatwala Haridwar..	88-TR(MT_1-111)
112.	Physical properties of cement samples received from WAPCOS Limited, Bhupatwala Haridwar.	88-TR(MT_1-112)
113.	Testing of Steel Bars, C.C.Cubes, Coarse & Fine aggregate received from, WAPCOS Limited, Bhupatwala Haridwar.	88-TR(MT_1-113)
114.	Testing of Steel Bars, C.C.Cubes, Coarse & Fine aggregate received from, WAPCOS Limited, Bhupatwala Haridwar.	88-TR(MT_1-114)

Sl.No.	Title of Test Report	TM No.
115.	Testing of Steel Bars, C.C.Cubes, Coarse & Fine aggregate received from, WAPCOS Limited, Bhupatwala Haridwar.	88-TR(MT_1-115)
116.	Testing of Steel Bars, C.C.Cubes, Coarse & Fine aggregate received from, WAPCOS Limited, Bhupatwala Haridwar	88-TR(MT_1-116)
117.	Testing of Steel Bars, C.C.Cubes, Coarse & Fine aggregate received from, WAPCOS Limited, Bhupatwala Haridwar.	88-TR(MT_1-117)
118.	Testing of C.C.Cubes, received from, M/s Kisan Sewa Kendra, Saharanpur.	88-TR(MT_1-118)
119.	Physical properties of cement samples received from Construction Unit. Uttarakhand Pey Jal Sansadhan Vikas & Nirman Nigam Chamba, Tehri Garhwal	88-TR(MT_1-119)
120.	Physical properties of cement samples received from Irrigation Divison, Kedarnath (Agustyamuni).	88-TR(MT_1-120)
121.	Physical properties of cement samples received from WAPCOS Limited, Bhupatwala Haridwar.	88-TR(MT_1-121)
122.	Testing of Steel Bars, C.C.Cubes, Coarse & Fine aggregate received from, WAPCOS Limited, Bhupatwala Haridwar	88-TR(MT_1-122)
123.	Physical properties of cement samples received from Irrigation Divison, Kedarnath (Agustyamuni).	88-TR(MT_1-123)
124.	Testing of Steel Bars, C.C.Cubes, received from Lokmitra, Saharanpur.	88-TR(MT_1-124)
125.	Testing of C.C.Cubes, Coarse & Fine aggregate received from, Irrigaation Diovison, Narendear Nagar, Tehri Garhwal.	88-TR(MT_1-125)

(8) MATERIAL TESTING UNIT – II

This unit deals with the determination of engineering properties of rock mass and rock samples received from different hydroelectric/ river valley and irrigation projects.

List of Test Reports: (For Year 2016-17)

Various Studies were carried out during the year are:

Sl. No.	Title of the Report	TM No.
1.	Rock to Rock Block Shear Test at Dam Site of Vyasi Hydro Electric Project (Uttarakhand).	87-TR(MT_2-02 & 03)
2.	Unconfined Compressive Strength of Rock Samples for Dam Site of Vyasi Hydro Electric Project (Uttarakhand).	87-TR(MT_2-04)

Photographs of Tests Conducted at Sites

Rock to Rock Block Shear Test at Dam Site of Vyasi Hydro Electric Project (Uttarakhand)

Unconfined Compressive Strength of Rock Samples for Dam Site of Vyasi Hydro Electric Project (Uttarakhand)

(9) SOIL RESEARCH UNIT – I

The Soil Research Unit – I, comprises of three sub-divisions each having a well-equipped Laboratory. The division is mainly working in the following area:

(a) Laboratory testing for the determination of engineering properties of soils.

(b) Field investigations for determination of

(i) Bearing capacity at foundation of structures.

(ii) In-situ Shear Parameters

(iii) Modulus of Subgrade Reaction

(iv) In-situ Permeability and Sub-Soil Strata to study the seepage behavior etc.

The laboratory and field tests of soil are generally carried out in accordance with relevant Indian Standards. Laboratory tests include soil classification, shear parameters, consolidation, permeability, maximum and minimum density etc. and special tests like, dispersability on clay materials, large size triaxial shear (200 mm dia. specimen upto a maximum pressure of 20 kg/cm^2), compressibility and permeability tests on rock fill material etc. are performed and field tests include standard penetration test, subgrade reaction test, block shear test, In situ dry density and permeability tests are also conducted.

List of Test Reports: (For Year 2016-17)

Various studies were carried out during the year are:

Sl. No.	Title of the Report	TM No.
1.	Determination of Field densities for construction of road in front of village Kotwal from Jhabrera- Gurukul main road to village Baswakheri Block-Narsan, Distt. Haridwar.	87-TR(SRU_1-02)
2.	Determination of grain size analysis & gradation curve of samples.	87-TR(SRU_1-03) 87-TR(SRU_1-04)
3.	Determination of laboratory and field density for construction of road Mehwad Kala main road to Piraan Kaliyar Imli Kheda, Block Roorkee, Distt. Haridwar.	87-TR(SRU_1-05)
4.	Determination of Silt factor of one soil sample. Collected by Irrigation Research Institute Roorkee from I.T.I. left bank of Alaknada River, Srinagar (Uttarakhand)	87-TR(SRU_1-06)
5.	Determination of Silt factor of three soil samples collected by Irrigation Research Institute Roorkee received from Irrigation Division, Rudraprayag, (Uttarakhand)	87-TR(SRU_1-07)
6.	Determination of Silt factor of 06 nos. soil samples. Collected by Irrigation Research Institute Roorkee from Executive Engineer, Irrigation Division, Kedarnath Rudraprayag, Uttarakhand.	87 TR (SRU_1-08)
7.	Determination of Silt factor of 08 nos. soil samples. Collected by Irrigation Research Institute Roorkee from Executive Engineer, Irrigation Division, Thrali, Chamoli, Uttarakhand.	87 TR (SRU_1-09)
8.	Determination of Silt factor of 05 nos. soil samples. Collected by Irrigation Research Institute Roorkee from Executive Engineer, Irrigation Division, Kotiyal sain Chamoli, Uttarakhand.	87 TR (SRU_1-10)
9.	Lab & Field test for proposed Gagaas Barrarge, Ranikhet, Almora. From Executive Engineer, Irrigation Division, Ranikhet, Almora, Uttarakhand.	87 TR (SRU_1-11)

