



8th International R&D Conference on “ Global Trends in Water, Power and RE Technologies”



Concept of a water diversion project to cater Drinking needs and Ground water conservation in the needy water scares parts of eastern Karnataka, India – A case study of Yettinahole comprehensive drinking water project.

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CBIP- IIT Roorkee, Uttarakhand

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Outline

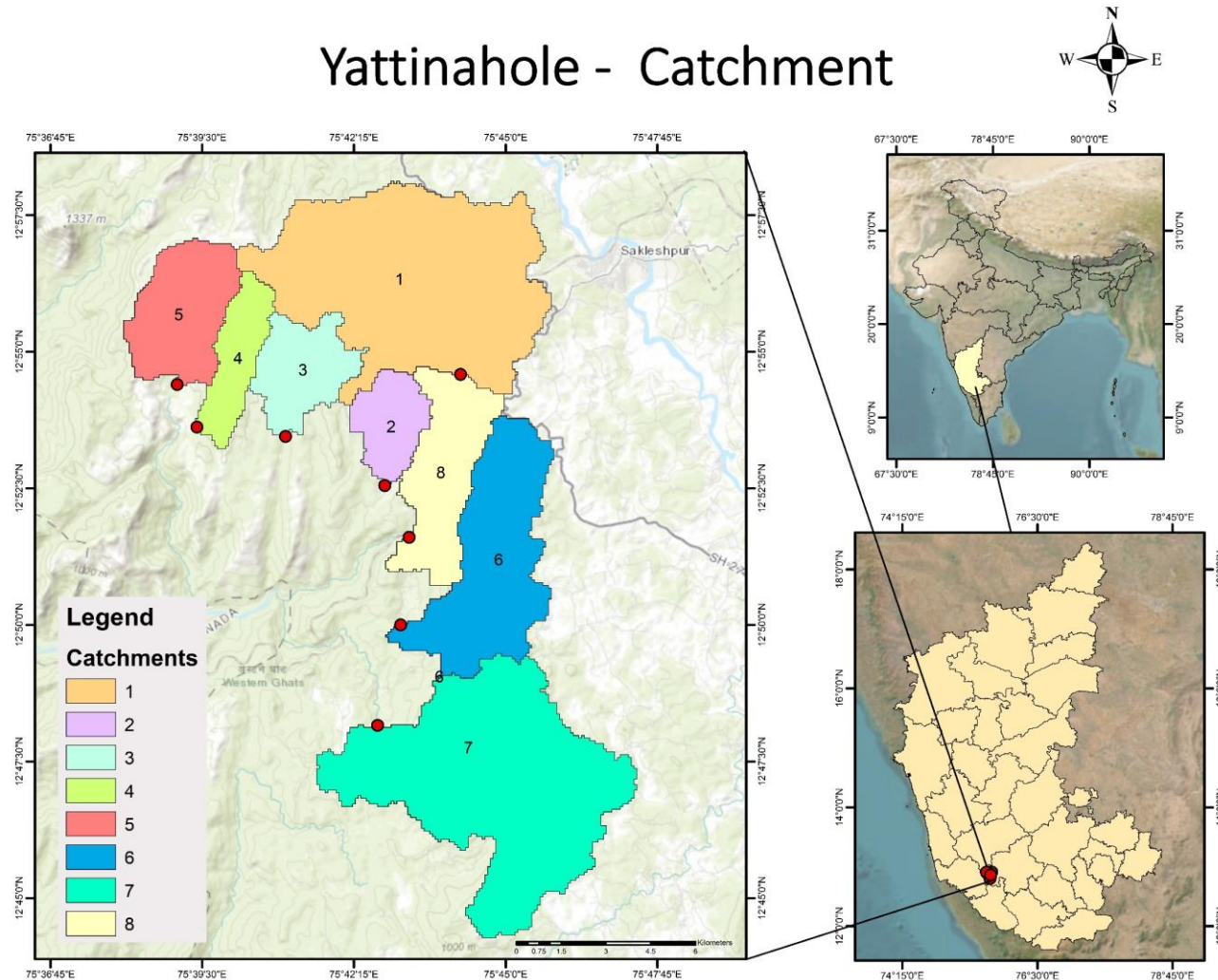
- Introduction
- Objective of the study
- Masterplan of the project
- Land Acquisition
- Mitigation measures
- Major challenges
- Conclusion

Preamble of Yettinahole Project

- Due to change in climate, uneven precipitation, flash floods, rise in sea levels over the spatial and temporal scale are occurring which in-turn causes frequent floods and droughts in different parts of Karnataka.
- Large gap is developing in demand and supply for drinking water in the fast developing 21st century. Since few decades, Palar and Pennar basins have witnessed the water stressed situation.
- In bridging the gap between supply and demand in water stressed – drought prone basins, inter basin water transfer is best solution to counteract the situation.
- Hence the Government of Karnataka has formulated Yettinahole project to draw 24.01 TMC out of 2000 TMC annual yield available from west flowing river basins by constructing eight weirs across in the upper reaches of western Ghats such as Yettinahole, Kadumanehole, Kerihole and Hongadahalla streams.
- Which is flood diverting scheme during monsoon season with negligible weir storage.
- The main **objective of this project** is to cater **drinking water** needs to seven districts and **ground water recharge** by filling 527 tanks enroute.

