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Ішкі істер қорықтарының құрылымына; е-2005

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**бырғандық және ішкі істер қорықтарының құрылымына;
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1.0 General description about the Irrigation department

The state of undivided Uttar Pradesh had set up the office of the Chief Engineer Yamuna Valley Projects at Dehradun under U.P. Irrigation Department some time around 1960 for construction of Yamuna Valley Projects.

During 1970 another chiefship of Tehri Dam Project under Irrigation Department was: set up at Dehradun. Subsequently other wing of Investigation and Planning was added for investigation of various Hydro electric projects in Ganga and Yamuna Valley.

During 1975, Irrigation Design Organisation was opened at Roorkee and subsequently Irrigation Research Institute at Roorkee was also extended in different fields of research and testing units. The Department was already having well equipped Roorkee workshop for fabrication and erection of Hydromechanical parts for Hydroelectric projects.

In the meantime post of Chief Engineer, Ganga Valley Projects was created for construction of Maneri-Bhali Stage-I Project. During 1981, Irrigation Department was further strengthened and the post of Chief Engineer (Multipurpose and Hydroelectric Projects) of the status of Chief Engineer Level-I was created. During 1995, the running canals were added to the jurisdiction of Chief Engineer (MHP) and it was renamed as Chief Engineer (Uttarakhand).

After formation of the new state of Uttarakhand, it is now known as Chief Engineer & Head of the Department, Irrigation Department, Uttarakhand. Thus, from the initial stage, Irrigation Department was engaged in the planning, construction and execution of the Hydro Electric Projects in Uttarakhand.

2.0 Information about its activities

Uttarakhand is endowed with huge water power potential in its holy and mighty rivers spanning the length and breadth of the region. The total hydro power potential in Uttarakhand as per preliminary estimate has been assessed around 16500 MW out of which only 1160 MW has been harnessed so far which constitutes hardly 7% of the available potential. A number of schemes on which work was started and infrastructure fully created, had to be stopped half way on account of financial constraints.

Commissioned Projects

With the expertise of construction of hydro electric projects by Irrigation Department, following projects have been successfully commissioned in Uttarakhand.

S.No.	Project	Installed capacity(MW)
1	Chhibro	240
2	Khodri	120
3	Dhakrani	33.75
4	Dhalipur	51
5	Kulhal	30
6	Khara	72
7	Maneri Bhali Stage-I	90
8	Chilla	144
9	Pathari	20
10	Kalagarh	198
11	Khatima	41

Projects Under Construction

Following projects were initially investigated and framed by Irrigation Department. Infrastructure works were also executed by Irrigation Department and thereafter these projects were transferred to Public Sector Undertaking or Private Sector due to paucity of funds on the part of the Government.

S.No.	Project	Installed capacity (MW)	Remarks
1	Tehri Dam Project	2400	Diversion Tunnel and HRT were constructed by Irrigation Department. 1st Phase of Project has been completed by THDC
2	Vishnu Prayag Project	400	Infrastructure by Irrigation Department. Project Completed by J.P. Associates.
3	Srinagar Project	330	Infrastructure by Irrigation Department
4	Maneri Bhali Stage -II	304	Civil works of the project have been completed and generation has started.

	Total	3434	
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Projects Under Construction but heldup

Following projects are under advance stage of construction by Irrigation Department, but are heldup for the last twelve years or so for want of funds.

S.No.	Project	Installed capacity (MW)	Remarks
1	Lakhwar Vyasi Project	420	About 40% work is complete
	Total	420	

Main works of Srinagar Project are yet to be started. It is noteworthy to mention that officers from Irrigation Department who opted for public/private sector, have contributed a lot towards these projects.