List of Test Reports: (For Year 2017-18)

Various studies were carried out during the year are:

Sl. No.	Title of the Report	TM No.
1.	Determination of Silt factor of 03 nos. soil samples. Pertaining to Irrigation Division, Dehradun (Uttarakhand).	88-TR(SRU_1-02)
2.	Determination of Silt factor of 05 nos. soil samples. Pertaining to Irrigation Division, Dugadda (Uttarakhand).	88-TR(SRU_1-03)
3.	Determination of Silt factor of 02 nos. soil samples. Pertaining to Kedarnath dham, Irrigation Division, Augustmauni, Kedarnath (Uttarakhand).	88-TR(SRU_1-04)
4.	Determination of Silt factor of 08 nos. soil samples. Pertaining to Song, Ganga, Chandrabhaga and Mahadevkhala, Irrigation Division, Dehradun (Uttarakhand).	88-TR(SRU_1-05)
5.	Determination of various parameters of the Soil at the site of village Barsu, block-Bhatwadi, Uttarkashi (Uttarakhand)	88-TR(SRU_1-06)

(10) SOIL RESEARCH UNIT – II

The Soil Research Unit – 2, comprises of two sub units.

(i) Chemical Laboratory (Sub Unit-I)

(ii) Soil Laboratory (Sub Unit-2)

Chemical laboratory carries out various tests viz. chemical analysis of water samples for examining its suitability for use in Irrigation, drinking and Cement Concrete test purposes. Chemical analysis of Cement Mortar/Cement Concrete samples are tested to find out mix proportions of cement, sand & ballasts and various constituents of cement by Gravimetric method. Test for Alkali reactivity test of aggregate samples, silt contents in water samples and grain size distribution of silt samples are also conducted here. Soil laboratory of this Unit which deals with Tests, Soil Classification, Determination of Engineering Properties of Soil Samples, Field Investigations for Determination of Bearing Capacity of Foundation Soil and in-situ Permeability Test of Soils.

List of Test Report: (For Year 2016-17)

Various Studies were carried out during the year are:

Sl. No.	Title of Report	TM No.
1.	Chemical analysis of cement mortar samples.	87-TR (S_2-01 & 02)
2.	Chemical analysis of cement concrete & cement mortar samples.	87-TR (S_2-03)
3.	Chemical analysis of cement mortar sample.	87-TR (S_2-04)
4.	Chemical analysis of cement concrete & cement mortar samples.	87-TR (S_2-05 & 06)
5.	Chemical analysis of cement sample.	87-TR (S_2-07)

List of Test Report: (For Year 2017-18)

Various Studies were carried out during the year are:

Sl. No.	Title of Report	TM No.
1	Chemical analysis of cement concrete sample.	88-TR (S_2-02)
2	Determination of silt content in water samples.	88-TR (S_2-03)
3	Chemical analysis of cement sample.	88-TR (S_2-04)
4	Chemical analysis of cement sample.	88-TR (S_2-05)

Participation in High Level Meeting/Seminar/Workshop (2016-2018)

Sl. No	Name of Meeting/Seminar/ Symposium/Workshop/ Training	Place	Date	Participants Name and Designation
1.	International Seminar on Reliable Data Acquisition System	Pune	07-09 Sep 2016	Mr. Anubhav Nautiyal, AE Mr. Sumit Malwal, AE
2.	Data processing using e-SWIS Software	NIH Roorkee	19-21 Dec 2016	Mr. Anubhav Nautiyal, AE Mr. Deepak Joshi, AE Mr. Sumit Malwal, AE Ms. Pratibha Shankar Sant, AE
3.	Challenges in Irrigation Management for Flood Security	WRDMD, IIT Roorkee	26-27 Nov 2016	Mr. Anubhav Nautiyal, AE Mr. Sumit Malwal, AE Ms. Neha, AE
4.	Technical Task Force meeting regarding River Morphological Study	IT park Dehradun	12 Jan 2017	Mr. Amar Nath Bisht, CE Mr. Kapil Kumar, EE
5.	National Event *जल मन्थन* 2017	MoWR, New Delhi	13 Jan 2017	Mr. Rajendra Chalisgaonkar, E-in-C Mr. Ajay Verma, CE
6.	Governing Body Meeting of National Institute of Hydrology	New Delhi	23 Jan 2017	Mr. Amar Nath Bisht, CE
7.	River Basin Planning using HEC SOFTWARE	NIH Roorkee	20-25 Feb 2017	Ms. Pratibha Shankar Sant, AE Ms. Neha, AE
8.	17th meeting of Hydraulics Gates &Valves Sectional Committee, WRD 12	BIS, Manak Bhavan , New Delhi	23 Feb 2017	Mr. Amar Nath Bisht, CE
9.	Awareness Raising Under NHP	Dehradun	03 March 2017	Mr. B K Panday, SE Mr. M K Khare, EE Mr. Ajay Kumar, EE, Mr. Sushil Kumar, RO, Mr. Anubhav Nautiyal, AE Ms. Pratibha Shankar Sant, AE Ms. Neha, AE
10.	Capacity Building in Water Forecasting for Flood and Water Management	NIH Roorkee	06-09 March 2017	Mr. Anubhav Nautiyal, AE Mr. Manish Shankar Sant, AE
11.	Special Committee for Interlinking of Rivers	Vigyan Bhawan New Delhi	08 March 2017	Mr.Amar Nath Bisht, CE

12.	International Workshop on Changes in Water Resources and Adaptation options in the Ganges Region	NIH Roorkee.	09-10 March 2017	Ms. Pratibha Shankar Sant, AE
13.	One day Conference on Sediment Managemnet in Indian Rivers	CSMRS New Delhi	17 March 2017	Mr. Amar Nath Bisht, CE
14.	ILBM Approach for Conservation and Management of Lakes	NIH Roorkee	20-24 March 2017	Mr. Ajay Kumar, EE Mr. Kapil Kumar, EE Mr. Anubhav Nautiyal, AE Ms. Pratibha Shankar Sant, AE Mr. Manish Shankar Sant, AE
15.	World Water Day	Institution of Engineers (India), Dehradun	22 March 2017	Mr. Rajendra Chalisgaonkar, E-in-C
16.	Governing Body Meeting of National Water Development Agency	Vigyan Bhawan New Delhi	27 March 2017	Mr. Amar Nath Bisht, CE
17.	Open Data Source	Deptt. of Hydrology, IIT Roorkee	08 Sep 2017	Mr. M. K. Khare, EE Mr. Amar Jeet Sah, AE

- One-day workshop on *Seismic Provisions & other aspects of RCC framed structures* was organized on 18.03.2017 at Sinchai Bhawan Dehradun. Dr. Ajay Chaurasiya, Principal Scientist, CBRI, Roorkee delivered key note lecture. Sri R. Chalisgaonkar, E-in-C, Uttarakhand Irrigation Department, Sri H. K. Upreti, E-in-C PWD & Sri Y.D. Panday, CE & HOD, Rural Works Deptt. along with all Chief Engineers/ Superintending Engineers & other officers participated in the workshop.