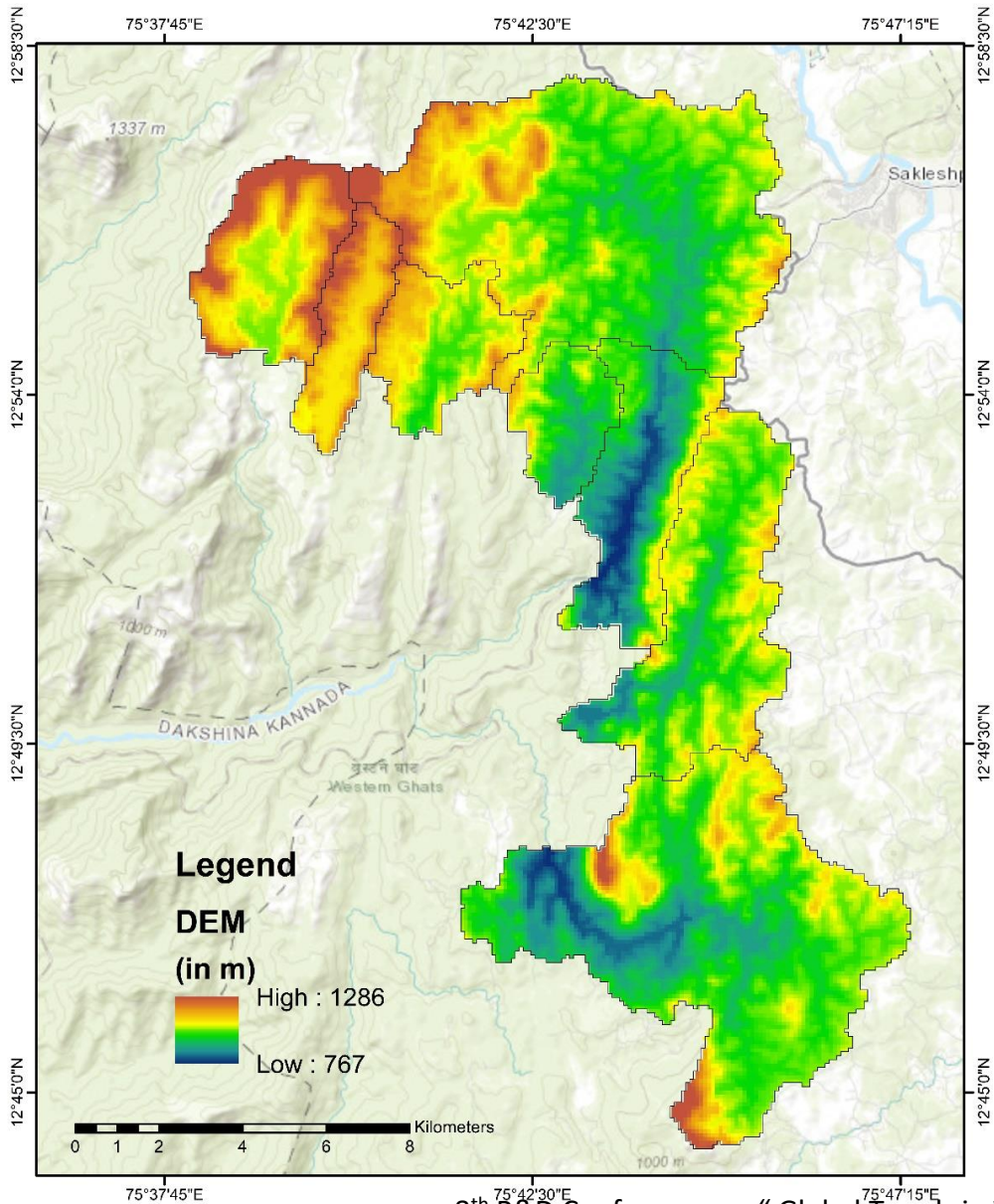
Study area-catchment area

Yattinahole - Catchment



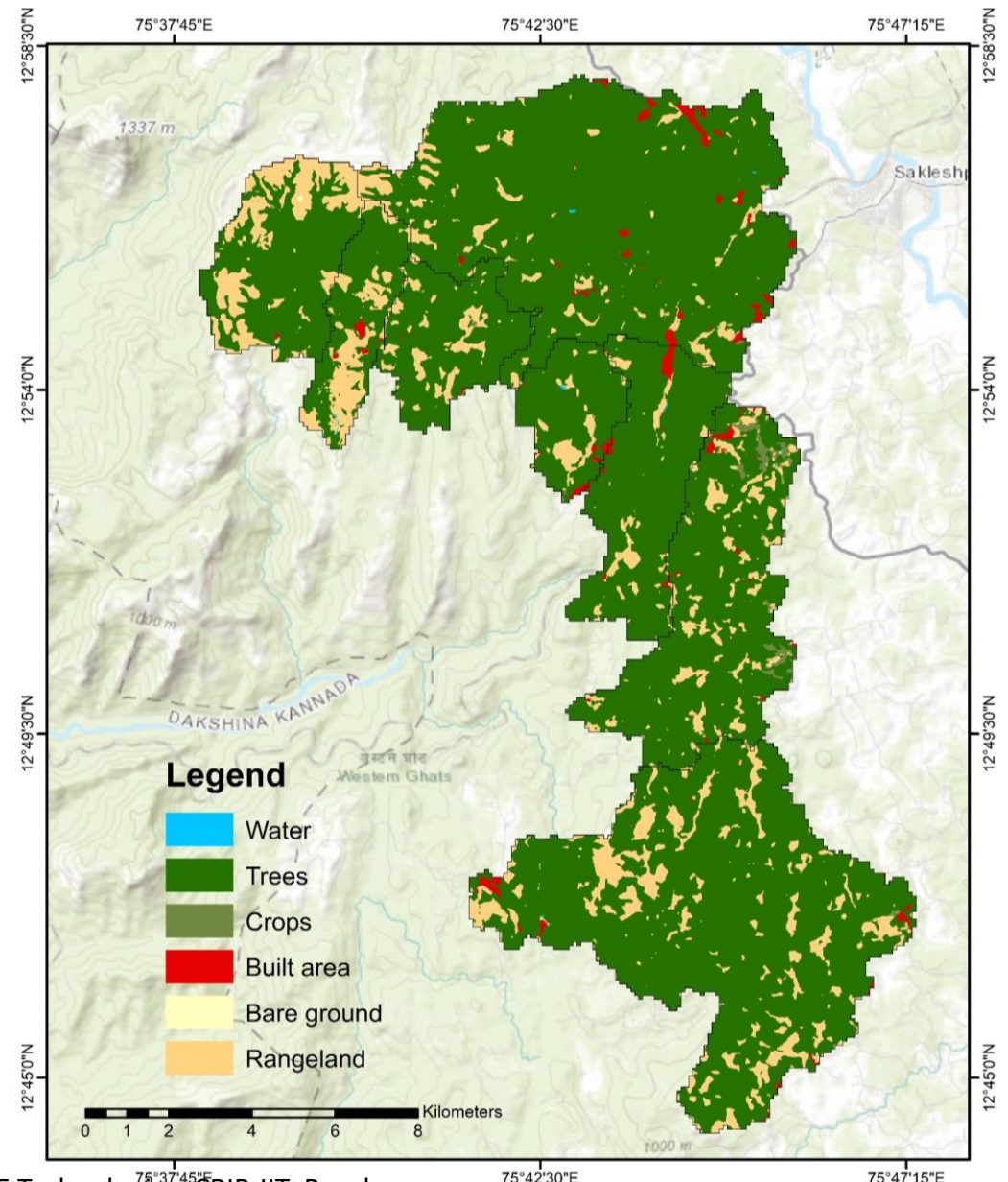
- **Study area:** 12.75°N – 12.95 °N & 75.78 °E - 76.61 °E
- **Basin:** West flowing River basin
- **Sub basin :** Nethravathy river
- **Catchment area of Nethravathy river basin:** 3222 km²
- **Origin of River:** Bangrabalige valley, Western ghats and flows towards Arabian sea
- **Altitude:** 1286 m
- **Catchment area of 8 weirs:** 176.74km²
- **Average rainfall :** 1500 mm-6000mm, from S-W monsoon in June –Sept
- **Avg. T_{max} :** 26 - 35 °C
- **Avg. T_{min} :** 14 -20 °C
- **Soil Type :** Sandy clay loam