Projects Identified after Survey and Investigations

Irrigation Department was instrumental in preparing the DPRs, Feasibility and Appraisal Reports of the following hydropower schemes in the Garhwal and Kumaon region :

DPR's Prepared by the Department

S.No.	Project	Valley	Installed capacity (MW)	Approximate Cost (Crore Rs.)/Base Year
1	Kishau Dam	Tons	600	3455(1998)
2	Tuini-Plasu	Tons	45	252(2000)
3	Pala Maneri	Bhagirathi	416	1248(1999)
4	Loharinag Pala	Bhagirathi	520	902(1995)
5	Tapovan Vishnugad	Dhauliganga	360	739(1996)
6	Bawla Nandprayag	Alaknanda	132	507(1996)
7	Song Dam Drinking Water Project	Song	6	534(2005)
8	Kotli Bhel Dam	Ganga	1000	4393(1996)
9	Jamrani Dam Project	Gola	30	928(2005)

Feasibility Reports Prepared by the Department

S.No.	Project	Valley	Installed capacity (MW)	Approximate Cost (Crore Rs.)/Base Year
1	Deora Mori	Tons	27	112(1995)
2	Mori-Hanol	Tons	27	215(1995)
3	Hanuman-Chatti Syana-Chatti	Yamuna	33	149(2000)
4	Barnigad-Naiangaon	Yamuna	34	234(2000)
5	Chunni-Semi	Mandakini	26	110(1996)
6	Markura Lata	Dhauliganga	45	154(1996)
7	Lata Tapovan	Dhauliganga	108	247(1996)
8	Vishnugad Pipalkoti	Alaknanda	340	1048(1996)
9	Utyasu Dam	Alaknanda	1000	1985(1996)

Appraisal Reports Prepared by the Department

S.No.	Project	Valley	Installed capacity (MW)	Approximate Cost (Crore Rs.)/Base Year
1	Hanol-Tuini	Tons	45	144(2000)
2	Arakot-Tuini	Tons	70	231(2000)
3	Jakhol Sankhari	Tons	60	90(1995)
4	Bhainro Ghati - I	Bhagirathi	324	640(1995)
5	Bhainro Ghati - li	Bhagirathi	240	2736(1995)
6	Barkot-Kuwa	Yamuna	30	172(2000)
7	Syana Chatti- Gangani	Yamuna	45	205(2000)
8	Bhuinder Ganga	Alaknanda	20	86(1996)
9	Karnaprayag Dam	Alaknanda	252	637(1996)
10	Pinder Ghati Scheme	Pinder	112	729(1995)
11	Padli Dam	Pinder	27	84(1996)

Projects Identified by the Department

S.No.	Project	Valley	Installed capacity (MW)	Approximate Cost (Crore Rs.)/Base Year	Remarks
1	Bhilangana	Bhilangana	19	50(1995)	Identified
2	Pancheshwar Dam	Sharda	1000	3000(1987)	Initial investigations were carried out by the Deptt. and the project was transferred to CWC, New Delhi in 1981.
3	Purnagiri Dam	Sharda	1000	1000(1990)	Identified, investigations not started.
4	Chamgad Dam	Saryu	400	1251.2(1986)	Feasibility Report prepared by the deptt.
5	Sheraghat Dam	Saryu	45	322.38(1986)	Financially not viable due to higher generation cost.
6	Balighat Binola Dam	Saryu	15	133.15(1986)	Financially not viable due to higher generation cost.
7	Babas Dam	Kosi	88	38.93(1986)	Due to non availability of additional water in Kosi river, not found viable.
8	Khairna Project	Kosi	20	65(1986)	Investigations not started
9	Barseemi Dam	Kosi	12	49(1986)	Due to non availability of additional water in Kosi river, not found viable.
10	Quarab Dam	Kosi	20	67(1986)	Due to non availability of additional water in Kosi river, not found viable.

11	Purvi Ramganga Dam	Ramganga	45	135(1986)	3 dam sites were found unsuitable due to availability of calcareous rocks. Further investigations were not started
12	Hardhawa Chheena	Ramganga	10	40(1986)	Non availability of land for irrigation and higher generation cost.

Canals

Close under the hills the sub soil water lies nearer to the surface in the form of either isolated pools or in rivulets which, after flowing a short distance, disappear below the surface. In all other parts of the valley, the subsoil water lies at a great depth rendering Irrigation from wells impossible. Under these conditions canals and reservoirs are the only means for Irrigation and supplying drinking water in the region.

With the deputation of Captain Caultey, in 1837, to make an estimate of the cost of a canal from the Tons river near the village Bijapur, a commencement was made on the construction of Dun canals. These now consist of the following separate works:

- Bijapur Canal
- Rajpur Canal
- Kalanga Canal
- Jakhan Canal
- Kata Pathar Canal

3.0 List of Officers

4.0 Activity Profile of Irrigation Research Institute, Roorkee

Uttarakhand Irrigation Department is responsible to plan, construct and maintain Water Resources and Hydroelectric Projects in the state of Uttarakhand. Irrigation Research Institute (IRI) was established to carry out Research and Development work under the aegis of the U. P. Irrigation Department in the year 1928 as a small research unit in Lucknow.

The success of this small unit was duly acknowledged and in 1945 activities were expanded. The expanded unit was shifted to Bahadrabad (Roorkee) in 1946, where abundance of experimental facilities were available. The research unit at Roorkee rose to a full fledged Institute in 1954. The Institute gradually developed into a pioneer research station and is now engaged in Research and Development activities for many water resources and hydropower projects of the country.

The Institute is headed by Chief Engineer and Director with Hydraulics Circle, Material Testing Circle and Basic Research Circle headed by a Superintending Engineer. The R & D activities of the Institute are carried out in twelve divisions - [Hydraulics Division -I, II, III and IV, Soil Division -I and II, Material Testing Division I and II, Basic Research Division, Ground Water Division - I and II, Administrative Division] staffed by well qualified and experienced personals. Hydraulics model studies are carried out at Hydraulic Research Station, Bahadrabad. The IRI has unique facilities to undertake Research and Developmental activities related to Irrigation and Hydroelectric Projects in the following major areas:

1. Evolving efficient and economical hydraulic design for various engineering works viz.
Canal Works, Spillways, Power Houses, Intakes, Diversion Works, Surge Tanks, Sediment Excluding and Ejecting devices
2. Siting of Bridges and Barrages, River training, Flood Protection and Anti erosion Measures.
3. Carrying out Geotechnical investigations and experimentations.
4. Economical design of Concrete Mixes using Flyash and Super plasticizers, Roller Compacted Concrete
5. Laboratory Testing of Concrete, Bricks, Tiles etc.
6. Ground Water Development
 - Conjunctive Use of Subsurface and Surface Water, Water Logging
 - Suitability for Canal Linings, Seepage from Canals, Tubewell
 - Studies for Regeneration/Seepage of Water from Perennial River by Radio active Tracer Technique.
- 7.0 Sedimentation Studies including Capacity and Life of Reservoirs
- 8.0 Mathematical Modelling of Hydrological Events and Hydraulic Structures

Studies Carried out on Important Projects include:

- Tala Hydroelectric Project(Bhutan)
- Maneri Bhali Hydroelectric Project Stage-II(UA)
- Baglihar Hydroelectric Project(J&K)
- Vishnu Prayag Hydroelectric Project(UA)

- Tehri Dam Project(UA)
- Salal Hydroelectric Project(J&K)
- Nathpa Jhakri Hydroelectric Project(HP)
- Baspa Hydroelectric Project(HP)

5.0 Activity Profile of IDO, Roorkee

Central Design Directorate was established at Lucknow in the year 1961 for the specific need of undertaking the designs of major hydro projects. The designs of Ram Ganga multipurpose project, Rihand Dam, Obra Dam and Yamuna stage-I, Sharda Sahayak Project, Narora Barrage and Lower Ganga Canal Projects were completed successfully without seeking any help from any outer agency. To facilitate the works of Tehri Dam Project. a Design Circle was transferred from Lucknow to Roorkee in the year 1971.

To cater the need of new multipurpose projects which were coming up for execution, particularly in the Yamuna and Ganga Valley located in the central Himalayan region. presently in Uttranchal, were also assigned to this circle resulting in the creation of Irrigation Design Organisation by expanding the only one Circle to ten Circles under two Chief Engineers in the year 1978 at Roorkee. The Irrigation Design Organisation has been serving the state for the last three decades by undertaking the planning and preparation of efficient and economical detailed designs and construction drawings of various multipurpose, hydroelectric and Irrigation projects with the help of well established infrastructure based on modern techniques.

Having served the state very well for three decades, this organisation has a well established base in the design of :

1. Concrete Gravity Dams
2. Earth and Rock fill Dams
3. Roller Compacted Concrete Dams
4. Spillways and Barrages
5. Cross-Drainage Works
6. Canal Works
7. Surface and Underground Power House
- 8 Surge Tanks / Tunnels
9. Penstocks / Pressure Shafts
10. Intakes and Sedimentation Chambers
11. Various Types of Hydraulic Gates
12. Pre-stressed Concrete Bridges and Aqueducts

Main Designs Carried out of Important Projects

- TEHRI DAM PROJECT
- YAMUNA HYDROELECTRIC SCHEME STAGE-I & STAGE-II

- RAMGANGA DAM PROJECT
- KHARA HYDROELECTRIC PROJECT
- MANERI BHALI HYDROELECTRIC SCHEME STAGE-I & STAGE-II .
- GARHWAL-RISHIKESH CHILLA HYDROELECTRIC SCHEME
- UPPER GANGA CANAL MODERNISA TION PROJECT
- GANGA BARRAGE at KANPUR, etc.

The organisation has also rendered consultancy services to U.P. Mini and Micro Hydel Corporation.

6.0 Activity Profile of Govt. Workshop, Roorkee

The workshop was incepted in 1843 at Roorkee during the construction of the Upper Ganga Canal, the largest artificial stream in the world at that time. It also served as an Army Workshop during war in 1903. The workshop was handed over to U. P. Irrigation Department in 1953. Since then, many prestigious works for fabrication and erection of hydro-mechanical equipments have been successfully completed for various important Irrigation and power projects. The workshop also earned the foreign exchange by export assignment of Rolling Gas Turbine Casing as per specifications of MIS SIEMENS, Germany, entrusted by SHEL, Hardwar. The workshop has three fabrication shops, two machine shops, plate bending shop equipped for heavy and light fabrication, forge and foundry shop, pattern shop etc..

Machine Shop	Capacity
Universal Milling Machine	250 and 900 mm
Vertical Milling Machine	300 mm
Horizontal Milling Machine	350 mm
Turret and Capston Lathe Machine	900 mm
Centre Lathe Machine	6 mm – 12 mm
Vertical Boring Machine	700 mm
Horizontal Boring Machine	300 mm
Duplex Boring Machine	450 mm
Planner Machine	
Shaper	600 mm
i) Horizontal	300 mm
ii) Vertical	
Gear Hobbing Machine	500 and 2000 mm
Central Grinding Machine	150 and 325 mm
Foundry & Black Smithy Shop	
Coupola	3 and 5 MT

Electric Furnace
 Mold Making Machine
 Air Compressors
 Blowers
 Power Hammer 3 and 10 Cwt.
Pattern Shop
 Band Saw 14 and 24 mm
 Wood Planner
 Turning Lathe
Fabrication Shop
 E.O.T. Crane 5 and 10 MT
 Punching Machine 40 and 70 MT
 Shearing Machine
 Centre Lathe
 Single and Double Lead Welding
 Transformer
 Hydraulic Jack
 Plate Welding Machine 25 mm
 Radial Drill machine
 Welding Machine
 Jack 100 MT
 Overhead Crane 10 MT
 HMT Radial Drill machine
 Welding generator set
 Pug cutting machine

Plate Bending Shop

- Hydraulic plate bending machine (conical bending, pre- prinching, pre-rolling)
- Submerged Arc Welding Boom with Automatic Welding Rectifier
- Miller D.C. Arch Welder with Welding Control
- Piper Rotator
- Welding Machine
- Pug Machine
- X-Ray Machine
- E.O.T. Crane 10 MT Capacity

The important jobs completed include :		
S.No.	Type of Job	Project/Sponsored by
1	Mini climbing crane 1000kg capacity	

2	Gate size 18 m x 5 m	Dakpathar Barrage, UPID
3	Gate size 18 m x 5.5 m	Ahsan Barrage, UPID
4	Hydro Mechanical Equipments	Dhakrani/Dhalipur Power House, UPID/UPSEB
5	Hydro Mechanical Equipments	Ramganga Barrage, UPID
6	Gate size 18 m x 6 m	Okhla Barrage, UPID
7	Hydro Mechanical Equipments	Badarpur Power House, Delhi
8	Gate size 18 m x 6 m	Gomti Barrage, UPID
9	Gates & Penstocks	Yamuna Hydro Electric Project UPID/UPSEB
10	Gate size 7M x 3 m	Eastern Ganga Canal, UPID
11	Gates & Penstocks	Maneri Bhali stage I & II UPID/UPSEB
12	Equipments for Gas Turbine	BHEL Hardwar (Export Assignment)
13	Hydro Mechanical Equipments	Triveni Structures Ltd., Allahabad.
14	Bye-pass Gates	NHPC, Tanakpur.
15	Equipments for Gas Turbines	BHEL, Hardwar.
16	Fabrication of Equipments for Paper Machinery	U. P. Agro Products Ltd.
17	Gate size 8M X 5 M	Upper Ganga Canal Modernisation Project.
18	Fabrication of various elements a. Tail race Gates b. Intake Gates c. Forebay Gates d. Draft Tube Gates e. Stoplog Gates f. Trash Racks g. Stacking Pit Rolling and fabrication of Penstock Steel Liners	Maneri Bhali Stage-II Project
19	Rolling of Segments for Turbine and Generator	BHEL, Hardwar.

20	Repair work of Flushing Conduit Gates and fabrication of Trash racks	Ichari Dam Project, UK
21	Repair work of Runner Chamber	Pathari Power House

7.0 Activity Profile of State Engineer's Academy, Kalagarh

The Academy was established at Kalagarh in Distt. Pauri Garhwal (Uttarakhand), with a view to impart training to Engineer Officers of Irrigation Department and Public Works Department. It was envisaged to provide training to the newly appointed Assistant Engineers and also the in-service middle/higher level officers of both the Departments.

Kalagarh is 46 km by road from Dhampur Railway station. Direct bus service is available from Kalagarh to Meerut, Delhi, Kashipur and Haldwani.

The Academy is headed by its Chief Engineer and Director. There is a provision of an Administrative Advisory committee for the consideration and decision on administrative matters of the Academy.

The courses organised are as follows:-

S.No.	Name of Course	Duration	Description	Training Courses Organized and Engineers Trained since inception	
				No. of courses	No of Trainees
1	Induction course	1 Year	For Newly Appointed Assistant Engineers of Irrigation and Public Works Department.	43	739
2	Foundation course	3 Months	For Newly Promoted Assistant Engineers of Irrigation and Public Works Department.	100	1645
3	Foundation course	3 Months	For Newly Appointed Junior Engineers of Irrigation, Public Works and Rural Engineering Services	10	300

			Department.		
4	Refresher course	1 Week	For Service Engineers of Irrigation and Public Works Department.	114	2382
			Total	257	4765

8. Brief account of constructed hydro-electric projects on River Ganga, Yamuna and Ramganga.

Start of hydroelectric projects

For the first time, the construction work of hydroelectric projects in Uttarakhand commenced in 1960. Power was generated in 1965 by constructing Dakpathar barrage, power channel and Dhalipur and Dhakrani powerhouse over Yamuna River.

A brief account of constructed hydroelectric projects: -

Hydroelectric project constructed on Yamuna River

Yamuna hydroelectric project stage-I:

In this project, 516 meter in length barrage was constructed at Dakpathar on Yamuna River. It has a capacity of 198 cumec. A 14.3 km long power channel provide water to two powerhouses, i.e. Dhakrani and Dhalipur. The Dhakrani power house has head of 19.3 meter with 33.75 MW and the Dhalipur has the installed capacity of 51 MW with 30.48 meter head.



All the works were completed in 1965 and 32 crores unit power is generated every year. Rs. 16.83 crores was spent the construction of the project.

Yamuna hydroelectric project stage-II, part one

59.25 meter high and 155 meter long concrete dam was built on Ichari area on Tons river, a tributary of Yamuna River. The water of Tons river was brought by a 7 meter diameter and 6.2km long tunnel to Chibro. At Chibro a powerhouse of the capacity of 240 MW was Installed. This is the first effort made on an underground project in Himalayan region. Many challenges were faced in making of this much lengthy tunnel in rocky mountain by the engineers of Irrigation Department.

Several innovations came into being which have been successfully adopted in similar projects in the country. The project was completed in 1975. 81 crores of units is being generated ever year. The project cost came to Rs. 73.32 crores.

Yamuna hydroelectric project stage-II, part two

In this project the water coming out of Chibro powerhouse was taken to Khodri area by 7-metre diameter and 6.6 km long siphon tunnel beneath Tons river. A power house of 120 MW capacity was constructed at Khodri power house, whose tail race meets Yamuna river at Dakpathar. The project was completed in 1983 and power was generated in February 1984. The total cost of project came to Rs. 65.15 crores and 37 crores of units are produced every year.

Yamuna hydroelectric project fourth phase, part one

In this project a 268 meter barrage was built on Asan river and water from Dhalipur power house was put in Asan river. 118 cumec water was carried through a 4 km long power channel to Kulhal power house to generate 30 MW of hydropower. The project work was completed in 1975. Total cost of project was Rs. 14.11 crores. 14 crores unit power is being produced every year.

Yamuna hydroelectricity project fourth phase, part two

In this project, the water outlet of 118 cumec from the tail race of Kulhal power house is being taken through a 13.0 km long power channel and 1.0 km in length of Twin tunnel, to Khara power house to generate 72 MW. 33 crores unit of electricity are being produced every year.

Hydroelectric project constructed on Ganga River

Garhwal-Rishikesh-Chilla hydroelectric project:

Birbhadra barrage was constructed on Ganga River near Rishikesh. In it, 565 cumec and 14 kms lengthy river was taken out to reach up to Chilla, where powerhouse is located. This project commenced in 1974 and it started generating power in 1981. Total cost of this project came to Rs. 98 crores with an Installed capacity of 114 megawatt. 72 crores-unit electricity is being generated every year.



Map-Ganga Valley

Maneri Bhali project, first phase

In Uttarkashi, at Maneri, on Bhagirathi River, a 39.0 meter high and 127 meter long concrete dam has been made. Water from here is being transported through 4.75-meter diameter and 8.63 kms long tunnel to Tiloth powerhouse. There after the water is channelised to Bhagirathi River. The power generation commenced in 1984. The project cost came to Rs.314.68 crores. The Installed capacity of this project is 90 MW and it produces 42 crores units every year.

Hydroelectric projects constructed on Ramganga

Near Kalagarh in Pauri Garhwal, on Ramganga river, a 128 meter high dam made out of soil has been constructed. The capacity of its powerhouse is 198 MW. The project was commissioned in 1962 and it was completed in 1975. 39 crores unit is being produced every year.