- One day Training Programme for Junior Assistants of Irrigation Department for *Pay fixation, updation of GPF Passbook, Diary dispatch and preparation of bills etc* organized on 25.03.2017 at Dehradun.

- One-day workshop on *Seismic Provisions & other aspects of RCC framed structures* was organized on 18.03.2017 at Sinchai Bhawan Dehradun. Dr. Ajay Chaurasiya, Principal Scientist, CBRI, Roorkee delivered key note lecture. Sri R. Chalisgaonkar, E-in-C, Uttarakhand Irrigation Department, Sri H. K. Upreti, E-in-C PWD & Sri Y.D. Panday, CE & HOD, Rural Works Deptt. along with all Chief

- One day Awareness Raising Programme under National Hydrology Project (NHP) was organized by the Central Ground Water Board, Dehradun in association with Irrigation department, Government of Uttarakhand on 03.03.2017 at Dehradun. Sri R. Chalisgaonkar, Engineer-in-Chief, Irrigation Department was the Chief Guest of the function.

Orientation Course for newly appointed Assistant Engineers at Dehradun

VISITS

Student Group Visit of Panipat Instititue of Engineering & Technology, Panipat (Haryana), date 03.03.2017

Today as a Representative of Water Resource Department, Maharashtra; I have got the opportunity to visit this Hydraulic Research Station. Personally, I think this is indirectly helping in Nation building through Hydraulic Research.

Shikha S. Piplewar, Assistant Engineer,
Grade I, Grade "A", WRD, 08.09.2016

Excellent Set-up & Facility.

Manish Nema,
NIH, Roorkee, 08.09.2016

Model run of Bogibil Bridge was witnessed. The model is being maintained in an excellent manner. The team engaged in the coach is highly competent and experienced. The result of model runs has been a very useful tool in maintaining the hydraulic structures of the bridge. IRI, Roorkee has played a Stellar role in the construction of the Bridge.

Sahemlong Kamei, Dy.Chief Engineer, Dibroogarh
N.F. Railway, 08.05.2017

A unique presense to watch the models and the station being are here. This institute is playing a great role in the study of present river behavior and response to the structures while helping engineers in making progress.

S.K. Jaggi, Former G.M APGCL
N.F. Railway, Delhi, 12.06.2017

Model studies for Bogobil bridge has played an important role in validiting the design of the bridge, the guide bank and the related units. I wish all success and best wishes to the Irrigation Research Institute & its future endeavours.

Amit Pandit, CAO (EON)
N.F. Railway, Delhi, 12.06.2017

It was very great experience to visit IRI, Roorkee. Officers & staff engaged in different model studies are very so apropriate and credible. I wish to visit once again.

Utpal Dutta, APGCL
Guwahati, Assam, 20.06.2017

Today as a Representative of Water Resource Department, Maharashtra; I have got the opportunity to visit this Hydraulic Research Station. Personally, I think this is indirectly helping in Nation building through Hydraulic Research.

Shikha S. Piplewar, Assistant Engineer,
Grade I, Grade "A", WRD, 08.09.2016

Excellent Set-up & Facility.

Manish Nema,
NIH, Roorkee, 08.09.2016

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LIST OF VISITORS REGARDING VARIOUS STUDIES (For Year 2016-17)

Sl. No.	Name / Designation	Project / Place	Date
1.	Sh. Bijay Kumar, E.E. Sh. Dhirendra Kumar, J.E.	Kanhar Project	19.04.2016
2.	Sh. V. Suresh kumar, Head PMG Hydro Sh. S.C. mittal, Consultant Design, Sh. Praveen kumar, G.M. Design, Sh. Amit Goel, Dy. Manager, PMG, Sh. K.P. Singh, Consultant Lanco Infratech Ltd. Gurgaon	Teesta	28.04.2016
3.	Sh. R.K. Sharma, A.G.M., Design, Sh. O.P. Thakur Uttarakhand, S.J.V.N.	Naitwar-Mori	05.05.2016
4.	Sh. Rajesh Kr. Maurya, J.E. Sh. Arvind Kumar, J.E.	Moradabad Ram Ganga Project	03.06.2016
5.	Sh. Neeraj Aggarwal, S.D.G.M., RITES Ltd., Gurgaon	Bogibil, River Vyanatheya, Vashistha and Gowthami	09.06.2016 15.06.2016 18.06.2016 27.06.2016 21.07.2016
6.	Sh. Nadeem Admad, A.G.M., RITES Ltd., Gurgaon	Bogibil, River	09.06.2016 18.06.2016 27.06.2016 09.07.2016 21.07.2016
7.	Sh. K. Suryanarayana, Dy. Chief Engg. Construction, South Central Railway, Vijaywada	River Vyanatheya, Vashistha and Gowthami	15.06.2016
8.	Sh. K. B. Parmar, CE, Sh. M. C. Shukla, SE, Sh. P. R. Agnihotri, SE	Sardar Sarovar Narmada Nigam Ltd., Gujrat	16.09.2016
9.	Sh. Monomoy Goswami	Tata Consulting Engineers, New Delhi	16.09.2016
10.	Sh. Sumit Agarwal, Manager	M/s Om Metals, New Delhi	16.09.2016
11.	Sh. A. F. Bhoraiya, CE Sh. K. B. Parmar, CE Sh. M. C. Shukla, SE Sh. R. D. Mehta, DE (Civil)	Sardar Sarovar Narmada Nigam Ltd., Gujrat	08.12.2016
12.	Sh. M. K. Meshram	Tata Consulting Engineers, New Delhi	08.12.2016
13.	Sh. Sumit Agarwal, Manager	M/s Om Metals,	08.12.2016