Yettinahole - DEM

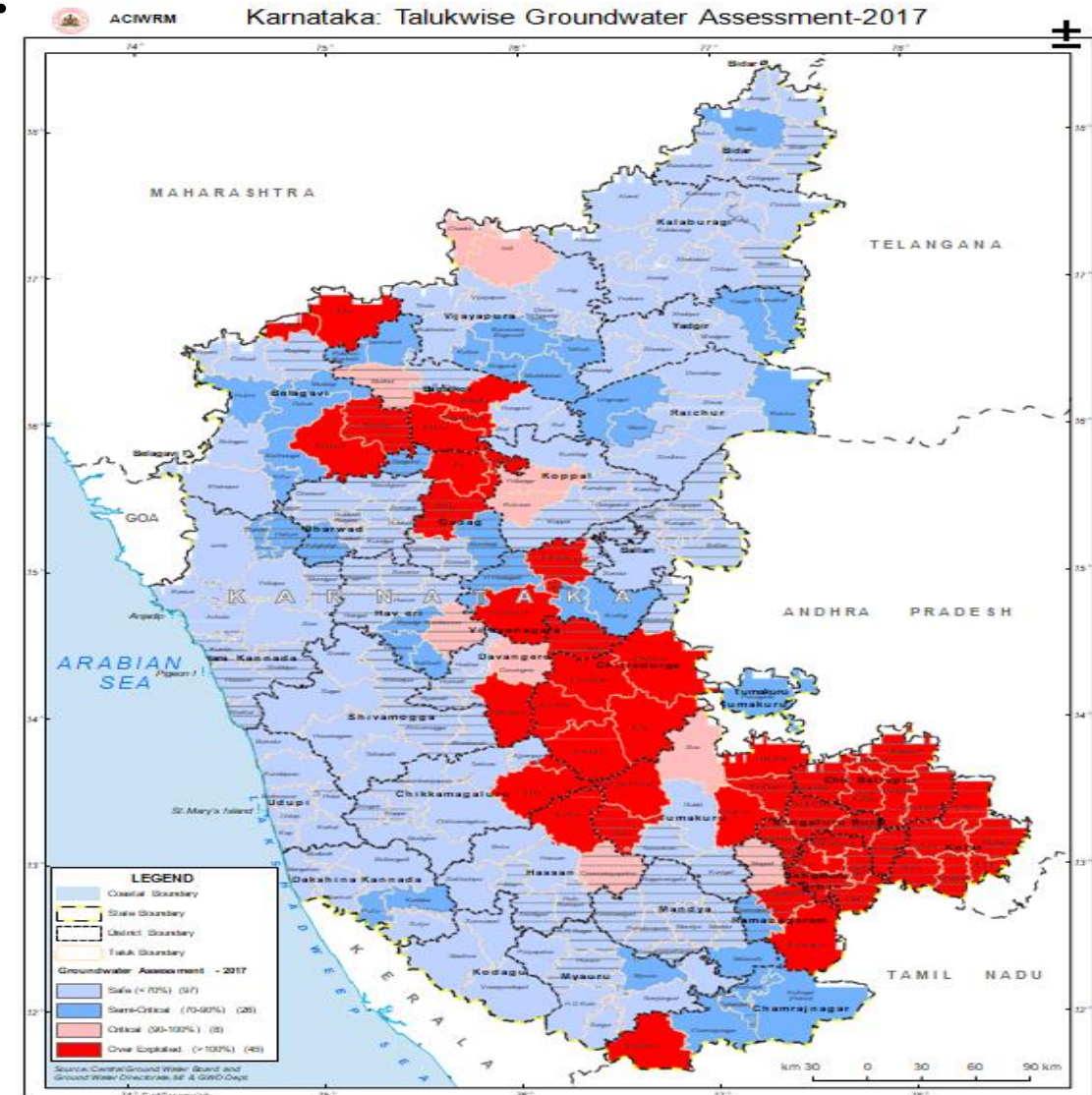
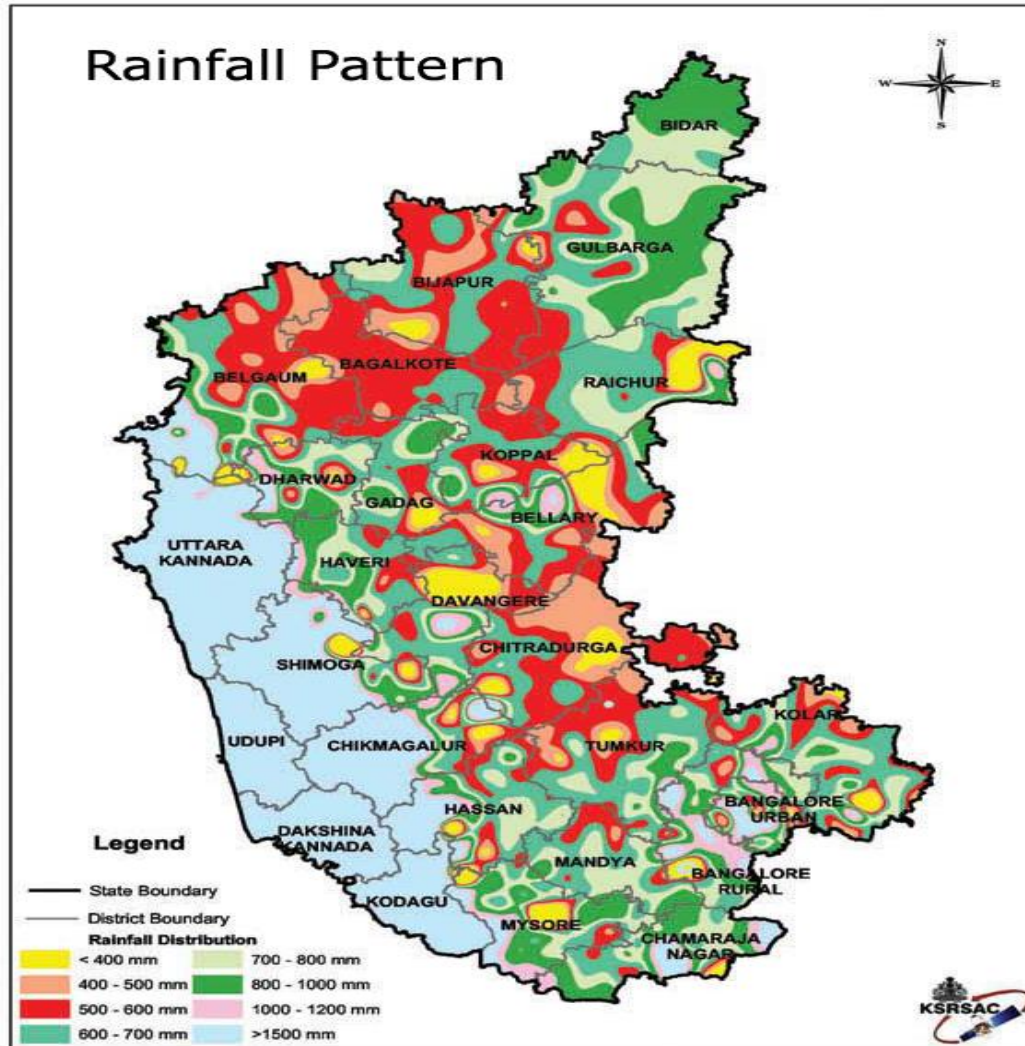


Yettinahole LULC

(Sentinel-2 of 10m resolution prepared by ESRI)

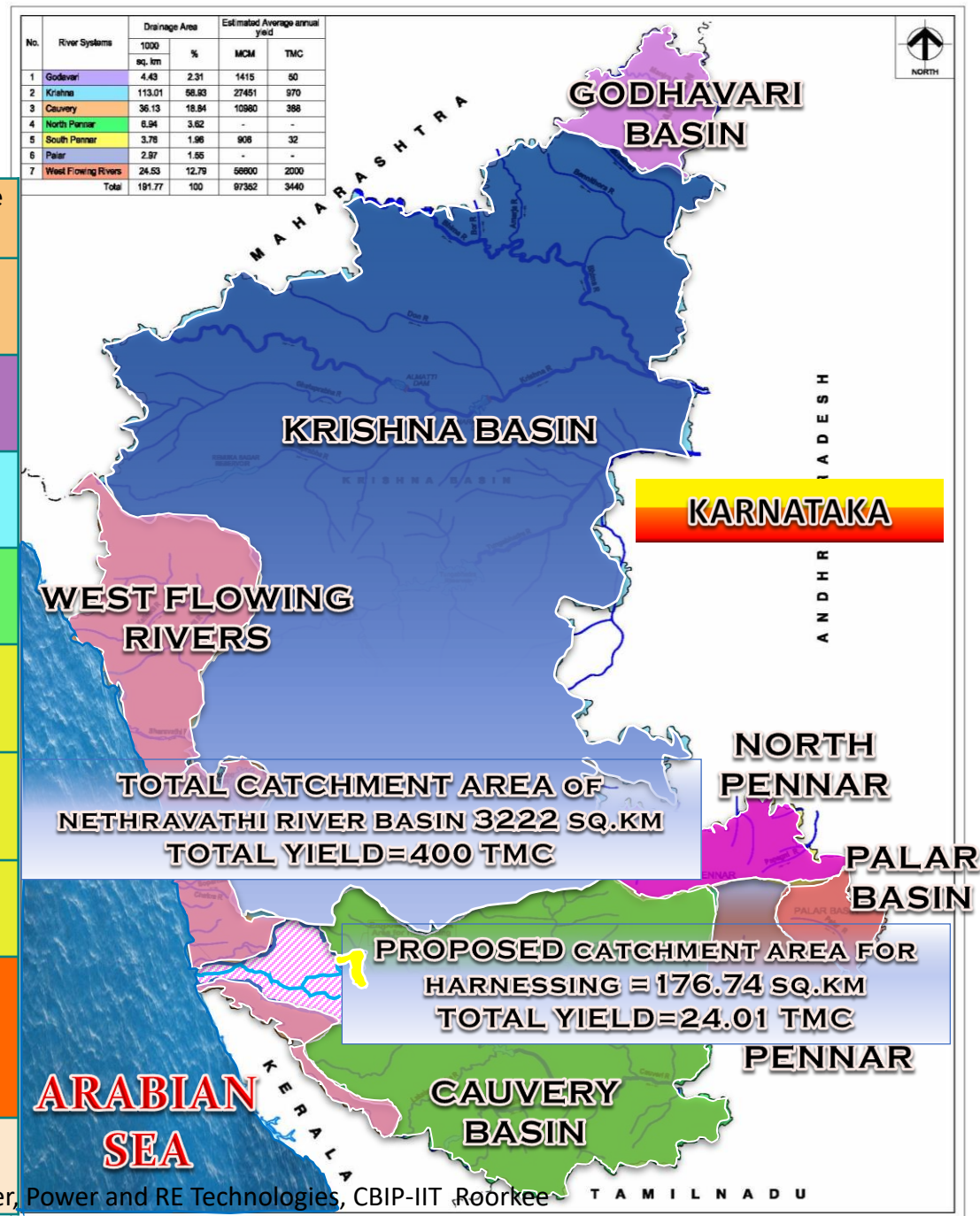


The rainfall intensity across the state varies from 400 mm in the Eastern and central area to around 6000 mm in Western Ghats.

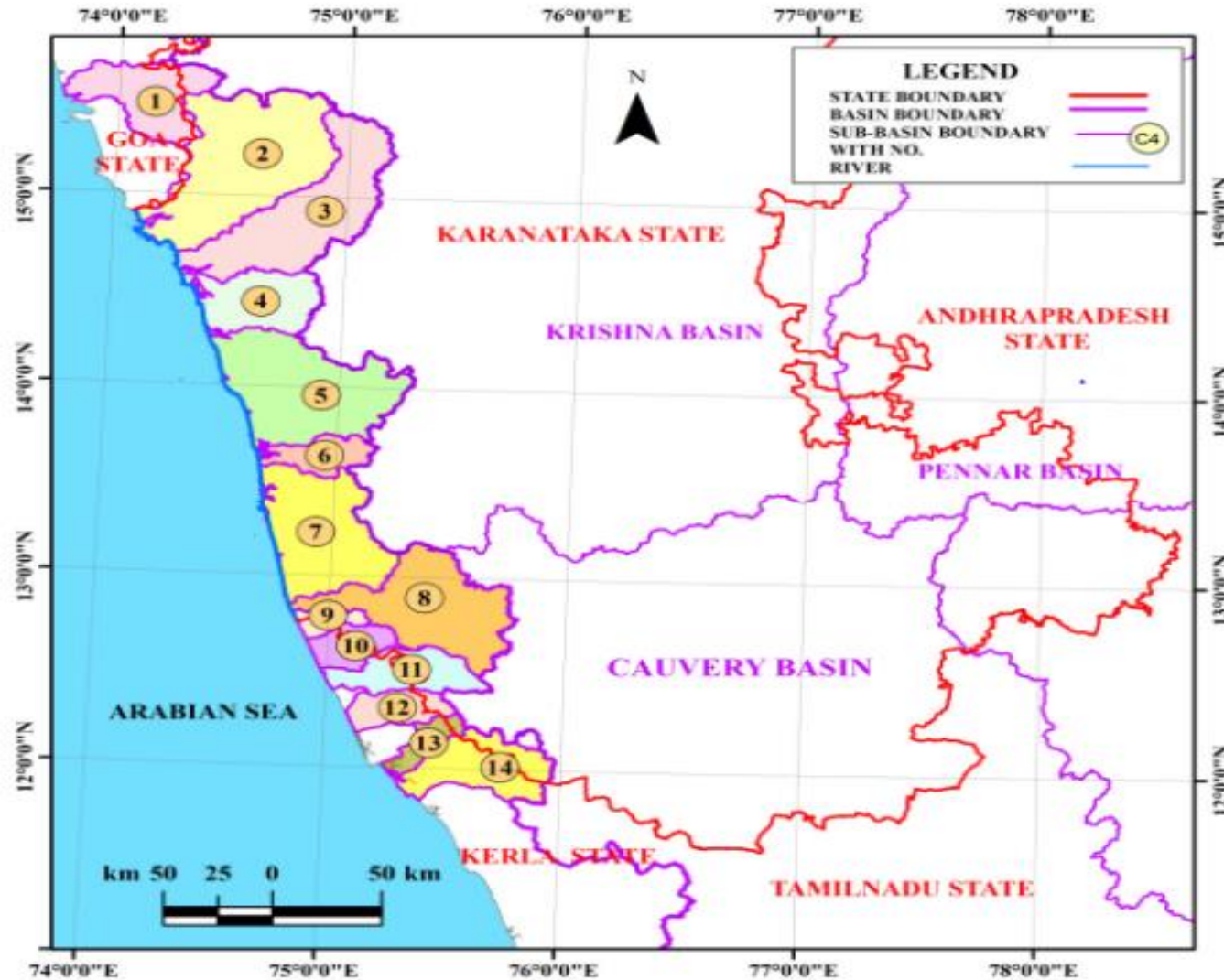


River Basin map of Karnataka

No	River Systems	Drainage Area		Estimated Average annual yield	
		1000 sq. km	%	MCM	TMC
1	Godavari	4.43	2.31	1415	50
2	Krishna	113.01	58.93	27451	970
3	Cauvery	36.13	18.84	10980	388
4	North Pennar	6.94	3.62	-	-
5	South Pennar	3.76	1.96	906	32
6	Palar	2.97	1.55	-	-
7	West Flowing Rivers	24.53	12.79	56600	2000
	Total	191.77	100	97352	3440



WEST FLOWING RIVERS BASINS OF KARNATAKA AND AVAILABILITY OF WATER

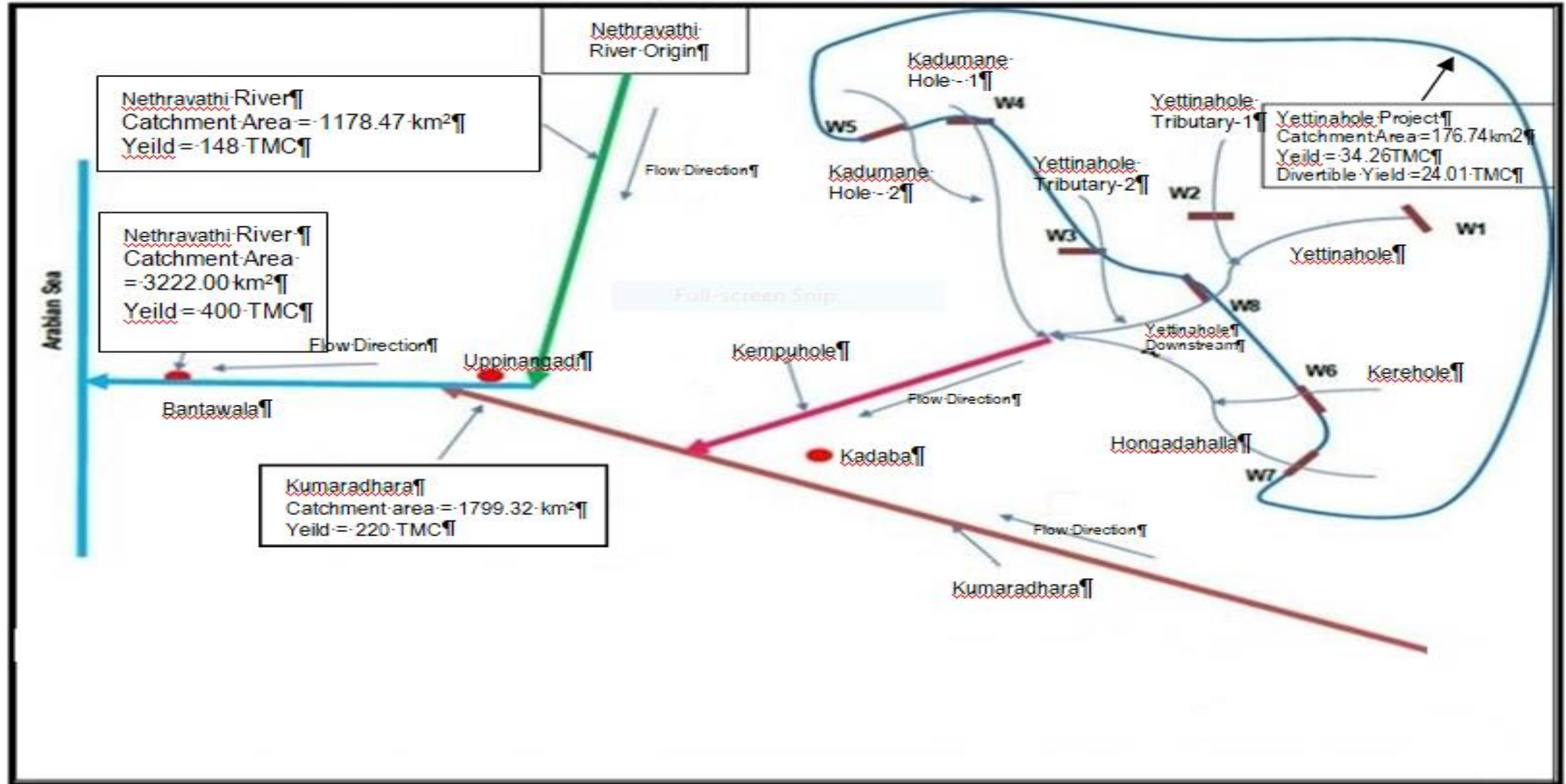


N0.	NAME OF THE BASIN	Gross yield @75% in TMC	Gross yield @50% in TMC
1.	Mahadayi basin	31	55
2	Kali nadi basin	283	305
3	Bedti basin	208	269
4	Aghnashini basin	144	167
5	Streams between Aghnashini & Chakra including Chakra basin	316	381
6	Varahi basin	163	186
7	Sreams between Varahi and Netravati basins	357	409
8	Netravati basin	383	428
9	Manjeswar and Uppala	18	21
10	Shiriya	18	23
11	Mogral and Chandragiri	75	91
12	Nileswar and Kariangode	13	15
13	Kuppam	4	5
14	Valapattanam	27	31
	Total	2040	2386

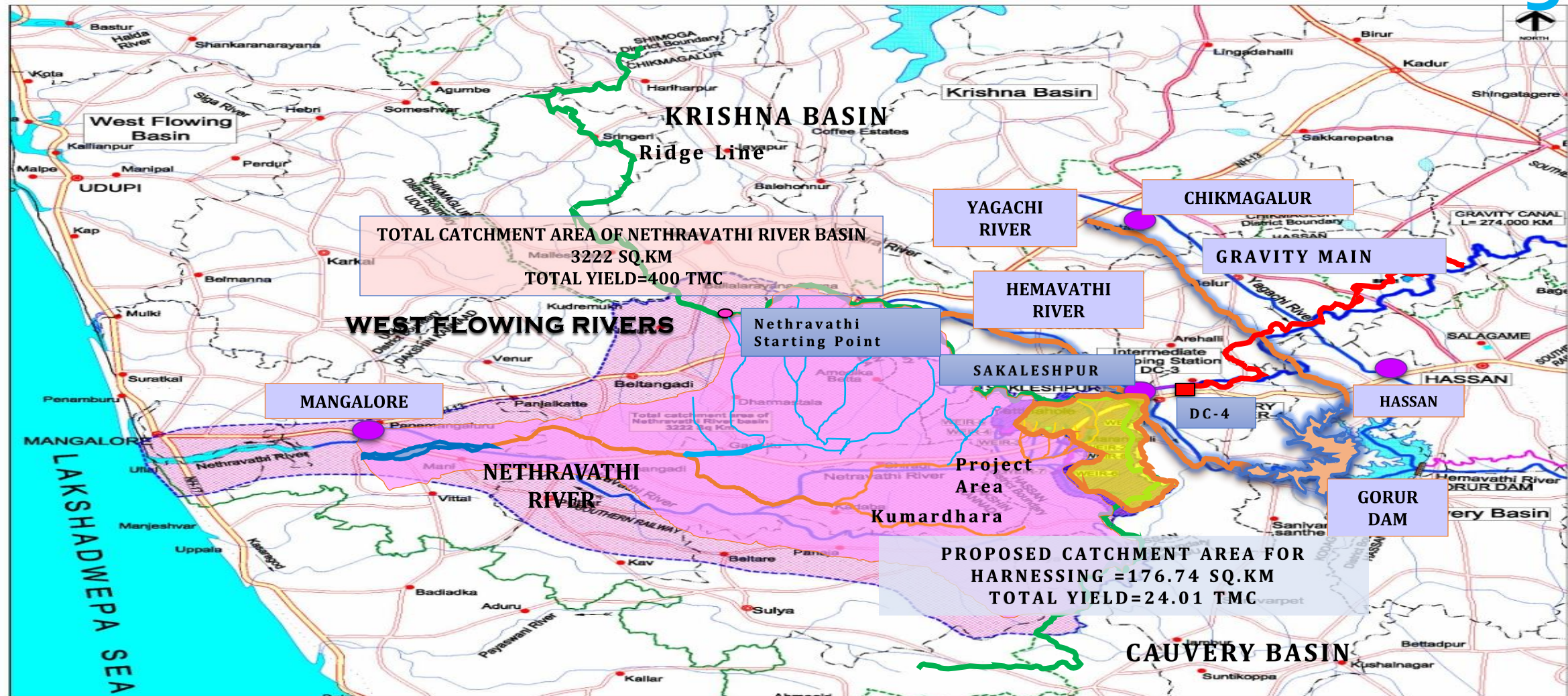
Overview of Yettinahole Project

- The Government of Karnataka has decided to mitigate the drinking water problems of drought prone areas, the detailed investigation and survey was carried for constructing 8 weirs across to diversion of surplus flood waters from upper reaches of Yettinahole, Kadumane hole, Kerihole and Hongadahalla streams by lifting water and conveying it to 7 districts such as Hassan, Chikkamagalur, Tumakuru, Chikkaballapur, Kolar, Ramnagara and Bengaluru Rural Districts to cater 75.59 Lakhs population.
- National water policy mandate - Drinking water for all.
- There is no impact on Environment since only 13.9 Hectares of Forest area diversion is involved.
- The project is aimed at providing 13.931 TMC of drinking water to 7 Districts and for recharge of Ground water by filling up of 10.064 TMC of water to 527 no's of MI tanks in palar and Pennar basin (50% of its Capacity)
- Every Year the Surplus water (24.01 TMC) is lifted only between June and November (169 days).

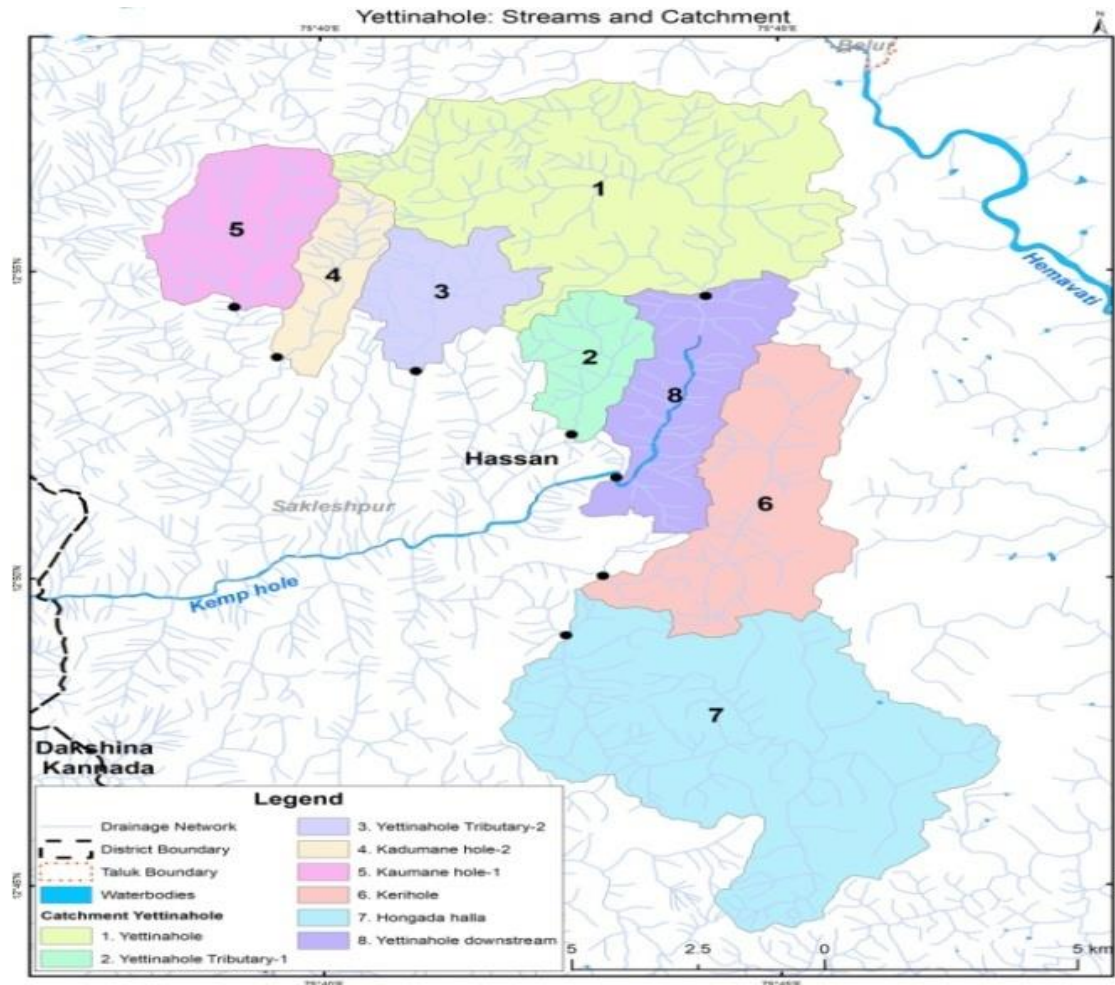
Schematic Diagram



CATCHMENT AREA of Nethravathi River Basin And Catchment Area For Harnessing

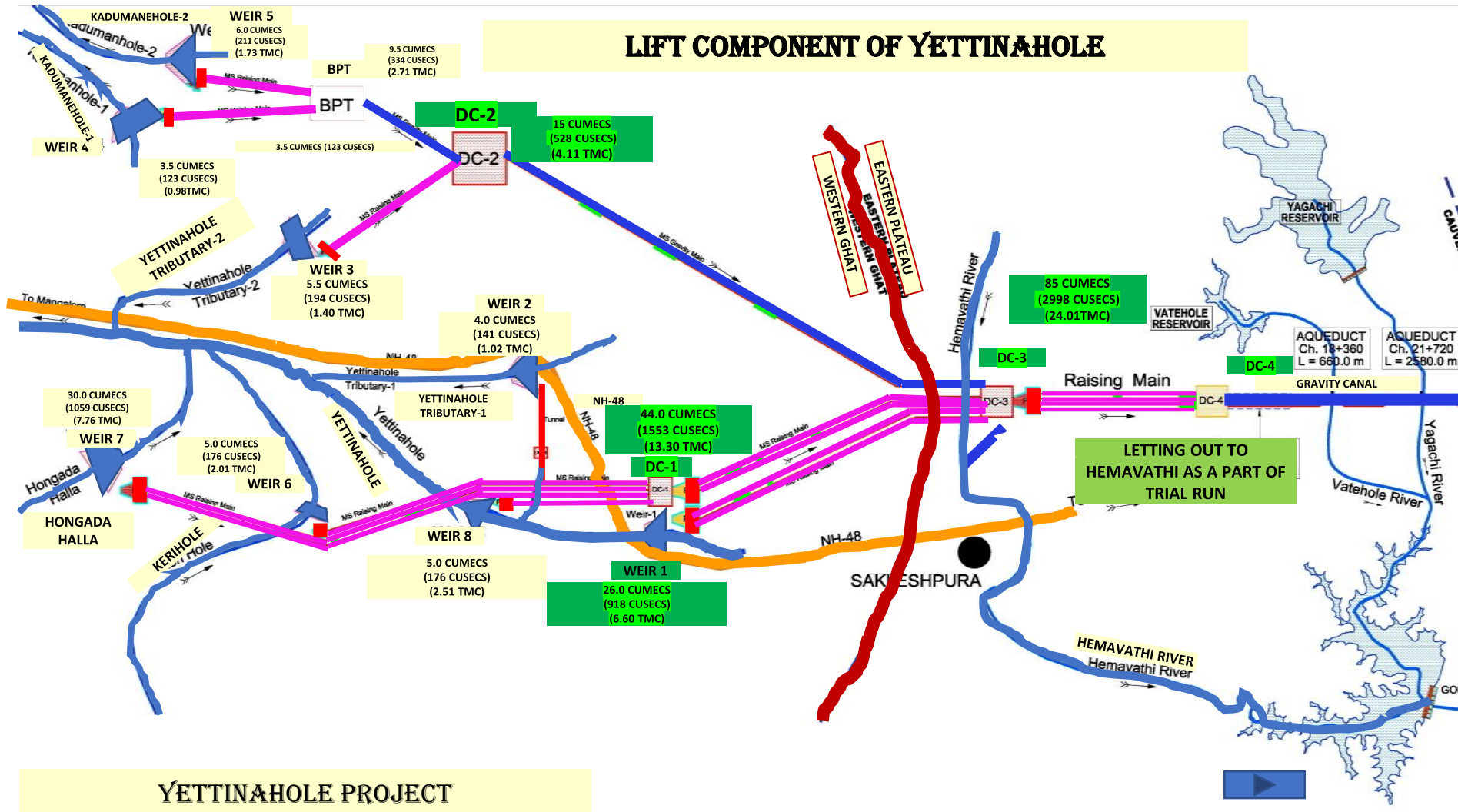


Yettinahole streams, Catchment map & Pumping Capacities



WEIR	CATCHMENT AREA km ²	PUMPING CAPACITY cumecs
Weir 1 (Yettinahole)	48.8	26
Weir 2 (Yettinahole tributary 1)	7.2	4
Weir 3 (Yettinahole tributary 2)	9.8	5.5
Weir 4 (Kadumanehole 1)	7.49	3.5
Weir 5 (Kadumanehole 2)	13.79	6
Weir 6 (Kerihole)	24.25	5
Weir 7 (Hongadahalla)	55.52	30
Weir 8 (Yettinahole Downstream)	12.06	5 (Total Pumping 9 cumecs i.e (W2+W8)
Total	176.74 Km²	85 Cumecs

Details of Lifting Components in Yettinahole Project



Weir's Elevation , Discharge

Weirs and Name of stream	Flow meter Device	RL	Discharge	Volume in TMC
Weir-1 (Yettinahole)	Radar Doppler	RL 800.000	26 CUMECS	6.6 TMC
WEIR-2 (Yettinahole Tributary-1)	Radar Doppler	RL 815.000	4 CUMECS	1.02 TMC
WEIR-3 (Yettinahole Tributary-2)	Optical Type	RL 846.200	5.5 CUMECS	1.40 TMC
WEIR-4 (Kadumane Hole-1)	Radar Doppler	RL 948.100	3.5 CUMECS	0.987 TMC
WEIR-5 (Kadumane Hole-2)	Radar Doppler	RL 906.600	6 CUMECS	1.73 TMC
WEIR-6 (Kerehole)	Radar Doppler	RL 777.500	5 CUMECS	2.01 TMC
WEIR-7 (Hongadahalla)	Optical Type	RL 729.000	30 CUMECS	7.76 TMC
WEIR-8(Yettinahole)	Radar Doppler	RL 747.500	5 CUMECS	2.51 TMC
		Total	85 Cumecs	24.01 TMC

- Water is lifted from RL 729.000 M reaches to RL 965.000 M (DELIVERY CHAMBER -4) using **Multi stage pumping**
- Water flows by gravity from RL 960.440m to buffer dam for a length of 261.69 km at full reservoir level of 812.500 M of capacity 1.88 TMC.

National water policy 2012

The paragraph of 5.5 of National water policy 2012 provides for inter basin transfer which is detailed as below

“Inter basin transfers are not merely for increasing production but also for meeting basic human need and achieving equity and social justice. Inter-basin transfers of water should be considered on the basis of merits of each case after evaluating the environmental, economical and social impacts of such transfers”.

Government Sanction for the Project

The Government has accorded the administrative approval for the Revised cost (2018-19 SR) for Rs 23,251.66 Crores.

Phase 1: Lift component: Rs. **4115.06**crores

Phase 2(a) Conveyance components : Rs: **12160.69** crores, others :**6975.91** Crores

(b) Construction of Reservoir- Lakkenahalli, Doddaballapura Taluk

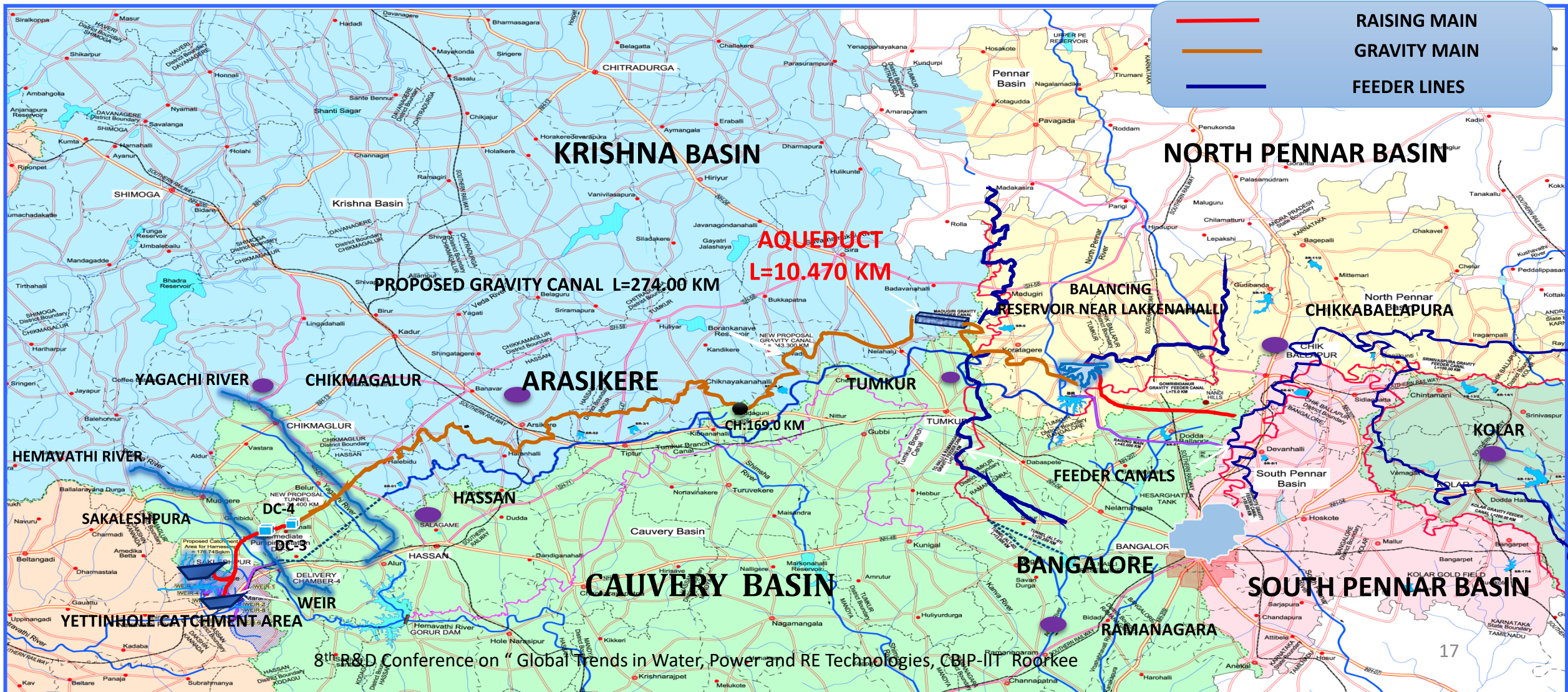
(c) Feeders 1.Madhugiri and Pavagada

2.TG Halli and Ramanagar

3.Kolar , Srinivasapur and Chickballapur

Master Plan of the Scheme

It is particular to mention here that, the unique feature of this project is that it is going to connect Krishna valley, Cauvery valley, South pennar, North pennar and Palar basin with west flowing river except Godavari basin. All other basin's are interconnected in one way the other.



Phases of the work

The project is planned in 2 Phases:

Phase-1 : Lift components up to DC-4 near Haravanahalli

- Construction of 8 diversion weirs across Yettinahole, Kadumanehole, Kerihole and Hongadahalla streams at identified locations
- Construction of 8 pump houses and 8 Electrical substations at the identified locations
- Construction of 126 KMs of Raising mains of suitable diameter along the selected route
- Construction of 400/220KV Electrical substations.
- 203 MW Power supply arrangements and Master SCADA arrangements.

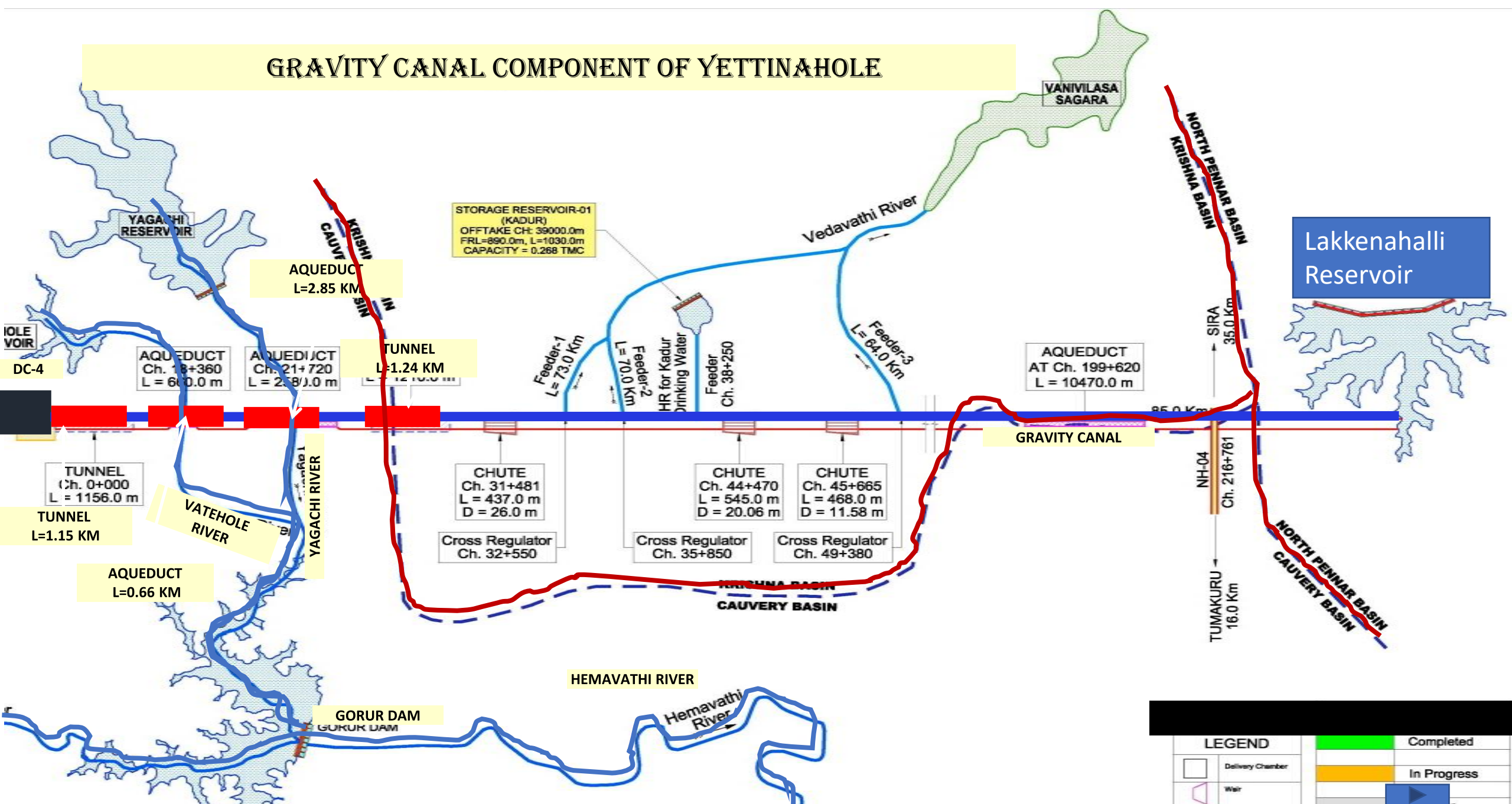
Phase-2 : Conveyance system beyond DC-4

- Construction of Gravity canal for a length of 261.690 Kms from DC-4 of Sakleshpura to Lakkenahalli Reservoir at Doddaballapura Taluk, Bengaluru Rural District.
- Construction of MS Feeders Such as T.G.Halli-Ramangara, Madugiri, Gowribidanur, Kolar, Srinavasapur etc.,

Salient Features of Conveyance system

1. Construction of Tunnels-10 nos of 6.03 kms
2. Aqueduct- 37 nos of 45.62 kms
3. Longest Aqueduct-10.6 Kms
4. Chutes-4 Nos
5. Canal in cutting and Embankment with Lining-220 Kms
6. Other structures i.e VRB , Under Tunnel, Super passage, Head Regulators, and Cross Regulator, Ground Trough,etc
7. Used Precast Technology for the construction of Aqueduct.
8. The canal runs in ridge line of Krishna and Cauvery Basin.

GRAVITY CANAL COMPONENT OF YETTINAHOLE



LEGEND	
	Completed
	In Progress
	Feeder
	22
	To Be Taken Up


YETTINAHOLE PROJECT

Purpose of Discharge measurement using Telemetry system in Yettinahole project

- To determining water yield in a monsoon period in Yettinahole stream and River.
- Constant monitoring 24/7 on the required ecological flow
- To analyse the quantum of water that can actually be pumped and when can it be pumped.

VJNL – Real Time Discharge Measurement Telemetry Stream Flow Meter In Yettinahole Drinking Project Information Portal <http://10.0.1.183:8012>



← → ↻ ⓘ Not secure | 10.0.1.183:8012

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Visvesvaraya Jala Nigam Limited
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Radar Doppler Instrument set up in Weir-5, Sensor holding assembly on data logger room with Radar level

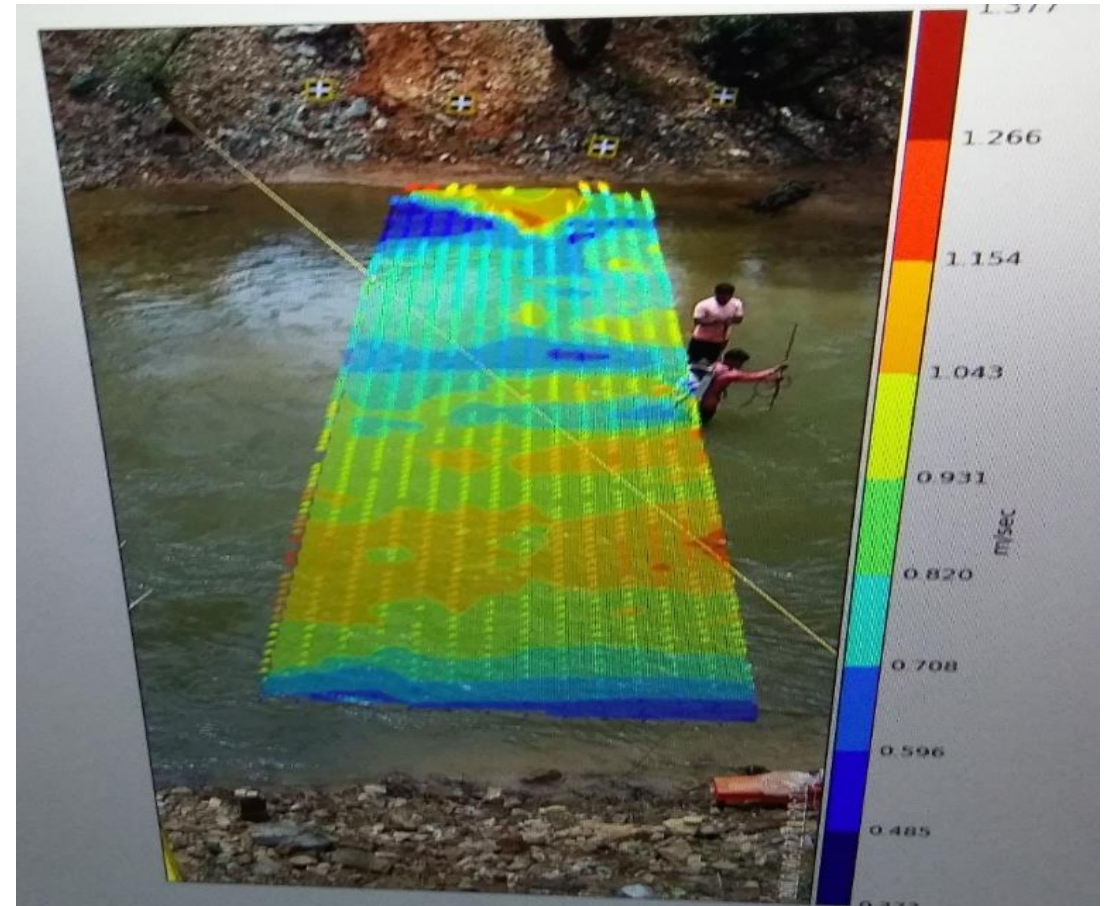


Cross verification of flow at Weir-7 By using Aqua Profiler

C/s sectional readings in stream in Wier-7 using Aqua Profilers during during low flow



Velocity profile along water Surface at weir -7



Data in web based vjnl software allows users to study and analyse the yield, the potential water that can be pumped

Yettinahole Streams Actual and Planned Harvest of Water in Volumetric Discharge.								
01 June 2018 - 06 May 2019 (339 days)					Actual Flow in the Streams - Yield			
Location Name	Planned (m3/s)	Planned TMC	Planned (ft3/s)	Daily Target Volume (MCFT)	Device Used	Actual Flow (MCFT)	Actual Flow (TMC)	% of Actual to Planned
Weir-1	26	6.6	918.181	79.331	HVMT801	6457.00	6.46	98%
Weir-2	4	1.02	141.259	12.205	HVMT0937	1237.00	1.24	121%
Weir-3	5.5	1.4	194	16.78	approx	3251.4	3.3	232%
Weir-4	3.5	0.98	123.601	10.679	HVMT0947	1884.00	1.88	192%
Weir-5	6	1.73	211.888	18.307	HVMT0934	3547.00	3.55	205%
Weir-6	5	2.01	176.573	15.256	HVMT0799	4365.00	4.37	217%
Weir-7	30	7.76	1059.44	91.536	DK007	9902.00	9.90	128%
Weir-8	9	2.51	317.832	27.461	HVMT0917	2597.00	2.00	80%
		24.01				33240.42	32.65	136%

Innovative mode of obtaining land for work without acquisition in respect of Kadumane Estate.

- ✓ There is a concept called “**Right of Use**” where there is no transfer of ownership, but we have the license to execute the work and only nigram officers would be allowed access for O&M requirement.
- ✓ License fee of Rs. 50.00 lakhs(one time) has been paid to the owner for 36.00 acre. This license is perpetual as long as project is there.
- ