

Karnataka Study Tour Report-2015



Water Resources Department
Government of Maharashtra



Report on Participation in
Karnataka Study Tour

By

**Officers of
Water Resources Department,
Government of Maharashtra**

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EXECUTIVE SUMMARY

As a delegates from Maharashtra Water Resources Department, it was great opportunity for all of us to participate in the Karnataka Tour. We visited major irrigation projects in the Karnataka state and interacted with the officers. The geographical terrain of Karnataka and Maharashtra is quite similar. There are three corporations under Karnataka Water Resources Department. The details of water sector of Karnataka is presented in Annexure 1.

Team visited following projects - Upper Bhadra Project, Bhadra Project, Ubrani-Amrutapur LIS, Shiggaon LIS, Dhupdal weir, Ghatprabha Project (Hidkal Dam), Navnagar Rehabilitation of Almatti project, Ramthal LIS, Tungabhadara Project and Almatti Project. The lessons learned during this study tour are mentioned in this report along with the recommendations for Maharashtra Water Resources Department. Important recommendations are summarised as below-

1) Irrigation Project Construction:

In Karnataka, project like Ubrani LIS is implemented successfully for mitigating drought in Drought prone areas through supplying water (1.25 TMC) to water conservation structures which solved problem of drinking water in rural areas and promoted indirect irrigation through ground water recharge. In Bhadra stage 2 project same model is being adopted on large scale (25 TMC). In Maharashtra also this model can be adopted for DP areas for drought mitigation. Water availability for such augmentation schemes may be accepted at lesser dependability than usual schemes.

Use of Micro irrigation for efficient use of scarce water- In Karnataka drip and sprinkler irrigation is planned to irrigate more area in available water as in case of Ramthal and Shiggaon LIS. Considering scarce water resources and high cost of electricity in lift irrigation schemes, micro irrigation must be considered compulsory in LIS. Also in case of water diversion for non-irrigation purposes, restoration of existing command areas may be considered by adopting micro irrigation instead of curtailment of command area. Cost of additional infrastructure like balancing tanks required for converting flow irrigation in command areas into micro irrigation may be done through restoration charges from NI users.

2) Irrigation Management:

In Karnataka Superintending Engineer is irrigation officer for major irrigation projects and Executive Engineer for medium and minor projects. Irrigation management is done by irrigation officers with the advice of the Consultative Committee under District Minister, Public Representatives, other administrative officers and Water User Associations (WUA) are members.

In Maharashtra we have Canal Advisory Committee in which Executive Engineer is chairman and another committee for reservation of water for drinking purpose under collector. Instead of dual arrangements, one committee under Chairmanship of District Guardian Minister and SE as member secretary and other administrative officers and Water User's Association's as members for both irrigation as well as non irrigation water management may be considered as alternative for oneness in command and efficient management.

3) Real Time Flow Measurement:

Telemetric real time flow measurement is adopted in Ghatprabha system for monitoring discharges in canals for efficient irrigation management. It can detect losses as well as illegal water use from canal at instance and rectification is possible in time. In Maharashtra we may try it on pilot basis for one major project intially and then all main canals of major projects in the state .

4) Participatory Irrigation Management:

In Karnataka, for registration of water user association's one registrar is posted in irrigation offices. Similarly in Maharashtra posting of Special Officer in Irrigation Circle office for special purpose of formation and post-formation legal issues to Water User's Association will be more suitable than doing it through irrigation engineers.

Arrangement of State level Federation of water user associations is also adoptable in Maharashtra to tackle state level policy issues. Provisions of office and supporting staff, vehicle and allowances to Apex level WUOs in state can also be thought of as admissible in Karnataka.

5) Organisational Set up:

Though organisation set up of Karnataka Water Resources Department is mostly like ours, they have constituted technical advisory committees comprising of retired senior officials to guide project officers for benefiting from their experience and knowledge. For major projects Control Board is

constituted to clear the proposals recommended by Technical advisory committees involving Chief Minister as Chairman and Water Resources Minister as vice Chairman. In Maharashtra we may adopt similar model to speed up and clear pending revised administrative approvals for Major projects and to decide on future proposals. The detailed organisation setup of KWRD is presented in Annexure 2.

6) General:

In Karnataka, on major dams like Almatti, Tungbhadra, Hidkal and Bhadra dams - gardens, musical light shows and galleries / museums, cafeteria are established and well maintained with tourist focus at dam site. At Bagalkot, a city rehabilitated due to Submergence of Almatti dam, museum and gallery depicting rural life pre project and various amenities provided during rehabilitation are established. At Tungbhadra, Almatti and Hidkal dam, statue and Photographs of engineers who contributed for the project are installed. In Maharashtra there are number of dams in vicinity of mega cities like Pune, Mumbai, Nashik and Nagpur. These dams need to be maintained properly and Tourism potential of these dams may be utilised by creating infrastructure on BOT basis. Also museum and galleries depicting various stages in construction, models of dam, photographs of Pre and post developments in command and Submergence area of project along with names and photographs of engineers and officers who contributed for projects may be installed in project premises and inspection bungalows for inspiration to future generations.

Team express their gratitude towards all officials of Karnataka Water Resources Department for assistance and support provided throughout the tour. At field level official welcomed us and explained in depth about the project and components. We are very much thankful to them.

Special thanks to the Mrs. Malini Shankar, Principal Secretary (WRP & D), Mr. H.T. Mendhegiri, Secretary (WRD & CAD) of Maharashtra Water Resources Department for providing this opportunity. We express gratitude towards Director General, Water And Land Management Institute, Aurangabad for making all arrangements regarding Karnataka Study Tour. We are also thankful to Dr. Sanjay Belsare for his support and encouragement.

Last, but not least, members of study tour express their gratitude to Mr. Ajit Nirmale, coordinator of study tour for efficient coordination.

1. INTRODUCTION ABOUT STUDY TOUR

1.1 ABOUT STUDY TOUR

Water Resources Department, Government of Maharashtra decided to organise visit of officers of department to the adjoining states of Maharashtra. The purpose of visit is to understand the best practices in water sector, visit to specific water resources projects in that state in order to enhance knowledge of officials, which will be helpful for implementation of best practices in water sector of Maharashtra. Water And Land Management Institute, Aurangabad was the nodal agency in order to organise such tours.

1.2 PARTICIPANTS OF KARNATAKA STUDY TOUR

Karnataka Study Tour was organised from 22nd Feb 2015 to 27th Feb 2015 and following were the participants of the tour-



Sr. No.	Name of Officer	Designation	Office
1	I.S. Chaudhari (Team Leader)	Superintending Engineer	Pune Irrigation Project Circle, Pune
2	D.R. Joshi	Superintending Engineer	CDO (Earthen Dam), Nasik
3	Pravin Kolhe	Executive Engineer	Change Management, e- Governance, Pune
4	S.P. Shinde	Executive Engineer	Bhima Irrigation Division, Pandharpur
5	Vijay Thorat	Executive Engineer	Ahmednagar Medium Project Division, Ahmednagar
6	T.M. Jengate	Executive Engineer	Tembhu Lift Irrigation Project Division No-2, Karad
7	Shivaji Bolbhat	Executive Engineer	Quality Control Division No.-2, Shirur, Pune

8	Jayant Khade	Executive Engineer	Mechanical Division, Kolhapur
9	Vijay Patil	Executive Engineer	Kolhapur Irrigation Division, Kolhapur
10	Pradakshine	Executive Engineer	
11	Ajit Nirmale (Coordinator)	Asst. Professor	Water And Land Management Institute, Aurangabad

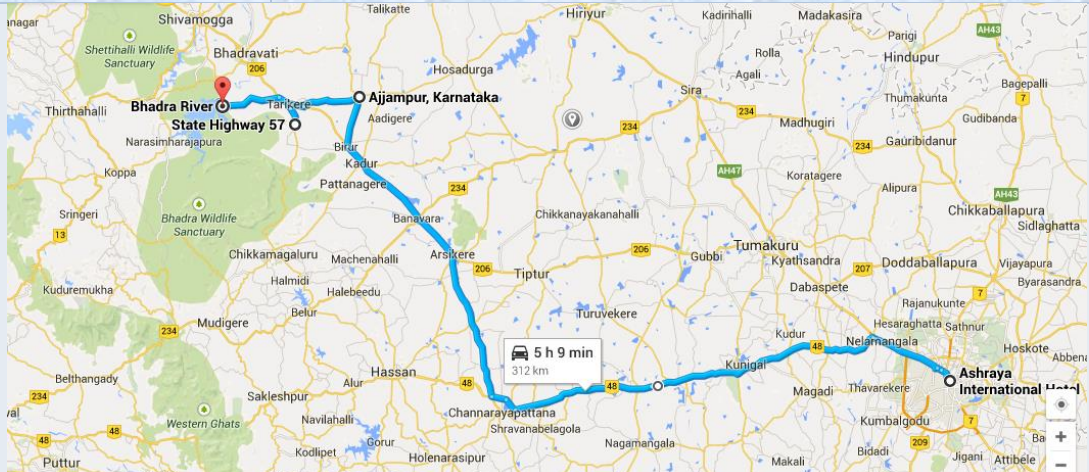
1.3 PROGRAMME OF KARNATAKA STUDY TOUR

The programme of study tour of Karnataka is given below-

Date & Day	Visit of Projects	Halts at	Distance (km)
22-02-2015 Sunday	Assembling and report to Hotel Ashraya International, Bangalore	Bangalore	-
23-02-2015 Monday	Bangalore to Upper Bhadra Project, 1. Ajjampura Tunnel 2. Pump House at Shantipura 3. Bhadra Dam	Shimoga	370
24-02-2015 Tuesday	Shimoga to Ubrani-Amruthapura LIS & Shiggon LIS (Sprinkler Irrigation) at Shiggon.	Belgaum	410
25-02-2015 Wednesday	Belgaum to 1. Hidkal Dam, (Ghatprabha Dam), Dhoopdal Weir and Telemetry System 2. Navnagar Rehabilitation at Bagalkot	Almatti	305
26-02-2015 Thursday	Almatti to Ramthal LIS and Drip Irrigation System, Humpi, Tungabhadra Project (Hospet Dam)	Almatti	335
27-02-2015 Friday	Almatti dam and return journey	Headquarter	-

2. STUDY TOUR

2.1 UPPER BHADRA PROJECT

Route	Bangalore to Ajjampura Tunnel, Shantipura Pump House
Date of Visit:	23/02/2015
Location Map:	
Accompanying Officers:	Mr. Mohan Kumar, Executive Engineer at Ajjampura Tunnel Mr. Shiv Kumar at Pump House
Salient Features:	Upper Bhadra project
<p>Chitradurga and Tumkur districts coming under middle part of Karnataka have been declared as drought prone districts. Upper Bhadra Project and had accorded Administrative Approval in 2003 for Rs. 2813 crores, which was revised as Rs. 12,340 crore in order to provide irrigation facilities to 2.25 lakh ha areas in Chikmagalur, Chitradurga, Davangere and Tumkur districts and fill up 367 minor irrigation tanks. A significant feature of the project is that the entire 2.25 lakh ha will be under drip irrigation with 81% project efficiency.</p> <p>The main features of the report as per administrative approval proposal are as below-</p> <ol style="list-style-type: none"> 1. Lifting of 15 TMC of water from Tunga river and delivery to Bhadra reservoir. 2. Lifting of 21.50 TMC of water from Bhadra reservoir and delivering it to proposed delivery chamber near Ajjampura through a canal system. 3. Construction of Tunnel near Ajjampura and letting out water in Chitradurga branch canal for irrigating semi-dry crops during Khariff and filling 156 MI tanks in draught prone areas of Chickmagalur, Chitradurga, Kolar and Tumkur districts there by increasing the underground water table in the region and creating basic facility of drinking water in the reason. <p>As per revised approval, water will be lifted from Tunga river to the Bhadra reservoir improving irrigation potential in Kadur (Chikmagalur district), Tarikere, Challakere, Hosadurga, Hiriyyur (Chitradurga district) and Chikkanayakanahalli and Sira (Tumakuru district) through the drip irrigation mode. The water extraction from the Bhadra reservoir will also be increased from 23.97 TMC to 29.97 TMC.</p>	



Visit to Ajjampura Tunnel of Upper Bhadra Project

The Stage 2 of Upper Bhadra LIS have 5 pumps of 18500 HP each installed to lift 24.5 TMC feet of water for 44m static head benefitting 2.25 lakh Ha area. Source of scheme is Bhadra dam and lifting period is only monsoon and for filling existing tanks. The Pumps have the steel volute casing, which is unique feature.



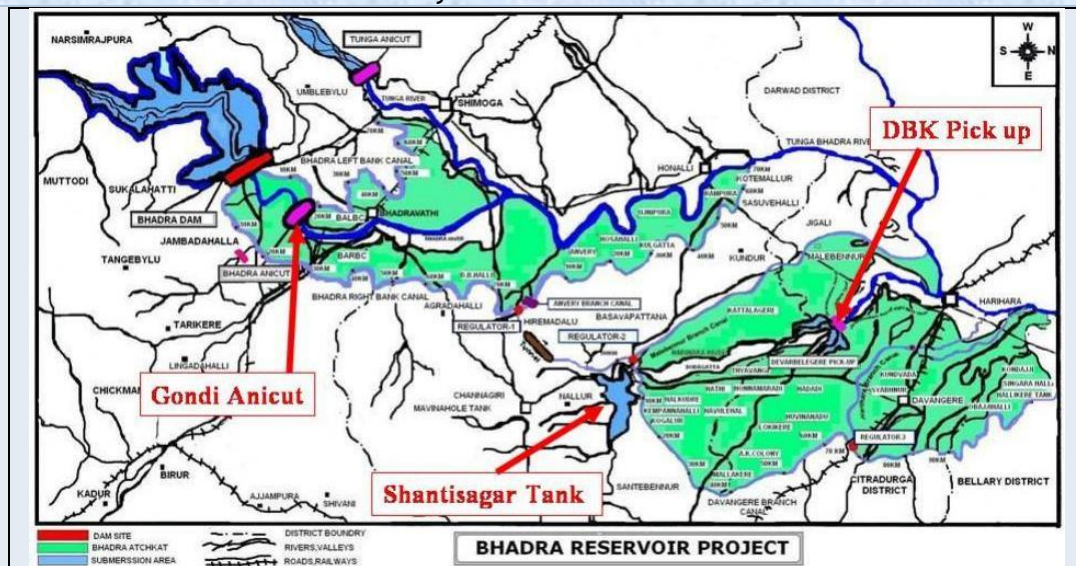
Upper Bhadra Project -Pump House near Shantipura

Learnings:	<ol style="list-style-type: none"> 1. Drought-prone area is brought under irrigation in Kharif season by massive mega lift irrigation schemes. 2. Lift irrigation schemes are implemented on turnkey based contracts and following innovative techniques were adopted- <ol style="list-style-type: none"> a. Metallic Volute Pumps of huge capacity of 20.25 cumecs (13.75 MW, 5Nos) are used. Selection of Huge capacity pump reduces number of pumps as well allied Electro-mech equipment's. b. Pumps are installed below FSL with isolation wall which allows better hydraulic condition for operation of pump and also economical pump construction. 3. The scheme is under construction and it would be interesting to record the following observations after functioning- <ol style="list-style-type: none"> a. Hydraulic and mechanical performance of imported Metallic Volute Pumps. b. Leakages if any through the isolation wall. c. Effect of heavy reverse flow on the pump due to steep static head and slow closing characteristics of the HOPD valve. 4. Entire command area is planned under drip irrigation, saving huge amount of water, which is used for irrigating additional area and improving project efficiency to 81%.
Recommendation:	All Lift Irrigation schemes in the Maharashtra State shall be constructed only through drip and or sprinkler irrigation.

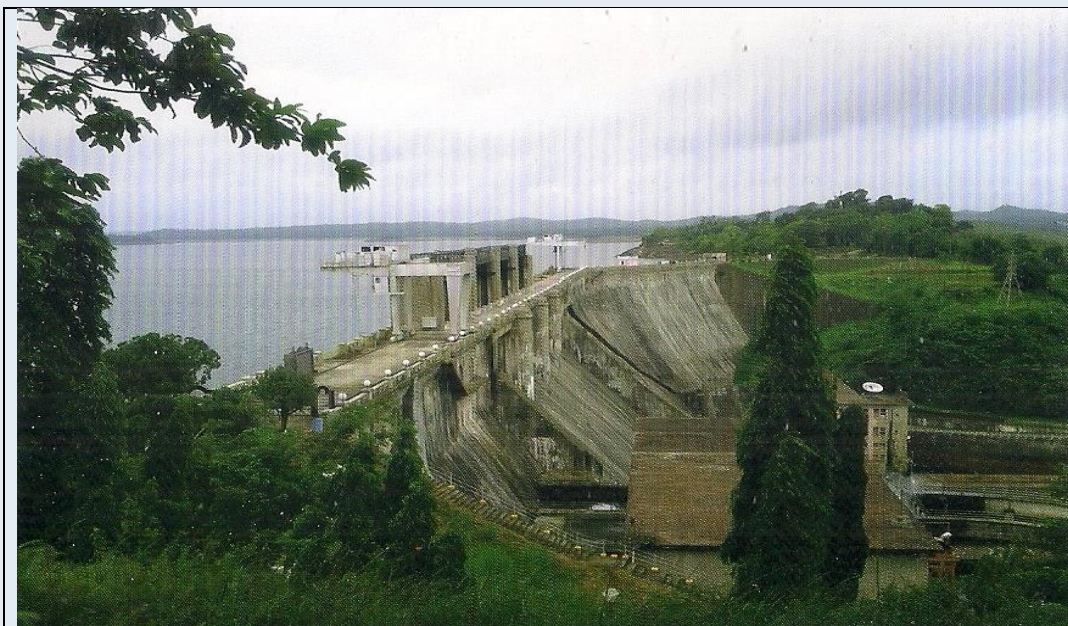
2.2 BHADRA PROJECT:

Location	Bhadra Project, Tarikere (Tq), Chickmagalore District
Date of Visit	23/02/2015
Accompanying Officers	Mr. Punit at Bhadra Dam
Salient Features	Bhadra project
<p>The river Bhadra raises from the Varaha hills in the Western Ghats of Chikkmagalur district. The Bhadra basin gets 82 % of inflow from SW monsoon (June to September) and 18% from NE monsoon (October to December). The basin has a catchment area of about 2000 sq Km with an average annual rainfall of 800mm. The Estimated yield is 84.63 TMC feet at 75% dependability. Study team visited Bhadra Dam which was constructed across Bhadra River near Lakkavalli (Village), Tarikere (Tq), Chickmagalore (Dist) in Karnataka (State) at an elevation of 601mtr above M.S.L. The Bhadra Project constructed between 1946 and 1966 has a gross storage capacity of 2,025 Mm³, a live storage of 1,608 Mm³, and a water spread area of 11,200 hectares. The Dam is Located at 13°42'00" N and 75°38' 20" E with</p>	

a view to provide irrigation facility to the arid regions in Davanagere, Shimoga and Chikmagalur district covering an area of 1,05,570 Ha and generating power to an extent 39.20 MW of Electricity.



Index Map of Bhadra Project, Tarikere(Tq), Chickmagalur District



Bhadra Dam

Learning

1. Maintenance of Bhadra Project was carried out on regular interval and dam is in good condition.
2. Vertical Gates are used as a flood control gates and these gates are performing well for more than 40 years. These designs must be reviewed for tackling some problems like vibration at partial opening in the vertical gated used for various barrages in the Maharashtra.

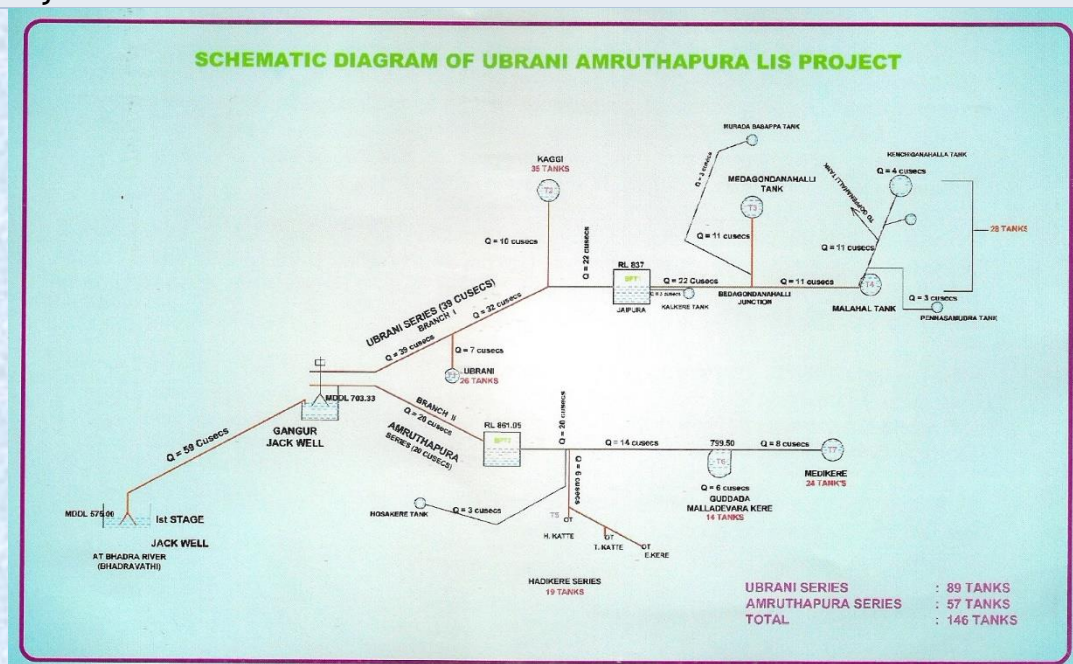
2.3 UBRANI AMRUTHAPURA LIS:

Route	Shiggaon to Ubrani Amruthapura LIS
Date of Visit:	24/02/2015
Accompanying Officers:	Mr. Jeevan Kumar, AEE Mr. Kariyappa K Mr. Ravi Kumar, AE Mr. Onkarappa, AE Mr. Raja, JE Mr. Shashikant Gowda
Salient Features:	

Team visited Ubrani Amruthapura LIS on 24/2/2015. The main aim of Ubrani Amruthapura LIS project is to provide drinking water facility and feed water to 57 Tanks of Tarikere Taluk & 89 Tanks Channagiri Taluk. The Ubrani-Amruthapura LIS envisages to stabilise 11818 acres of land in Chennagiri and Tarikere taluk by lifting of water from upstream of a diversion structure across Bhadra river near Gourapura village near Bhadravathi.

Water has been lifted in two stages. The first stage is from Bhadravati river near Gowrapura village. The rising main length 14.415 km and lifted to 134.14 m height. The second stage is from Gangur village of Bhadravati taluka. The water has been lifted towards Ubrani series 183 meter and 186 meter, the total length of 55 km up to terminal tank points.

Layout Plan



In Maharashtra, WRD feeds existing empty storage tanks, which are mostly out of scope of Project like in Purandar and Janai Shirsai LIS. In, Karnataka, it has been observed that special LIS with sole purpose feeding storage tanks on large extent is designed and operational with electricity charges born by the the Government. The Ubrani Amruthapura LIS is only for filling tanks. Annual electricity bill of 5 crores and 1 crore is Operation and Maintenance cost. Quantity of water lifted is 1.25 TMC. In short Karnataka Government is bearing the cost of running and O&M

charges. Also they are not charging anything to farmers or villages for feeding water.

Team visited Stage 1 and stage 2 of Urbani Amrutpura LIS and tanks. Supari is the major crop with Banana as inter crop. Gum drawn from stem of Supari tree is main market product which is used in preparation of paints. Micro as well as flow irrigation is practiced in the command area.

Learning:	<ol style="list-style-type: none"> 1. The scheme is under operation and water is being supplied to the storage tanks. Team visited the pump house and discussed about various components of the project. 2. Annual maintenance contract was made in order to maintain electrical and mechanical components of the scheme. Such AMC's are recommended in Maharashtra for schemes where all pumps are commissioned. 3. The scheme is allowed to operate for 245 days in the year and water supplied to the various tanks through closed pipe line from where indirect irrigation (through percolation) is done. Farmers are utilizing the water from charged borewells which are almost 8587 in numbers.
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2.4 SHIGGAON LIFT IRRIGATION PROJECT:

Site	Shiggaon Lift Irrigation Scheme
Date of Visit	24/02/2015
Accompanying Officers	Mr. S.P. Bidnar, Executive Engineer Mr. S.S. Palegar, AEE Mr. M.S. Bhajantra, AE Mr. C.N. Gurudutta, Dy. Project Manager, Jain Irrigation Mr. Suresh Nalaware, Project Engineer, Jain Irrigation
Salient Features	<p>Shiggaon Lift Irrigation Scheme is proposed to irrigate 9900 ha dry lands in 30 villages of Shiggaon, Savanur and Hanagal Taluks in Haveri district. 42.45 M. Cum water will be diverted by constructing a diversion weir across Varada River near Halasur village of Savanur taluk, Haveri district, to lift the water to higher lands and providing Sprinkler Irrigation facility. The Jack well is located at Longitude 75°17'00" E and Latitude 14°51'00" N near Halasur village of Savanur Taluka. The total land required for the project is 45 ha and land resources conservation achieved is 94%. The total cost of the project is 238 Crores and the Benefit - cost ratio is 1.28.</p> <p>Team visited Shiggaon LIS where 1.25 TMC feet water is lifted from Varda river to irrigate 9900 Ha by Sprinkler irrigation. It is a pilot project taken up in constituency of then WRD minister. Water is distributed to various blocks having command area of 20 Ha, in a sump tank of size 13×13×3 m through network of rising main and gravity distribution. From sump water is fed to sprinkler sets by means of 10 HP pump. Farmers to use sprinkler sets in rotation at the interval of 4 days. KNNL is to operate scheme up to sump. From sump it is to be managed by farmers through WUAs. Scheme is in running since last 2 years and about 60% command is developed till date of visit.</p>



Farm Pond for Water Distribution at Field of Shiggaon Lift Irrigation Project

<p>Learning</p>	<ol style="list-style-type: none"> 1. Entire command area of project is irrigated using sprinkler irrigation. Water is lifted and feeded to filed tanks as per predefined schedule. 2. Irrigation efficiency is increased to a great extent. 3. Dedicated electricity network is provided for effective functioning of the scheme. 4. There are 6 numbers of Delivery Chamber's (DC) at various chainage of Rising Main and these DCs are operated through single source station with 4 VT pumps. Thus pumps are operated through variable head which reduces the capital cost with scarifying hydraulic and operational efficiency.
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2.5 DISCUSSION WITH SENIOR OFFICERS

Date	24/02/2015
Accompanying Officers	Mr. B.B. Jagalasar, Chief Engineer, KNNL, Irrigation (North) Zone Club Road, Belgaum, Karnataka. Mr. U.V. Kulkarni, Executive Engineer, GLBC, Division No.-2, Bagalkot.
Points of Discussion:	

Following issues were discussed-

- Organisation structure of department
- Telemetry system
- Issues in Irrigation Management
- Impact of irrigation projects

2.6 DHUPDAL WEIR:

Site	Dhupdal Weir
Date of Visit	25/02/2015
Accompanying Officers	Mr. U.V. Kulkarni, Executive Engineer, GLBC, Division No.-2, Bagalkot. Mr. B.P. Kambale, Executive Engineer
Salient Features	The Dhupdal weir was constructed in the year 1883 by British Empire across Ghatprabha River near Dhupdal village with design capacity of 0.37 TMC feet. This weir is having main canal of total length 109 km, which is called as Ghatprabha Left Bank Canal with total command area of 1,61,881 Ha. Team visited Dhupdal weir and observed that due to long service, since 1883, siltation occurred in the storages. At has been told that about 30 to 40 percent of total storage is silted up.



Dhupdal Weir on Ghatprabha River

2.7 REAL TIME FLOW MEASUREMENT SYSTEM:

Site	Ghatprabha Canal
Date of Visit	25/02/2015
Accompanying Officers	Mr. U.V. Kulkarni, Executive Engineer, GLBC, Division No.-2, Bagalkot. Mr. B.P. Kambale, Executive Engineer
Salient Features	

Team also visited the telemetry station installed on canal. The purpose of project is to improve water management, service delivery and water conservation by monitoring and controlling the canal discharge to meet the actual crop water requirements in the command area. The system as a whole helps capture the water requirements in discharge terms, across the canal network. Once the water requirement or plan is captured into the system software, the flow monitoring field station sensors monitors the flow accurately and communicate the same in real time to the central monitoring station. The real time data is compared with the captured plan to assess the deviation in the flow as against the plan. The deviations are then communicated to the relevant officers for further corrective action. The deviations are escalated to the superior officers, if there are repeated deviation.



Real Time Flow measurement system

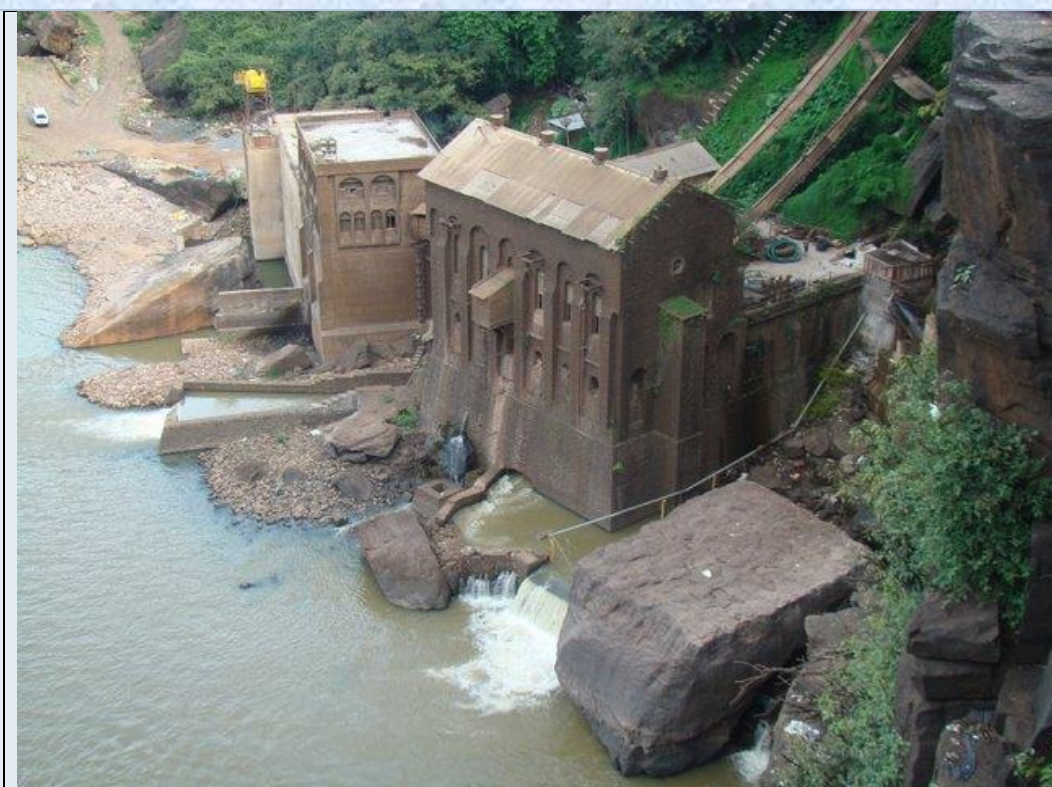
On GLBC, real time flow measurement system has been established for monitoring canal discharges. Devices are installed at 50 stations in a length of 105Km. Below real time message from system-
 Dhupdal telemetry readings...
 25/02/2015 11:00 GLBC Flow 0.6 Km 6.24 ft Dis 1699.24 Cs 50 Km 1.11 ft Dis 23.94 Cs NRTN Br Dis 18.04 Cs

Learning	Present system of measurement of head and discharge in a canal is based on flumes which are installed during construction of canal, which was not calibrated time to time and human intervention is required for reading, recording and reporting the readings at specified interval. The real time flow measurement system installed at canal monitors flow continuously, concurrently and accurately.
Recommendation	Real time flow monitoring system shall be established at any major project in Maharashtra State, as a pilot.

2.8 HYDRO POWER PLANT OF GOKAK SPINNING MILL:

Site	Hydro Power Plant of Gokak Spinning Mill
Date of Visit	25/02/2015
Accompanying Officers	Mr. U.V. Kulkarni, Executive Engineer, GLBC, Division No.-2, Bagalkot. Mr. K.M. Bhayya, VP, Gokak Power & Energy Limited
Salient Features	

Gokak is a place of philosophical and historical significance and was founded in 1853. During the British rule in India, the Forbes Gokak Spinning Mill (now owned by Gokak Textiles Limited of the Shapoorji Pallonji Group) was set up in 1887 in Gokak Falls which is located about 6 km north-west of Gokak. It was modernised over decades and is functional till date being a major source of economy for the city. A hydroelectric power plant was also set up in Gokak Falls in 1907, is one of the oldest projects of a kind in the region. Team visited the hydro-power house of Gokak Spinning Mill.



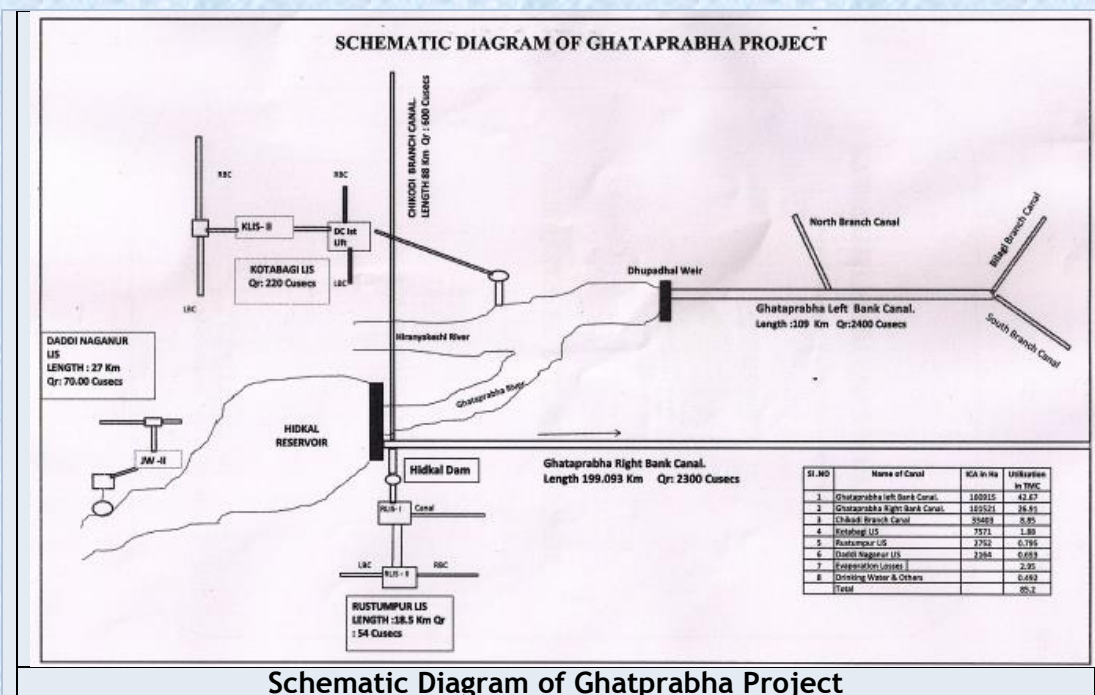
Power House of Gokak Spinning Mill

Learning	<ol style="list-style-type: none"> 1. The earlier power transmission from hydro power house to spinning mill was through mechanical arrangement and now it is hydro-electric. 2. The regular maintenance of hydro-power structure as well as component is carried out. Hence it is operational since several years.
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2.9 GHATPRABHA PROJECT (HIDKAL DAM):

Site	Ghatprabha Canal
Date of Visit	25/02/2015
Accompanying Officers	Mr. E.H. Cholacgudda, Superintending Engineer, KNNL, CRBCC Circle, Hidkal Dam. Mr. U.V. Kulkarni, Executive Engineer, GLBC, Division No.- 2, Bagalkot. Mr. Shankar Shindhu, President, Ghatprabha Project Level Water User's Association Federation.
Salient Features	<p>Ghatprabha Project comprises of Three stages. Stage I consists of a 71 km long left bank canal from the Dupdal weir constructed across Ghatprabha river in 1897 near Dupdhal in Gokak canal for providing irrigation to an extent of 0.425 lakh ha. Stage II comprises of extension of left bank canal from the Dupdal weir from Km 72 to its full length of 109 Km and a reservoir across Ghatprabha river near Hidkal, up to a partial height of RL 650.14 m creating a storage of 659 Mcum for providing irrigation to a total extent of 1.396 lakh Ha inclusive of the area under stage I. Stage III comprises of raising the FRL of Hidkal dam to its final level of RL 662.94 Mtr (RL 2175.00 feet) creating gross storage of 1448 Mcum and providing a 202 Km long Right Bank Canal and 86 Km long Chickkodi Branch Canal to irrigate 191386 Ha bringing the total area under the project to 3.31 lakh ha.¹ Team visited Ghatprabha Project along with Superintending Engineer and other officers of Ghatprabha project.</p> <p>Hidkal dam of 51 TMC storage on Ghatprabha having command area of 2.25 lakh Ha, Constructed during Seventies. Composite dam with masonry NOF, concrete spillway And earthen dam for dykes. Construction quality is superb with no leakage problems.</p>

¹ http://waterresources.kar.nic.in/salient_features_ghatprabha.htm



Schematic Diagram of Ghatprabha Project



Discussion with Superintending Engineer, Karnataka Water Resources Dept Learning

- 1) Unique thing noticed was the photo and statue of Late Engineer Shri. S G Balekundri in dam premises in respect of his contributions. He is respected as second Vishweshwarraya of Karnataka.
- 2) Group discussed with SE and EE's of Ghatprabha Project about issues in irrigation management and role of WUAs. In Karnataka, SE is irrigation officer for Major Project whereas EE for medium and minor. Canal committee with SE as member Secretary and District Guardian Minister as President, other official and

	<p>nonofficial members like MLAs, MPs, and WUAs advises to WRD.</p> <p>3) In Karnataka they have WUAs at 4 levels. Above project level there is State level federation of WUAs mainly for policy issues. Higher level WUAs are provided with some basic facilities like office, vehicle and assistant staff and also some allowances.</p> <p>4) Instead of refund from water cess, concession is allowed to WUAs while remittance only.</p> <p>5) Team also discussed with Chairman of Ghatprabha Project level water user society who is also member of state level federation. WUAs are registered under Cooperative act. One registrar is posted in CADA office specially. Recovery percent is only 15-20 % at WUA level.</p> <p>6) A special group of 2-3 officers from IWM wing, MWRRRA & WALMI may be sent to Karnataka to discuss this arrangement of refunding the part of Water charges (by way of deduction at the time of remitting only) and make special recommendations on this. This may give an alternative to resolve the present problem of long delay in refund to WUAs which is affecting adversely on the distribution system.</p>
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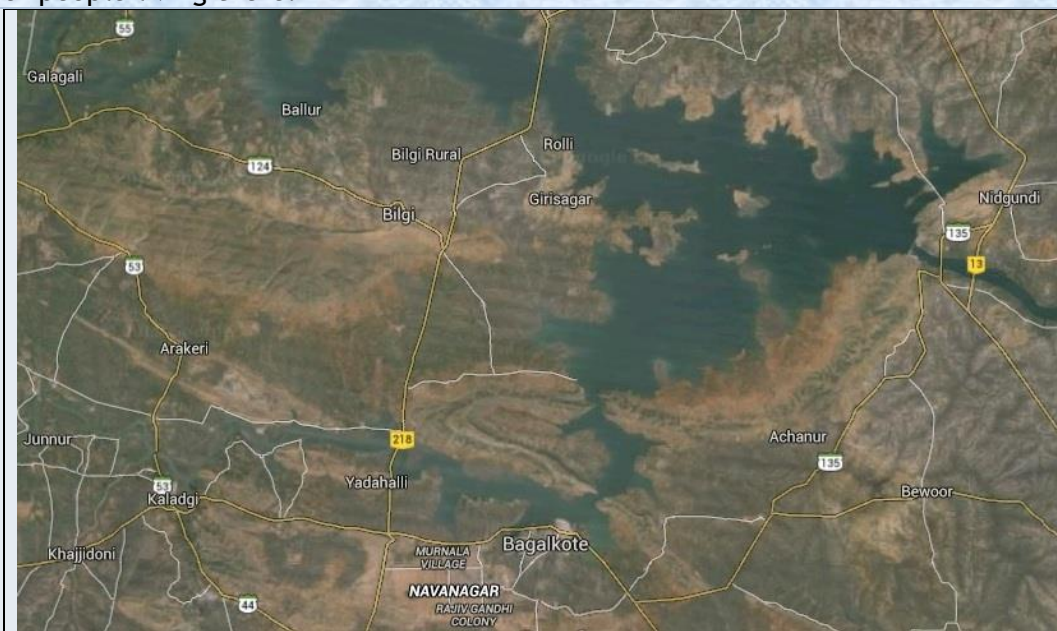
2.10 NAVNAGAR REHABILITATION:

Site	Navnagar town of Bagalkot
Date of Visit	25/02/2015
Accompanying Officers	Mr. U.V. Kulkarni, Executive Engineer, GLBC, Division No.- 2, Bagalkot. And other officers from Almatti Rehabilitation Works
Salient Features	<p>Almatti Dam a part of U.K.P. is already constructed with FRL of 524.256 m across the river Krishna. The gates are erected and storage is restricted up to RL 519.60 m as per Supreme Court order issued during April 2000. The Dam is located immediately below the confluence of river Ghataprabha with river Krishna. Bagalkot Town is on the right bank of Ghataprabha River A substantial portion of this town will get submerged in the back waters of Almatti Reservoir when the dam is raised to its ultimate FRL at 524.256. For the present FRL of Almatti reservoir i.e. 519.60 m., the back water effect at Bagalkot is up to RL 521.00 m. Accordingly the structures in Bagalkot town are acquired up to RL 521.00 Mtr and submerged portion of the city is re-located and resettled in Unit-I Navnagar Bagalkot.</p> <p>Team visited new township of Navnagar and it has been observed that the layout for the rehabilitated town was developed as a modern city. Resettlement plan consists of acquisition of lands for locating the new Bagalkot town and making all arrangements to provide basic infrastructure in the new town. The plan of new</p>

township provides adequate and reasonable resettlement for the Project Displaced Families (PDFs) and also allows sufficient scope for further development of the town for additional population (including immigrants, industries, business and so on). Thus the new Bagalkot town is envisaged both as a modern town and as a Rehabilitation centre.

For speedy implementation the state Government has enacted a special legislation called “BAGLAKOT TOWN DEVELOPMENT AUTHORITY ACT 1983” dated 30.04.198. The act provides for establishment of separate autonomous authority to plan, develop and manage the resettlement and rehabilitation of PDF’s of the old Bagalkot town as well as to create a modern township. Funds have been provided for this project by the State Government up to 1995 and afterwards the KBJNL Bangalore has been funding.²

Team also visited museum constructed at Navnagar, showing tradition and culture of people living there.



Satellite image showing Navnagar Town of Bagalkot and Almatti Dam

Learning

- 1) Efforts taken for the rehabilitation of massive number of Project Affected Persons (PAP) is commendable. Amenities provided to the PAP are helpful to improve their standard of living.
- 2) A rehabilitation museum is established in town centre depicting life style in village’s prior submergence with full sculpture scenes, paintings, photographs. Facilities provided for rehabilitation, civic amenities. Besides rehabilitation museum also contains sections depicting mythological, cultural and historical glances of Karnataka. It’s worth visiting even anyone happens to be in nearby vicinity of 100 kms.

² <http://www.kbjnl.com/BTDAB>

Recommendations:	<ol style="list-style-type: none"> 1. Museum shall be constructed to maintain the records of tradition and culture, when any area is submerging under any water resources project. 2. Benefits of water resources projects shall be presented along with photos of important structures. 3. Participation of PAP is necessary and in order to do that, special authority shall be established.
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2.11 RAMTHAL LIS:

Site	Ramthal Lift Irrigation Scheme
Date of Visit	26/02/2015
Accompanying Officers	Mr. Vasant L Nikam, Manager, Projects, Jain Irrigation Systems Ltd Mr. Amol Shinde, Project Engineer, Jain Irrigation Systems Ltd Mr. Hamid Mulla, Engineer, Design, Community Irrigation Business Dn, NETAFIM Irrigation India Pvt Ltd. Mr. Gopi, KNNL And other officials
Salient Features	Ramthal Lift irrigation scheme is biggest micro irrigation scheme that provides irrigation facility to Hungund Taluk of Bagalkot district for 26,200 hectare by utilising 5.84 TMC of water. 1 st Headwork in the backwater of Narayanapur reservoir, near Marol is completed. Team visited the site and studied the mechanism of supplying water to crop by drip irrigation.
	
Group Photo taken at Ramthal LIS	
Learning	1) Team visited biggest Drip irrigation scheme, which will irrigate 26,200 ha of land, operating at 81% project efficiency.

	<ol style="list-style-type: none"> 2) The pumping station is under construction and proposed with Centrifugal Pumps with Variable Frequency Drives (VFD) to cater the changing demand of the system. 3) The HDPE pipes are used for distribution and rising main. It has been told that HDPE pipes are economical as compared to the MS pipes. The detailed study of techno-financial feasibility of HDPE pipe shall be carried out in order to ascertain the statement.
Recommendations:	<ol style="list-style-type: none"> 1. There is a need for implementing such projects in the state, in drought prone areas in order to mitigate water crisis issue. 2. Water, once lifted shall not be delivered in canals, rather closed pipe distribution network shall be used.

2.12 TUNGABHADRA PROJECT:

Site	Tungabhadra Project
Date of Visit	26/02/2015
Accompanying Officers	Mr. Gopi, KNNL And other officials
Salient Features	<p>The Tungabhadra Dam is constructed across the Tungabhadra River, a tributary of the Krishna River. The dam is near the town of Hospet in Karnataka. It is a multipurpose dam serving irrigation, electricity generation, flood control, etc. This is a joint project of erstwhile Hyderabad state and erstwhile Madras Presidency when the construction was started; later it became a joint project of Karnataka and Andhra Pradesh after its completion in 1953. The main architect of the dam was Dr. Thirumalai Iyengar, an engineer from Madras.</p> <p>The dam creates the biggest reservoir on the Tungabhadra River with 101 TMC feet of gross storage capacity at full reservoir level (FRL) 498 m MSL, and a water spread area of 378 square kilometres. The dam is 49.5 meters high above its deepest foundation. The identified water use from the project is 230 TMC feet by the Krishna Water Disputes Tribunal. Karnataka and Andhra Pradesh got 151 TMC feet and 79 TMC feet water use entitlement respectively.</p> <p>Canal Systems-three canal systems originate from the Tungabhadra barrage, (a) The Left Bank Canal is called Tungabhadra Canal. It is 340 km long and irrigates about 3.32 lakh hectares of land in Raichur and Mahbubnagar districts; (b) Tungabhadra Low Level Canal originates from the right side of the dam. It is 347 km long and irrigates about 60,000 ha of land in Bellary and Kurnool districts; (c) Tungabhadra High Level Canal with 196 km length provides irrigation to 1.82 lakh hectares of land in Bellary and Anantapur districts.</p>



Tungabhadra Project

2.13 ALMATTI PROJECT:

Site	Almatti Project
Date of Visit	27/02/2015
Accompanying Officers	Mr. H.C. Narendra, AE Mr. K. Rajesh, AE
Salient Features	
<p>The Almatti project is constructed on the Krishna River in North Karnataka which was completed in July 2005. The construction of this project was started in 1964. The target annual electric output of the dam is 560 MU (or GWh). The Almatti Dam is the main reservoir of the Upper Krishna Irrigation Project; the 290 MW power station is located on the right side of the Almatti Dam. The facility uses vertical Kaplan turbines: five 55MW generators and one 15MW generator. Water is released in to the Narayanpur reservoir after using for power generation to serve the downstream irrigation needs. The dam is located on the edge of Bijapur and Bagalkot districts. Geographically, it is located in the Bijapur district, but large areas of Bagalkot district have also been submerged due to filling of the reservoir. The dam holds a gross water storage capacity of 123.08 TMC at 519 meters MSL.</p>	



Almatti Project

Learning

1. High level canal is constructed on right bank. Water is being lifted in the canal, when water level of dam is below the sill level of canal. This enables irrigation at higher level.
2. Dam was maintained in good condition. Sufficient outsources staff was available for inspection.
3. Control room equipped with monitoring through CCTV camera on all gates and crucial points is installed.
4. Musical fountain and garden created and maintained in good condition at the toe of dam is good picnic spot.

Recommendation

1. Tourist spots shall be developed at dam site in Maharashtra near metro cities like, Mumbai, Pune, Aurangabad, Nagpur etc.
2. Special attention shall be given to maintain clean galleries.
3. Equipments for cleaning vertical porus holes in drainage gallery shall be procured for each major dam.

ANNEXURE 1. WATER RESOURCES OF KARNATAKA

a) ABOUT KARNATAKA STATE

Karnataka is a state in South West India, formed on 1 November 1956, originally known as the State of Mysore and renamed Karnataka in 1973. The capital and largest city is Bangalore. Karnataka is bordered by the Arabian Sea and the Laccadive Sea to the west, Goa to the north west, Maharashtra to the north, Telangana to the North east, Andhra Pradesh to the east, Tamil Nadu to the south east, and Kerala to the south west. The state covers an area of 191,976 square kilometres (74,122 sq mi), or 5.83 per cent of the total geographical area of India. It is the seventh largest Indian state by area. With 61,130,704 inhabitants at the 2011 census, Karnataka is the eighth largest state by population, comprising 30 districts. Kannada is the most widely spoken and official language of the state³.

b) WATER AVAILABILITY IN KARNATAKA

As mentioned in Karnataka State Water Policy, 2002⁴, the Karnataka state is endowed with limited water resources that are stressed and depleting. Different Sectoral demands are growing rapidly. Increase in population, urbanization, rapid industrialization and rising incomes are putting this resource under stress. Unless water resources are properly developed and managed, the State will face acute crisis within the next two decades. Serious destabilization of the water sector affecting the hydrology, economy and ecology of the State is likely.

i) Rainfall

The occurrence and distribution of rainfall in the Karnataka state is highly erratic. The annual normal rainfall is 1138 mm received over 55 rainy days. It varies from as low as 569 mm in the east to as high as 4029 mm in the west. About 2/3rd of the geographical area of the State receives less than 750 mm of rainfall. Even assured rainfall areas of the State experience scarcity of water in some years.

ii) Surface Water Availability

There are seven river systems in Karnataka viz., Krishna, Cauvery, Godavari, West Flowing Rivers, North Pennar, South Pennar and Palar. Yield in these rivers is presented below-

³ <http://en.wikipedia.org/wiki/Karnataka>

⁴ http://waterresources.kar.nic.in/state_water_policy-2002.htm

50% Dependable Yield = 3418 TMC

- Yield in Six Basins excluding West Flowing Rivers = 1396 TMC (41%)
- Yield in West Flowing Rivers = 2022 TMC (59%)

75% Dependable Yield = 2934 TMC

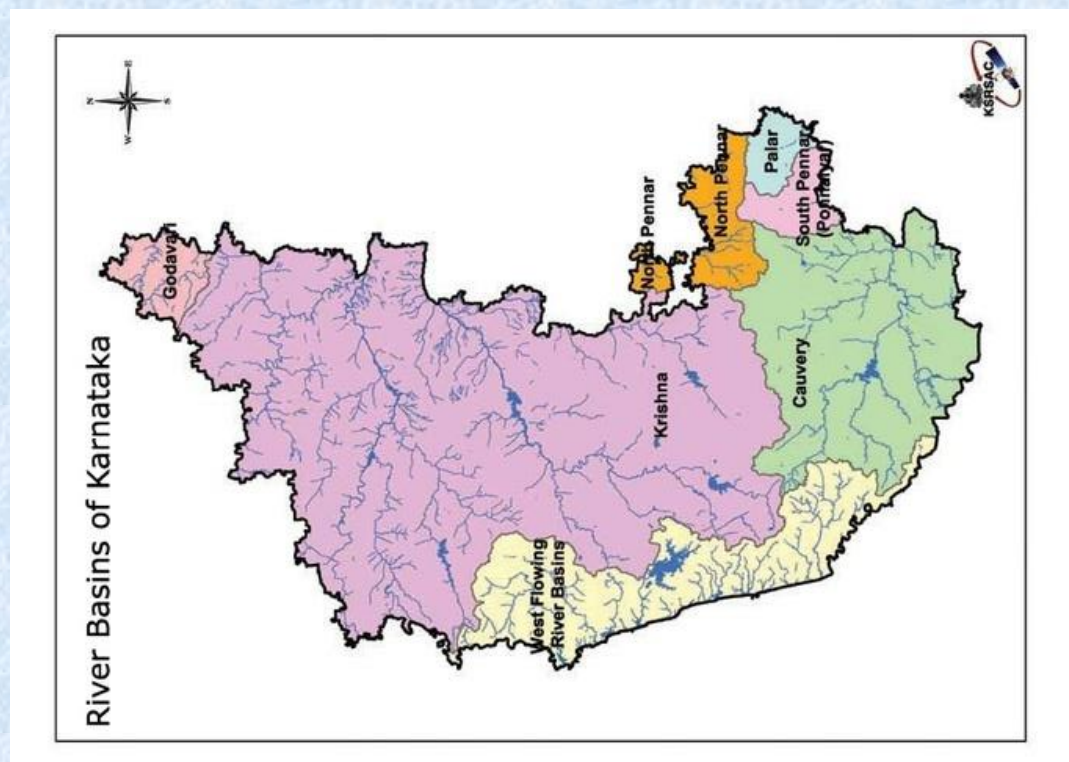
- Yield in Six Basins excluding West Flowing Rivers = 1198 TMC (41%)
- Yield in West Flowing Rivers = 1736 TMC (59%)

iii) Ground Water Availability

Availability of ground water is estimated as 485 TMC. Ground water resources have not been exploited uniformly throughout the state. Exploitation of ground water in the dry taluks of North and South interior Karnataka is higher as compared to Coastal, Malnad and irrigation command areas.

c) RIVER SYSTEMS IN KARNATAKA

There are seven river systems in Karnataka which with their tributaries, drain the state. The names of these river systems and area drained by them are given below-



Sr. No.	River System	Drainage Area	
		1000 Sq. km	Percentage
1	Krishna	113.29	59.48
2	Cauvery	34.27	17.99
3	West Flowing Rivers	24.25	12.73
4	North Pennar	6.94	3.64
5	Godavari	4.41	2.31
6	South Pennar	4.37	2.29
7	Palar	2.97	1.56
	Total	190.5	100

i) Krishna River System

The river Krishna is an Inter-State river in Southern India. It is the second largest river in Peninsular India, rises in the Western Ghats at an altitude of 1337 m. near Mahabaleshwar in Maharashtra State. It flows across the whole width of the peninsula, from west to east, for a length of about 1400 km, through Maharashtra, Karnataka and Andhra Pradesh. The entire catchment area of Krishna basin is 2,58,948 sq km. including the other basin states.

The principal tributaries of Krishna in Karnataka are Ghataprabha, Malaprabha, Bhima and Tungabhadra. All these rivers except the Malaprabha River having their catchment area both in Karnataka and Maharashtra.

ii) Cauvery River System

The river Cauvery is an Inter-State river in Southern India. It is one of the major rivers of the Peninsular flowing east and running into the Bay of Bengal. The Cauvery rises at Talakaveri on the Brahmagiri Range of Hill in the Western Ghats, presently in the Coorg district of the State of Karnataka, at an elevation of 1.341m (4,400 ft.) above mean sea level. The catchment area of entire Cauvery Basin is 81,155 sq. km. including the other basin states of Cauvery River System.

The principal tributaries of Cauvery in Karnataka are the Harangi, the Hemavathy, the Lakshmanathirtha, the Kabini, the Shimsha, the Arkavathi and the Suvarnavathy. All these rivers except the Kabini River, Arkavathi River and Suvarnavathy River rise and flow fully in Karnataka.

iii) West Flowing Rivers River System

The Western Ghats provides a principal geographical barrier in the path of the Arabian Sea branch of the Southwest monsoon, and is principally responsible for the heavy rainfall over the western coastal belt. The Southwest monsoon season (June to September) is the principal rainy season, over 90 % of annual rainfall is realised in this period.

The rivers in the Western Ghats region generally originate at an elevation ranging from 400 meters to 1,600 meters above the mean sea level, close to the Western Ghats ridge. The rivers generally flow westward and meet the Arabian Sea after a short run varying from 50 km to 300 km the rivers are very steep in the upper reaches and fairly steep in the middle reaches. It is only near the sea that they have relatively flat gradients and some sort of flood plain.

iv) North Pennar River System

Name of the tributary	Catchment area in Sq.km	Origin, Length	Sub-tributaries
Uttara Pinakini (North Pennar River)	6937	Nandi hills of Kolar, 597km	Jayamangali, Kumadavathy, Chitravathy and papagni

v) Godavari River System

The river Godavari rises in the Nasik district of Maharashtra about 80km from the shore of Arabian sea, at an elevation of 1067m, after flowing for about 1465km in a general south-easterly direction, through Maharashtra and Andhra Pradesh, Godavari falls into the Bay of Bengal above Rajamundry. The Godavari has a drainage area of about 3,12,813 sq.km.

The principal tributaries of Godavari are the Pravara, the Purna, the Manjra, the Pranahita, the Indravathy and the Sabari.

vi) South Pennar River System

Name of the tributary	Catchment area in Sq.km.	Origin	Name of the state
South Pennar	4370	Nandi hills of Kolar	Karnataka, Tamil Nadu

vii) Palar River System

Name of the tributary	Catchment area in Sq.km.	Origin	Name of the state
Palar	2813	Talagavara village in Kolar, 900 meters , 348 km.	Karnataka, Andhra Pradesh Tamil Nadu

d) INSTITUTIONAL SET UP IN WATER SECTOR

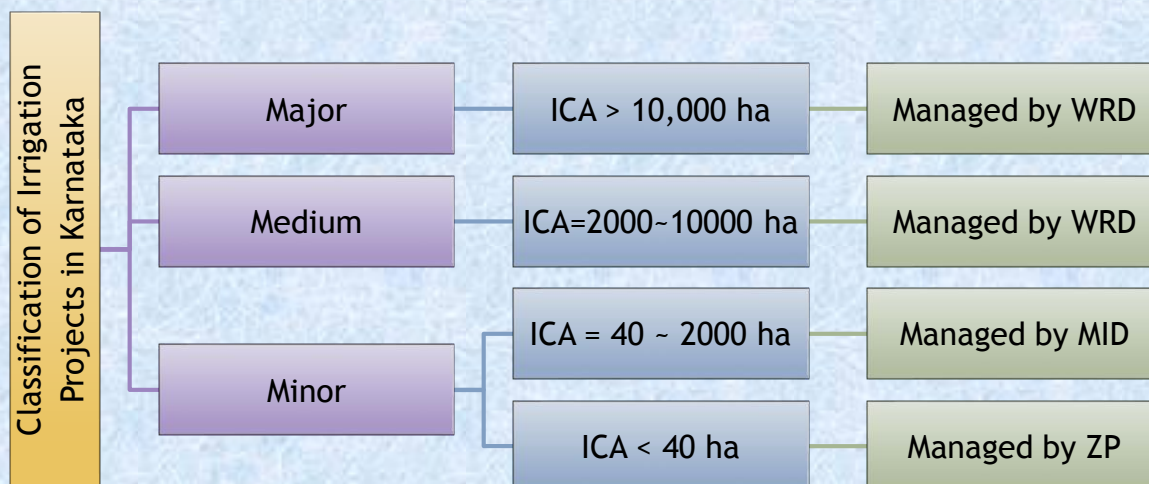
For development of water in the Karnataka state, the state has revamped the institutional structure and presented as below⁵-

SN	Name of Organisation	Important Tasks
AT STATE LEVEL		
1)	Water Resources Development Organization (WRDO)	Development of major and medium irrigation, collection of information related to hydrology, command area development and research and developmental activities.
2)	Command Area Development Authority (CADA)	Identification of and protection of command areas at river basins
3)	Department of Minor Irrigation	Identification of areas for taking up new tanks, trapping the silt and rejuvenation of tanks
4)	Department of Mines and Geology (Groundwater Wing)	Hydrological Survey and identification of watersheds
5)	Soil Survey division	Assessing soil quality, suggestions for cropping pattern for command area
6)	Watershed Department (Department of Agriculture)	Identifying watershed areas and identifying the agencies for watershed programmes
7)	Drought Monitoring Cell	Review of drought situation and information sharing with other line departments
8)	Regional Remote Sensing Centre	Generating information about the water resources, planning and modelling
9)	Karnataka Engineering Research Station	Developing training modules, conduction training to engineers
10)	Directorate of Economics and Statistics	Collection of information and dissemination
11)	Department of Environment, Ecology & Forests	Formulation of rules and regulation for preventing environmental pollution
12)	Karnataka State Pollution Control Board	Monitoring pollution from industries and other sources and ensuring implementation of pollution control.
DISTRICT LEVEL		
1)	Zilla Panchayat	District level programmes on watershed
2)	Urban Local Bodies	Water Supply and Sanitation programmes
VILLAGE LEVEL		
1)	Gram Panchayats	Implementation of programmes at the local level

⁵ Karnataka State Development Report, 2007, published by Planning Commission, Government of India, New Delhi

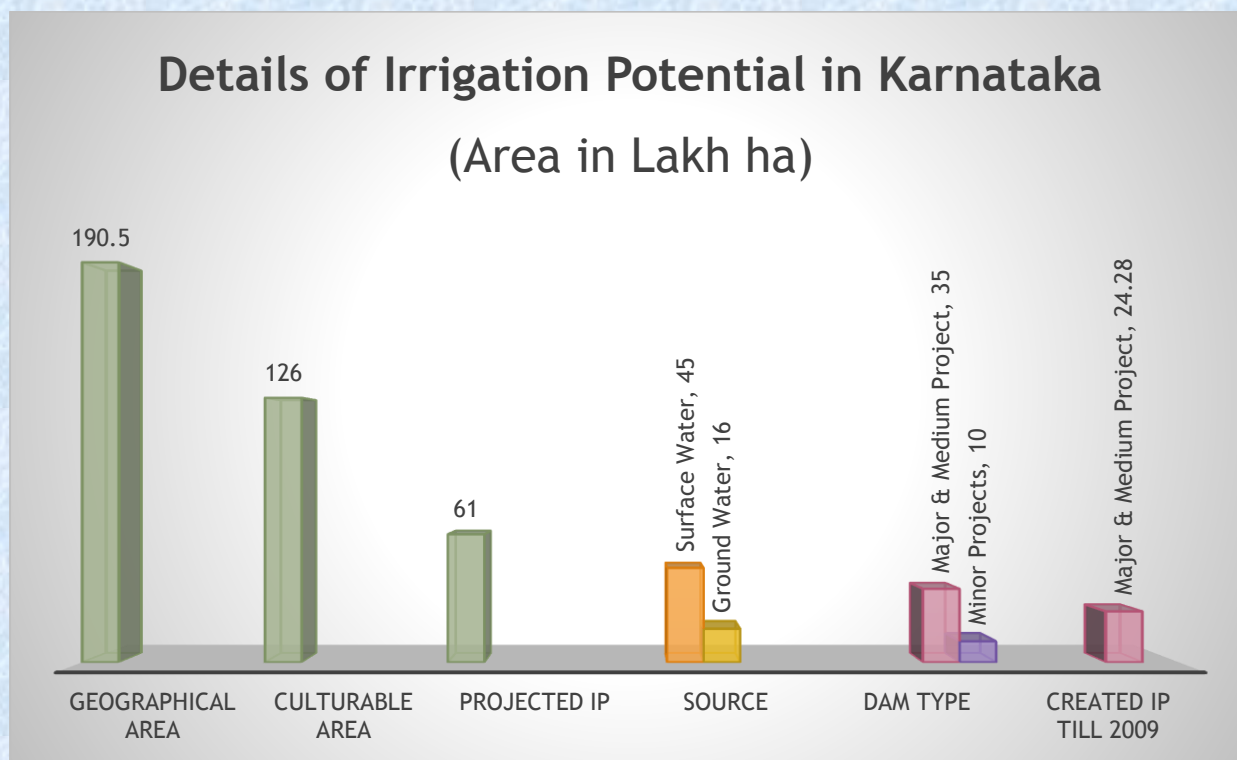
e) CLASSIFICATION OF PROJECTS

Irrigation projects are classified as major, medium and minor projects with following limit of Irrigable Command Area (ICA)-



f) IRRIGATION POTENTIAL OF KARNATAKA

The geographical area, total projected Irrigation Potential (IP), projected irrigation from various sources, from various dam types and actual irrigation potential created till 2009 is presented below-

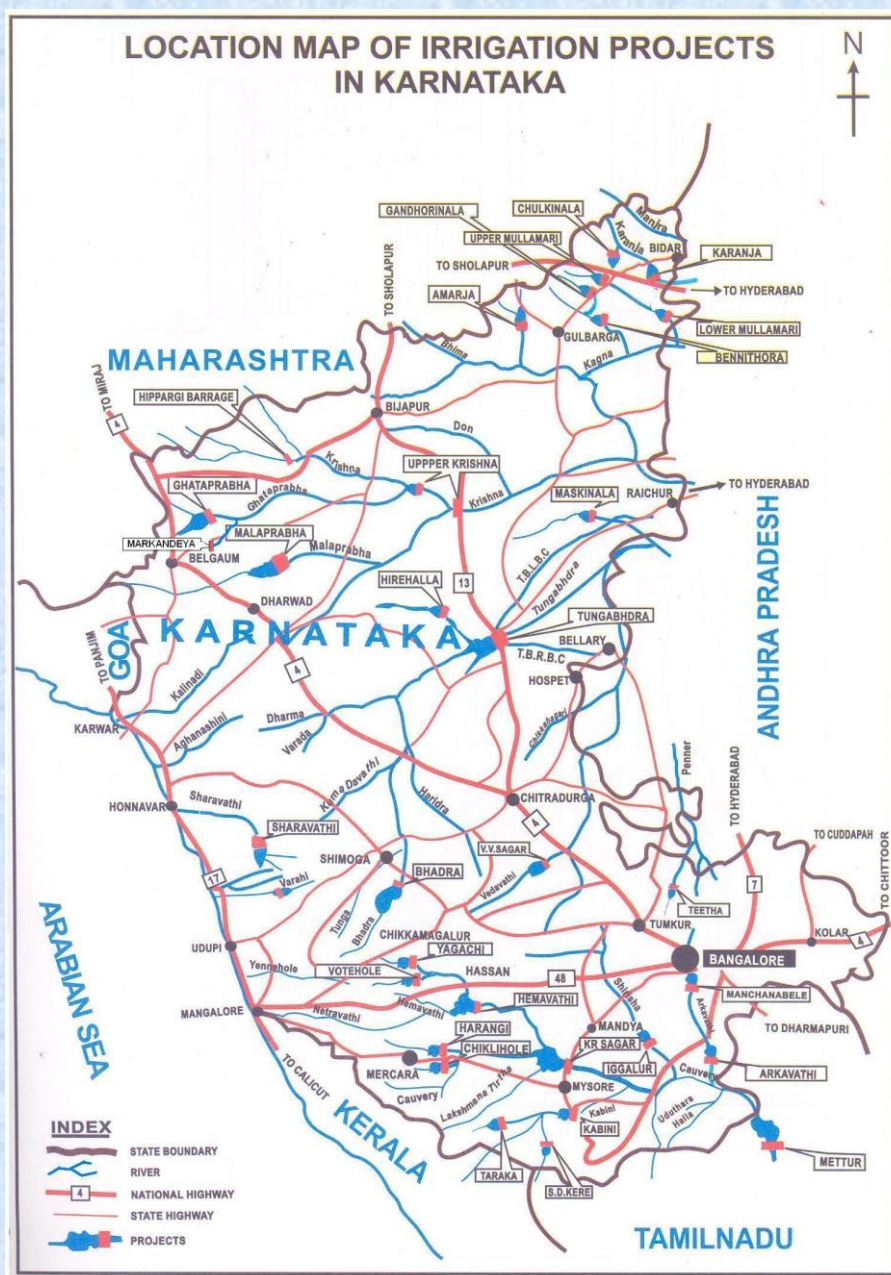


g) KARNATAKA WATER RESOURCES DEPARTMENT-MINOR IRRIGATION (KWRD-MI)

All Ground water and Surface water Schemes (both flow & lift), having command area up to 2000 hectares individually are considered as Minor Irrigation Schemes and managed by KWRD-MI. MI projects under Surface Water Scheme having Command area less than 40 ha are managed by Zilla Parishad. Organisation structure of KWRD-MI is presented below-

h) IRRIGATION PROJECTS

Following is the location map of irrigation projects in Karnataka State.



ANNEXURE 2. ABOUT KARNATAKA WATER RESOURCES DEPARTMENT (WRDO)

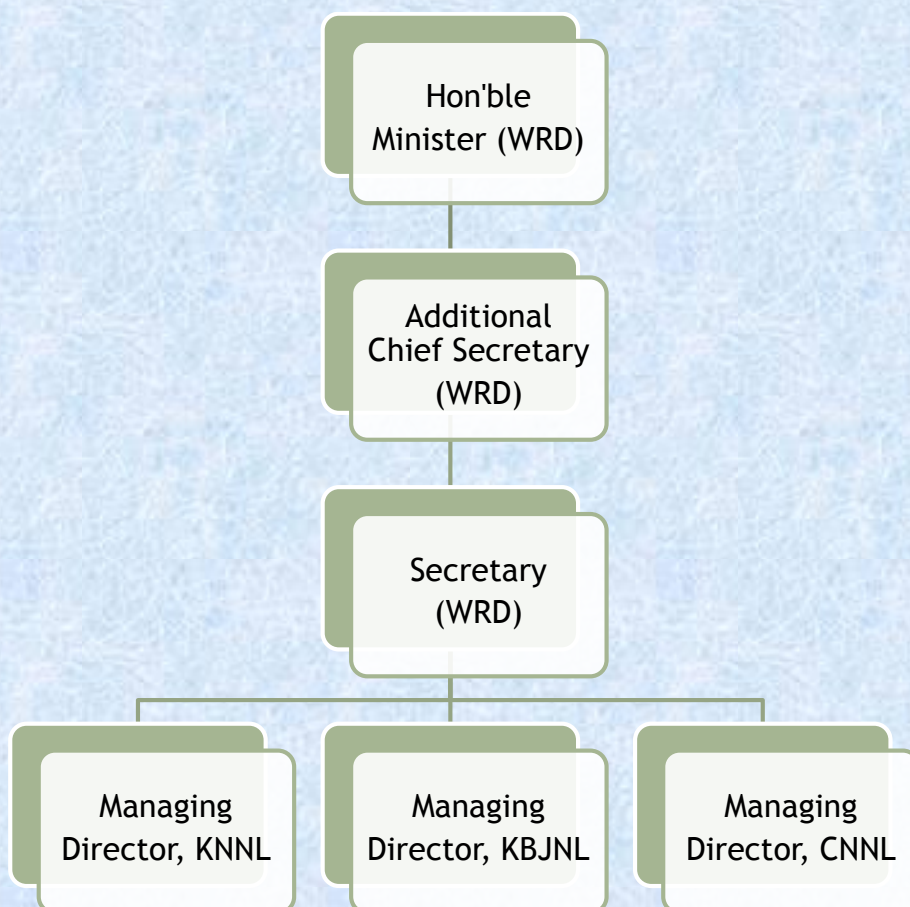
a) KARNATAKA WATER RESOURCES DEPARTMENT ORGANISATION (WRDO)

The Water Resources Department Organisation is one of the major department in the Government of Karnataka is headed by the Hon'ble Minister for Major and Medium Irrigation. The Department harnesses Surface Water for Irrigation and Drinking Water Purposes. The Irrigation projects are classified under two categories, as indicated below depending upon the extent of Culturable command area (CCA)-

Major Project • CCA > 10,000 ha

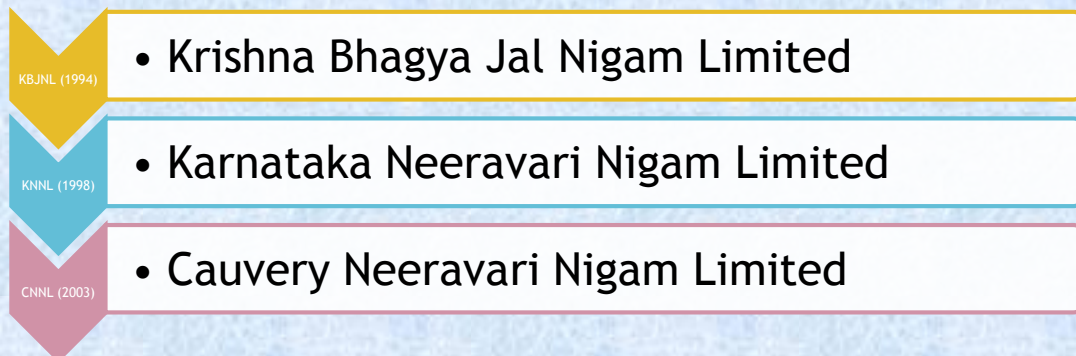
Medium Projects • 2000 < CCA < 10,000

b) ORGANISATION STRUCTURE OF KWRD



c) CORPORATIONS OF KWRD

The Karnataka Water Resources Department consists of three major corporations-



These three corporations are unique establishment of the state of Karnataka as these are envisaged as Special Purpose Vehicle for speedy implementation of irrigation projects and to enable the Government to borrow funds from external sources. In addition to these three corporations, there are some projects which are being handled by Water Resources Department directly.

i) Krishna Bhagya Jala Nigam Limited⁶

Incorporated under the company's Act of 1956 with a view to expedite the works of Upper Krishna Project by mobilising additional resources required for project through private and public issue of Bonds / Debentures. The Managing Director, Krishna Bhagya Jala Nigam Limited is in-charge of this corporate body.

ii) Karnataka Neeravari Nigam Limited:

It was incorporated in 1998 under the company's act, as a wholly owned company of the Government of Karnataka to expedite the completion of the On-going Irrigation Projects in Krishna Valley. The Managing Director, Karnataka Neeravari Nigam Limited is in-charge of this corporate body.

iii) Cauvery Neeravari Nigam Limited:

It is constituted as per the Hon'ble Chief Minister announcement made in the budget speech dated 12-5-03. Cauvery Neeravari Nigam came to existence on 4-6-2003 vide Regd No.32044. The Nigam is proposed to raise Rs.1500 crores in the period of 3 years for completion of all ongoing works and Modernisation of completed projects in Cauvery basin.

d) COMMITTEES IN KWRD

The Water Resources Department has set up various boards, councils, committees and bodies consisting of both Officials and Non-Official as Members. The various boards, councils, committees and bodies set-up under the Water Resources Department are:

i) Irrigation Consultative Committee (ICC)

⁶ <http://www.knnlindia.com/>

The Irrigation Consultative Committee is established under each Major and Medium Irrigation project. The Superintendent Engineer of the concerned project acts as the Member-Secretary. It consists of both Officials and Non-Officials. The Non-Officials members also include the representative of farmers. The function of the ICC is to give recommendations & directions regarding watershed management during each season.

ii) Technical Advisory Committee (TAC)

The Secretary is one of the members of TAC. It consists of 7 members, of which 2 are Officials and 5 are Non-Official Members. The Non-Official members are retired technical experts who have rendered valuable service under the Water Resources Department. The Government accords Administrative approval on the basis of the recommendation and suggestions offered during the Meetings of the TAC.

The functions of Technical Advisory Committee are:

- Planning and monitoring of all major and Medium Irrigation Projects
- Scrutiny of estimates of all Major and Medium Irrigation schemes, before according administrative approval and technical sanction.
- Tenders and claims of contractors in respect of all Major and Medium Irrigation works costing Rs. 2.50 Crores and above.
- The Technical Committee shall make suitable recommendations to the Major Irrigation Projects Control (MIPC) Board in the above matter.

iii) Master Plan Committee (MPC)

The Master Plan Committee consists of both Officials and Non-Official Members. The Non-Official Members being retired technical experts of the rank of Secretary. The function of the MPC is to give recommendations & directions regarding identifying the most economical MMI projects, along with allocation of water efficiently and effectively regarding Krishna, Cauvery and Other Basins.

iv) Major Irrigation Project Control Board (MIPC)

The Hon'ble Chief Minister is the President and the Hon'ble Minister for Water Resources Department, Government of Karnataka is the Vice President of MIPC. It consists of 14 members, of which 4 are Officials and 9 are Non-Official Members. The functions of the major irrigation projects control (MIPC) board are:

- The MIPC Board shall review the recommendations of Technical Committee in all the matters of planning, monitoring, estimates, tenders and claims in respect of Major and Medium Irrigation.
- The Board shall have the powers to deliberate any other subject pertaining to the irrigation sector and also direct the reference of any files to the Chairman of the Technical Committee, for advice.

- Necessary Government Orders shall be directly issued by the Water Resources Department immediately after clearance by the Board, excepting cases which have to be taken to Cabinet as per the Rules of Business.
- In respect of cases requiring Cabinet approval, the Water Resources Department shall put up all such cases directly to the Cabinet, Immediately after clearance by the Board.

e) CHIEF ENGINEERS OFFICES UNDER WRDO

SN	Name of the Zones / CADA
Karnataka Water Resources Department (WRDO)	
1	The Chief Engineer, Water Resources Development Organisation , Bangalore
2	The Chief Engineer, Inter State Waters (W.R.D.O) Bangalore
3	The Chief Engineer, Hydrology and Central Mechanical Organisation, Bangalore
4	The Director, Karnataka Engineering Research Station, K.R.S.Mandya
5	The Director, Water and Land Management Institute, Dharwad
Karnataka Neeravari Nigam Limited (KNNL)	
6	The Chief Engineer, Irrigation (N), Belgaum
7	The Chief Engineer, Malaphrabha Project, Dharwad
8	The Chief Engineer, Upper Bhadhra Project, Chitradurga
9	The Chief Engineer, Varahi Irrigation Project, Siddapur
Krishna Bhagya Jal Nigam Limited (KBJNL)	
10	The Chief Engineer, Upper Krishna Dam Zone, Almatti
11	The Chief Engineer, Canal Zone No.1, Bheemarayangudi
12	The Chief Engineer, Canal Zone No.2, Kembhavi
13	The Chief Engineer, Operation and Maintenance Zone, Narayanapur
Cauvery Neeravari Nigam Limited (CNNL)	
14	The Chief Engineer, Irrigation (South) Mysore
15	The Chief Engineer, Hemavathy Project, Gorur, Hassan
16	The Chief Engineer, Hemavathy Canal, Tumkur
Department / Nigam	
17	The Chief Engineer, Upper Tunga Project Zone, Shimoga
18	The Chief Engineer, Irrigation Central Zone, Munirabad
19	The Chief Engineer, Irrigation Project Zone, Gulbarga
CADA'S	
20	The Administrator, Tungabhadra, CADA ⁷ , Munirabad
21	The Administrator, Malaprabha and Ghataprabha Project, CADA, Belgaum
22	The Administrator, Cauvery Basin Projects, CADA, Mysore
23	The Administrator, Upper Krishna Project, CADA, Bheemaranagudi
24	The Administrator, Bhadra Reservoir Project, CADA, Shimoga
25	The Administrator, CADA, Gulbarga
26	The Chief Engineer, Bagalkot Town Development Authority, Bagalkot

⁷ Command Area Development Authority