LIST OF VISITORS REGARDING VARIOUS STUDIES (For Year 2017-18)

Sl. No.	Name / Designation	Project / Place	Date
1	Sh. R.a. Oak, Consultant Sh. Neeraj Agarwal, S.D.G.M., RITES Ltd. Sh. Nadeem Ahmad, MGR/C., RITES Ltd. Sh. Vikalp Pandey, A.M., RITES Ltd.	Bogibil	02.05.2017
2	Sh. S.K. Mai , Dy. C.E. Northen Railway	Bogibil	16.05.2017
3	Sh. H.K. Gajji G.M. Sh. Ajit pandit , EAO / N.F. Railway Sh. Mahendra singh, C.E. Sh. R.K. Dayal, G.M., RITES Ltd.	Bogibil	26.05.2017
4	Sh. Kamlesh G.E.T., RITES Ltd.	Bogibil	07.07.2017
5	Sh. NeerajAggarwal, S.D.G.M., RITES Ltd. Sh. VikalpPandey, A.M., RITES Ltd.	Bogibil	21.07.2017
6	Sh. S.C. Mittal, Consultant Design	Teesta	27.05.2017
7	Sh. Rajeev Bhagat, Senior Project Engineer, Civil Design, Hydro	Kabu-16, H.E.P. (10X2 MW), Republic of Burundi (East Africa)	18.09.2017
8	Sh. Rajesh Kumar, A.E. Flood Works Division, Allahabad	Allahabad	05.08.2017
9	Sh. Vivek Singh, Manager, HPPCL, Delhi	Delhi	25.08.2017 & 15.10.2017
10	Sh. Vikash Chauhan, THDC Sh. Jagat Ram Kothari , THDC	Tehri	10.01.2018
11	Sh. A. F. Bhorniya, (CE-E&M) SSNNL Gujrat Sh. M. C. Shukla SE SSNNL Gujrat Sh. P. B. Vidyarthi SSNNL Gujrat Sh. Mahesh K Meshram, TCE Sh. Saurabh Mehta TCE Sh. Sumit Agrawal, Om Metals Sh. N. C. Mathur	Kachch	09.02.2018

The following are the types of publications, which were issued during the year 2016-18.

(i) **Annual Report** — Annual Report for the year 2016-18 was published giving the brief account of the technical activities of the institute, including the important studies carried out, Papers Presented, Research Reports and Test Reports issued during the year.

(ii) **Technical Papers and Research Reports** — During the year 2016-17 & 2017-18, a total number of 43 Research Reports were issued by the Institute on the basis of studies carried out by different research units. A list of the Research Reports and Technical Papers under different titles and the abstracts of the Research Reports as well as Technical Papers are given in chapter Research Unit.

(iii) **Test Reports** — Test reports are issued on the basis of field or laboratory tests carried out by the respective divisions. During the year 2016-17 & 2017-18, 278 Test Reports pertaining to various projects/agencies were issued.

(iv) **Quarterly News Letter**— During the year 2016-17, a total of 03 Quarterly News Letter of Irrigation Department of Uttarakahnd, were issued by the institute giving the brief details of important work executed by the department & Govt. Workshop, Studies Completed, Project under going in IRI & IDO & Paper published etc.

List of Published Research Papers

- Paper titled **Estimation of Scour Depth in Upper Himalayan Rivers** authored by Pratibha S. Sant., Manish S. Sant. And Rajendra Chalisgaonkar was published in the National conference on water resources and hydro power at university of petroleum & energy studies on , Dehradun on 17-18 June 2016.

ABSTRACT

Estimation of scour is necessary for economic and safe designing of hydraulic structures. An accurate estimation of regime/scour depth below stream-bed during design is important since it determines the foundation levels of all elements of hydraulic structures such as piers, abutments, guide bund, spur, groynes, etc. In general, Lacey's method of estimating regime depth of flow in loose bed alluvial rivers is being used by the designers in alluvial as well as non alluvial rivers. Recently, questions have been raised about its application for rivers in gravelly strata, as the bed slopes in the hilly regions are very steep which create tremendous velocities and bed materials being unable to stand such velocities are scoured and transported down the river. In this paper, the authors have tried to compute the scour depth for different discharges using the Lacey's regime formulae and the formulae suggested for gravelly terrains for discharge above 500cumec and the comparison has been presented. The authors have recommended that some large scale model studies should be conducted to establish the scour predicted by the formulae suggested for computing scour depth in upper Himalayan rivers.

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ABSTRACT

Estimation of scour is necessary for economic and safe designing of hydraulic structures. An

VOCATIONAL TRAINING

Engineering Students of following Institutes took part as Group Trainees during 2016-17.

Sl. No.	Name of Institution	Period (In Weeks)
1	National Institute of Technology, Srinagar, (Uttarakhand)	04
2	G. B. Pant Engineering College, Ghurdauri, Pauri Garhwal, (Uttarakhand)	04
3	Bipin Tripathi Kumaon Institute of Technology, Dwarahat, Almora, (Uttarakhand)	04
4	Graphic Era Hill University, Dehradun & Nainital, (Uttarakhand)	04
5	Phonics Group of Institution, Roorkee, (Uttarakhand)	04
6	Quantum School of Technology, Roorkee, (Uttarakhand)	04
7	Institute of Technology Roorkee, Haridwar, (Uttarakhand)	04
8	Institute of Technology, Gopeshwar, Chamoli, (Uttarakhand)	04
9	Roorkee Institute of Technology, Puhana, Roorkee, (Uttarakhand)	04
10	College of Engineering Roorkee, Vardhamanpuram, Roorkee (Uttarakhand)	04
11	Rajkiya Engineering College, Azamgarh, (U.P.)	04
12	Gautam Buddha University, Greater Noida, (U.P.)	04
13	Madan Mohan Malaviya University of Technology, Gorakhpur (U.P.)	04
14	Government Polytechnic Haridwar, (Uttarakhand)	04
15	Government Polytechnic Gauchar,Chamoli, (Uttarakhand)	04
16	Government Polytechnic Pokhari, Chamoli, (Uttarakhand)	04
17	Government Polytechnic Gopeshwer, Chamoli, (Uttarakhand)	04
18	Government Polytechnic Chopta, Rudraprayag, (Uttarakhand)	04
19	Government Polytechnic Narendra Nagar, (Uttarakhand)	04
20	Government Polytechnic Bijnor, (U. P.)	04
21	K.L. Polytechnic, Roorkee, (Uttarakhand)	04
22	IMS Institute of Technology, Roorkee, (Uttarakhand)	04
23	Institute of Professional Studies, Roorkee, (Uttarakhand)	04
24	Uttaratech Polytechnic, Dhanauri, Roorkee, (Uttarakhand)	04
25	College of Advanced Technology, Roorkee, (Uttarakhand)	04
26	B.S. Diploma Engineering College, Roorkee, (Uttarakhand)	04
27	OM Institute of Technology, Daulatpur, Rooree, (Uttarakhand)	04
28	Roorkee College of Engineering, Bajuheri, Roorkee, Uttarakhand	04
29	Motherhood Institute of Management & Technology, Roorkee (Uttarakhand)	04
30	B.S.M. College of Polytechnic, Roorkee-Laksar Road, Roorkee (Uttarakhand)	04
31	Shakambhari Institute of Higher Education & Technology, Roorkee (Uttarakhand)	04
32	Swami Darshnanand Institute of Management & Technology Polytechnic, Haridwar (Uttarakhand)	04
33	Uttarakhand Institute of Technical & Professional Education, Ramnagar, Nainital, (Uttarakhand)	04
34	Ramanand Institute of Management & Technology, Haridwar (Uttarakhand)	04
35	Savitribai Phule Government Polytechnic, Saharanpur (U.P.)	04

Engineering Students of following Institutes took part as Group Trainees during 2017-18.

Sl. No.	Name of Institution	Period (In Weeks)
1	National Institute of Technology, Srinagar, Uttarakhand	04
2	G. B. Pant Engineering College, Ghurdauri, Pauri Garhwal, Uttarakhand	04
3	THDC Institute of Hydropower Engineering and Technology, Tehri, Uttarakhand	04
4	Graphic Era Hill University, Dehradun & Nainital, Uttarakhand	04
5	Phonics Group of Institution, Roorkee, Uttarakhand	04
6	Quantum School of Technology, Roorkee, Uttarakhand	04
7	Institute of Technology, Gopeshwar, Chamoli, Uttarakhand	04
8	Roorkee Institute of Technology, Puhana, Roorkee, Uttarakhand	04
9	College of Engineering Roorkee, Vardhamanpuram, Roorkee, Uttarakhand	04
10	Integral University, Lucknow, U. P.	04
11	Gautam Buddha University, Greater Noida, U.P.	04
12	Manav Rachna International University, Faridabad, Haryana	04
13	Parul Institute of Technology, Vadodara, Gujrat	04
14	Government Polytechnic Haridwar, Uttarakhand	04
15	Government Polytechnic Gauchar,Chamoli, Uttarakhand	04
16	Government Polytechnic Pokhari, Chamoli, Uttarakhand	04
17	Government Polytechnic Gopeshwer, Chamoli, Uttarakhand	04
18	Government Polytechnic Chopta, Rudraprayag, Uttarakhand	04
19	Government Polytechnic Narendra Nagar, T. G., Uttarakhand	04
20	Government Polytechnic, Bas Bagarh, Pithoragarh, Uttarakhand	04
21	Government Polytechnic, Bironkhal Pauri Garhwal, Uttarakhand	04
22	K.L. Polytechnic, Roorkee, Uttarakhand	04
23	IMS Institute of Technology, Roorkee, Uttarakhand	04
24	Phonics Group of Institutions, Roorkee, Uttarakhand	04
25	Uttaratech Polytechnic, Dhanauri, Roorkee, Uttarakhand	04
26	College of Advanced Technology, Roorkee, Uttarakhand	04
27	B.S. Diploma Engineering College, Roorkee, Uttarakhand	04
28	OM Institute of Technology, Daulatpur, Rooree, Uttarakhand	04
29	Roorkee Institute of Technology, Puhana, Roorkee, Uttarakhand	04
30	Roorkee College of Engineering, Bajuheri, Roorkee, Uttarakhand	04
31	Motherhood Institute of Management & Technology, Roorkee Uttarakhand	04
32	B.S.M. College of Polytechnic, Roorkee-Laksar Road, Roorkee, Uttarakhand	04
33	Quantun Global Campus, Roorkee, Uttarakhand	04
34	Shakambhari Institute of Higher Education & Technology, Roorkee, Uttarakhand	04
35	GRD Polytechnic, Dehradun, Uttarakhand	04
36	Swami Darshnanand Institute of Management & Technology(Polytechnic), Haridwar, Uttarakhand	04
37	Savitribai Phule Government Polytechnic, Saharanpur, U.P.	04

HUMAN RESOURCES

The Quality of work in any Institute depends on the quantity & quality of available man power. This Institute had a total sanctioned strength of 43 officers on 31st March 2018.

Name	Designation	Email	Work Experience
 T.S. Tolia	Chief Engineer (Design) & Director IRI , Roorkee	ce@iriroorkee.res.in cedesign-irri-uk@gov.in	Construction of water conservation schemes and flood protection works; Physical Modelling of Hydraulic structures; Testing of Engineering materials; Soil & Geo-technical Investigation; Mix design of Roller Compacted Concrete (RCC) Dam; **National Hydrology Project** for management of water resource as well as flood forecasting and reservoir operations in real- time; **National Water Mission** for preparation of Framework of State Specific Plan (SSAP).
 P. K. Mall	Superintending Engineer Research Circle IRI, Roorkee	sereasearch-irri-uk@gov.in	Construction of water conservation schemes ; Physical Modelling of Hydraulic structures; Testing of Engineering materials; Soil & Geotechnical Investigation; Mix design of Roller Compacted Concrete (RCC) Dam; **National Hydrology Project** for management of water resource as well as flood forecasting and reservoir operations in real- time; flood protection works
 R.C. Gupta	Superintending Engineer Water Science Circle, HRS Bahadrabad	rameshchandragupta6@gmail.com	Construction of barrage (HEP-304MW) & Constructions & Maintenance of Stage - I & II Hilly Roads
 Ajay Kumar	Executive Engineer Hydraulic Research Unit-III, HRS, Bahdrabad	roh2.iri@gmail.com	Design & Hydraulic Model Studies of Different Hydraulic Structure.
 Bijendra Pal	Research officer Material Testing Unit-I	romt1@iriroorkee.res.in	Research/Testing of Cement Concrete and Soil Testing & Lecturer on Ingredients of Concrete and Concrete Mix Design
 C.P. Kothiyal	Executive Engineer, Administration Division, IRI, Roorkee	ckothiyal@yahoo.com	Regulation, operation & maintainance of hydro power project(Dam & Intake). Construction & maintance of hill canal and flood protection work, Tehri dam rehabilation pertain work, building & road works.

Name	Designation	Email	Work Experience
 Chhatter Singh	Research officer Soil Research Unit-I	ros1@iriroorkee.res.in	Remote Sensing & Chemical tests in Soil Research
 Dheer Singh	Research officer Soil Research Unit-II	ros2@iriroorkee.res.in	Model Studies of Hydraulic, Sedimentation Survey of Reservoirs, Chemical Analysis of Cement Mortar/Concrete and Water & Alkali aggregate Reactivity Test of Aggregate Samples & Soil Investigation.
 M.K. Khare	Executive Engineer Hydraulic Research Unit-I	roh1.iri@gmail.com maheshkhare2007@gmail.com	Construction & Maintenance of Hydro Electric Project, Construction & Maintenance of rural road under PMGSY & Design, Research of various civil project/Hydro projects.
 Ram Ashish	Research officer (Incharge) Ground Water Research Unit-II	ram_ash_ish@yahoo.com	Statistical Lab & hydraulic model studies
 R.B. Singh	Executive Engineer Hydraulic Research Division, HRS, Bahdrabad	rbsingh.iduk@gmail.com	Construction and Maintenance of Irrigation and Hydraulic Structures
 R.R. Mohan	Research officer Ground Water Research Unit-I	rajmohan2261@yahoo.in	Regarding to 2D, 3D Physical Modeling of Hydraulic structure to determine the Uplift Pressure & Exit Gradient Beneath the Hydraulic Structures on Alluvium & Permeable Soil.
 Sushil Kumar	Research officer Basic Research Unit	robasic-iri-uk@gov.in sushil.iri@gmail.com	Hydraulic Model Studies, Capacity Survey of Reservoirs, Testing of rock material, Highway material and Maintenance of computer centre.

Name	Designation	Email	Work Experience
 Vinod Kumar	Research officer Material Testing Unit-II	romt2@iriroorkee.res.in	Remote Sensing Lab & Capacity Survey of Reservoir
 Abhishek Rajput	Assistant Engineer SO (I/C) CE(Design) Roorkee	abhi.88.iitr@gmail.com	Planning and Construction of flood protection works, Canals & Regulation and maintenance of canals.
 Ajay Kumar	Assistant Research officer Material Testing Unit-II	ajayaro1959@gmail.com	Hydraulic Model Studies, Photo Elastic Lab & Rock Mechanics Lab.
 Ajay Kumar	Assistant Research officer Basic Research Unit-II	ajakumar1963@gmail.com	Hydraulic Model Studies & Capacity Survey of Reservoir
 Amarjeet Sah	Assistant Engineer Hydraulic Research Unit-I	amarjeet.sah@gmail.com	Conducting various hydraulic model studies
 Anubhav Nautiyal	Assistant Engineer Basic Research Unit	nautiyal.anubhav@gmail.com	Involved in implementation of NHP funded by World Bank and assisted by Ministry of Water Resources, River Development & Ganga Rejuvenation, Govt. of India, New Delhi. Successfully completed the quality control assurance works of Arddh Kumbh Mela 2016 & quality control work of various roads, buildings.....
 Anil Kr. Tyagi	Assistant Engineer Hydraulic Research Unit-II	a.k.tyagi.rke@gmail.com	Construction irrigation canals in hill areas, Flood protection work & Hydraulic model studies.
 Arun Kr. Singh	Assistant Engineer Hydraulic Research Unit-III	arunkhundiyan@gmail.com	Hydraulic Model Studies

Name	Designation	Email	Work Experience
 Ashish Shukla	Assistant Engineer Material Testing Unit-I	shuklanitp@gmail.com	Research /Testing work of cement concrete testing. Successfully completed the quality control assurance works of Arddh Kumbh Mela 2016.
 D. S. Rawat	Assistant Engineer Hydraulics Division HRS, Bahadrabad	aedsrawat@gmail.com	Maintenance of civil works
 Deepak Joshi	Assistant Research officer Hydraulic Research Unit-II	erdav.joshi@gmail.com	Hydraulic Model Studies, Current Meter Calibration
 K.P. Singh	Assistant Research officer Soil Research Unit-I	singhkp1162@mail.com	Soil testing and Hydrographic Survey.
 Khadak Singh	Assistant Engineer Administration Division, IRI, Roorkee	k.s.chauhan078@gmail.com	Maintenance of civil works
 Kishan Lal	Assistant Research officer Soil Research Unit-II	klsant25@gmail.com	Chemical Analysis of Cement, Cement Mortar/Cement Concrete, Water Samples, Alkali Aggregate Reactivity Test of Aggregate Samples and Grain size distribution of silt samples as per I.S. Codes and CRRI Reports.
 L. M. Kuriyal	Assistant Engineer Hydraulics Division HRS, Bahadrabad	lmkudiyal@gmail.com	Maintenance of civil works

Name	Designation	Email	Work Experience
 Manish Shankar Sant	Assistant Engineer Basic Research Unit-IV	manishshankarsant@gmail.com	Involved in implementation of NHP funded by World Bank and assisted by Ministry of Water Resources, River Development & Ganga Rejuvenation, Govt. of India, New Delhi. Successfully completed the quality control assurance works of Arddh Kumbh Mela 2016.
 Md. Hamid Hassan	Assistant Engineer Basic Research Unit-I	hamid14uk@gmail.com	Construction and Maintenance of Building works (RAMSA), Designing & Construction of Flood Protection Work, Hydraulic Model Studies, Designing of Civil Structures.
 Md. Irfan	Assistant Engineer Hydraulics Research Unit-I HRS, Bahadrabad	md.irfan1970@hotmail.com	Building Works, Flood Protection Work (Studs, Earthen Bunds), Mechanics Foundation (Turbian, Boilers, Mills Foundation, Canal Works etc.)
 Neha	Assistant Engineer Basic Research Unit-III	nehakanojia24@gmail.com	3D EHDA Model Studies Siphon Aqueduct on Rapti Main Canal, Involving in World Bank aided project for Uttarakhand state & River Migration Study, Digitization with the help of Remote Sensing Techniques
 Omjee Gupta	Assistant Engineer Hydraulics Division HRS, Bahadrabad	mrgupta.omjee@gmail.com	Works in Floods, Minor, Fields Guls
 Ram Swaroop	Assistant Research officer Hydraulic Research Unit-III HRS, Bahadrabad	rsarya3342@gmail.com	Hydraulic model studies
 S. K. Mamgai	Assistant Engineer Administration Division	mamgaisk@gmail.com	Maintenance of civil works
 Salma Jahan	Assistant Engineer Hydraulic Circle HRS, Bahadrabad	salmajahan786r@gmail.com	Hydraulic model studies of different hydraulic structure

Name	Designation	Email	Work Experience
 Sheela Rani	Assistant Research officer Soil Research Unit-II	sheelarani811@gmail.com	Soil Classification, Determination of Silt Factor, Compaction Test etc.
 Sumit Malwal	Assistant Engineer Executive Engineer (I/C) Hydraulic Research Unit-II	roh2.iri@gmail.com sumit11malwal1@gmail.com	Hydraulic model studies of different hydraulic structure
 Surendra Kumar	Assistant Research Officer Hydraulic Research Unit-I HRS, Bahadrabad	sk2027.iri@gmail.com	Hydraulic model studies of different hydraulic structure
 Surendra Mohan	Assistant Research Officer Hydraulic Research Unit-I HRS, Bahadrabad	srendra.mohan12@gmail.com	Hydraulic model studies of different hydraulic structure
 Sukhvir Singh	Assistant Research officer Soil Research Unit-I	aro4.s1@gmail.com	Dam Tunnel Discharge, Seismological Observatory, Isotope, Chemical & Soil Laboratories.
 Tarun Gupta	Assistant Engineer Hydraulic Research Unit-III HRS, Bahadrabad	tarundeepgupta@gmail.com	Canal Works, Flood Works, Building Works, Making & Study of Different Models
 Vivek Kumar	Assistant Engineer Administration Division	ae55.adm@gmail.com	Maintenance of civil works, T&P

AWARDS

The Institute received the first CBI&P Trophy in 1986 for Outstanding Contribution in the field of Research and Development. The institute also received CBI&P - IRPO-HI-TECH-87 award for the exhibition set up at Pragati Maidan New Delhi. The Research Personnel of the Institute have received the following prestigious awards:

- CBIP-Pt. Jawahar Lal Birth Centenary Research Award
- CBIP- Young Engineers Award
- CBIP-Cash Your Idea Award
- HYDROSEM Award of the Institution of Engineers (India), U. P. State Centre
- Gold Medals, Cash Awards and Certificate of Merits for Best Research Papers

ISO 9001:2008 CERTIFICATION

Irrigation Research Institute was awarded ISO 9001:2008 certificate on Dec 15, 2012. It was certify that the quality management system of this institute has been audited as per guidelines of ISO 19011:2011 and found to be in accordance with the requirement of the management system standard detailed below:

- Providing servicing of Testing of all Civil Engineering constructions materials.
- Hydraulic Model & other civil Engineering studies.


EQFS CERTIFICATION
Certificate of Registration
IRRIGATION RESEARCH INSTITUTE
ISO 9001 : 2008

Time Schedule of Different Lab. Tests Carried Out at IRI Roorkee

(i) Soil Mechanics:

Sl. No.	Name of the Test	Days
1	Mechanical Analysis (Screen/ Sieve/ Hydrometer/ Liquid Limit)	10
2	Specific Gravity	1
3	Natural Moisture Content and Density	1
4	Compaction test	3
5	Maximum and Minimum density of cohesion less soil	1
6	Consolidation test (At Saturation)	15
7	Permeability test (At Saturation)	2
8	Direct shear test (60x60x20 mm)	4
9	Direct shear test (300x300x150 mm)	6
10	Unconfined compression test	1
11	Triaxial shear test (37.5mm Dia x 75mm high) {At OMC/NMC & Saturation}	4 - 8
12	Triaxial Compression test (100mm Dia x 200mm high)) { At OMC/NMC & Saturation }	4 - 8
13	Triaxial Shear Test (200mm Dia x 400mm) { At OMC/NMC & Saturation }	10-15
14	Large size permeability test (50 cm dia)	2
15	Dispersibilty test	10

(ii) Chemical Analysis of Cement Mortar/Water Sample/Soil Sample etc.:

Sl. No.	Name of the Test	Days
1	Chemical Analysis of Cement Sample	23
2	Chemical analysis of Cement Mortar /Concrete Sample	14
3	Chemical Analysis of Water Sample	14
4	Alkali Aggregate Reacting test of Alkali Aggregate Sample	14
5	Silt content(mg/liter) in Water Sample	3
6	Determination of grain size distribution of Silt Sample	3

(iii) Rock Mechanics:

Sl. No.	Laboratory Test	Days
1	Modulus of Elasticity and Poisson Ratio	2 – 3
2	Unconfined Compressive Strength on Rock core Specimen	2 – 3
3	Shear Parameters 'C' and 'Ø'	3
4	Point Load Strength Index/Tensile Strength	1
5	Water Absorption/Porosity/Density	2 – 3
6	Cutting, Grinding and Polishing of rock cubes	2
7	Drilling, Cutting, Grinding and Polishing of rock core	2
8	Co-efficient of Permeability	2 – 3
9	Abrasion Test (by Dorry's Method)	1

(iv) Material Testing :

Sl. No.	Name of the Test	Days
[A] Concrete		
1	(i) Cement Concrete Mix Design (28 days basis)	70
	(ii) Cement Concrete Mix Design (90 days basis)	160
	(iii) Cement Concrete Mix Design (180 days basis)	250
	(iv) Roller Compacted concrete Mix Design	75
2	Compressive Strength of Concrete cubes as per requirement	1-28
3	Flexural Strength of Concrete beams as per requirement	1-28
[B] Bricks/ Brick Tiles		
1	Warpage	1
2	Water absorption/ Flexural Strength (only for Tiles)/ Efflorescence	3
3	Compressive Strength	6
[C] Steel/ Welded Joints (Upto 25mm dia)		
1	Tensile Strength (9 bars)	1
[D] Fine Aggregate		
1	Sieve Analysis, Unit Weight	1
2	Material finer than 75 microns	2
3	Specific gravity & Water absorption/ Organic Impurities	3
4	Soundness	6
[E] Coarse Aggregate		
1	Sieve Analysis/ Unit Weight/ Impact Value/ Crushing Value/ Abrasion Value/ Flakiness/ Elongation Index	1
2	Material finer than 75 microns	2
3	Specific gravity & Water absorption/ Organic Impurities	3
4	Soundness	6
[F] Cement		
1	Standard Consistency/ Setting time/ Fineness (Specific Surface)/ Specific Gravity	1
2	Soundness	2
3	Compressive Strength	28
[G] Pozzolana		
1	Standard Consistency/ Setting time/ Fineness (Specific Surface)/ Specific Gravity	1
2	Soundness	2
3	Compressive Strength	28-90
4	Lime Reactivity Test	28
[H] Abrasion Test		
1	By Sand Blast Method	2
2	By High Velocity Water Jet Method	3

(v) Highway Laboratory:

Sl.	Name of Test	Days
Bituminous Materials		
1	Specific Gravity Test	3
2	Water Content Test	3
3	Softening Point Test	3
4	Penetration/Penetration Ratio Test	3
5	Ductility Test	3
6	Loss on heating Test	4
7	Viscosity Test	4
8	Flash-Point and Fire-Point	3
9	Float Test	3
10	Distillation Test	3
11	FRAASS Breaking Point Test	3

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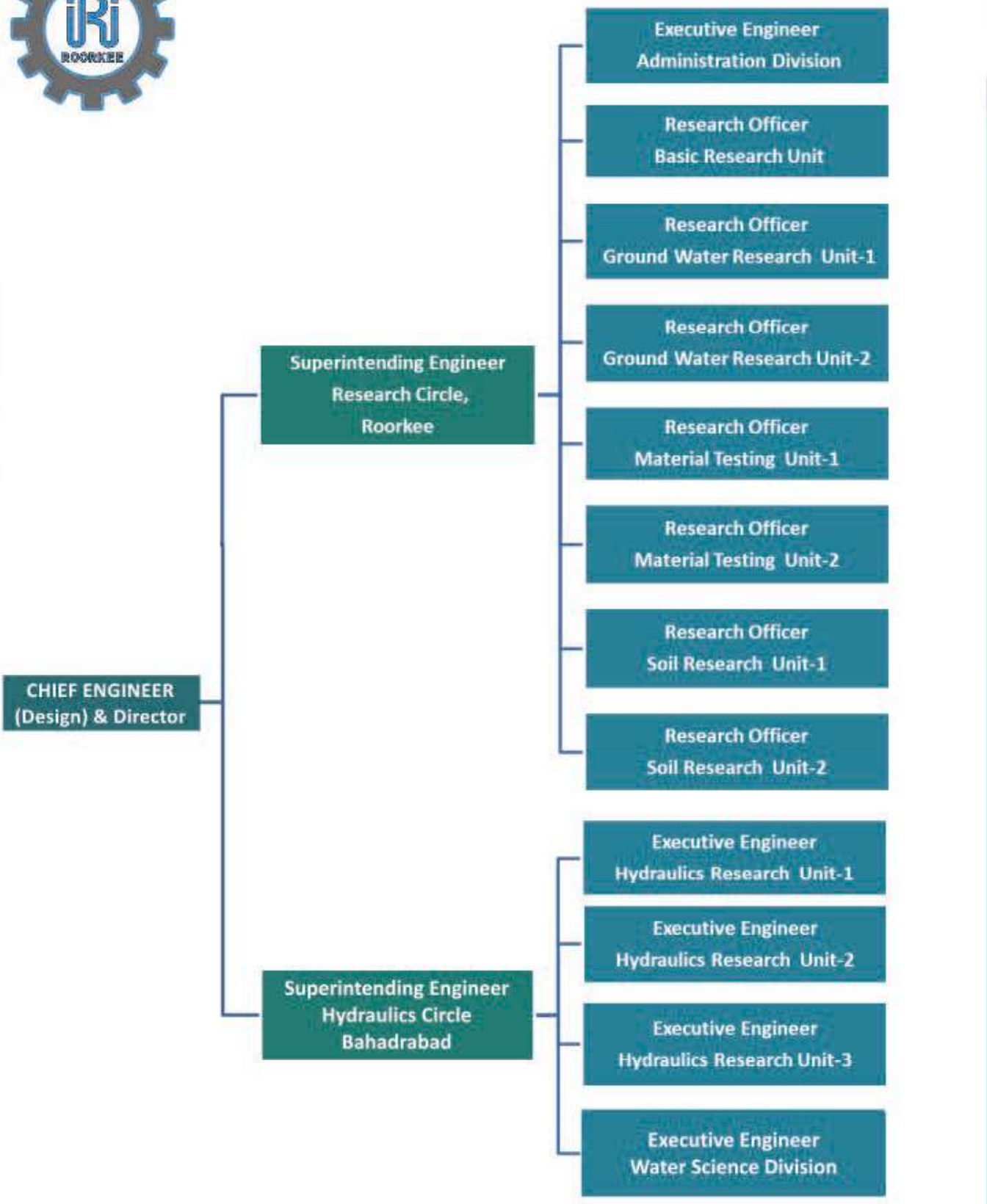
ORGANIZATIONAL STRUCTURES

Irrigation Research Institute, Roorkee



Aerial view of Hydraulic Research Station, Bahadrabad









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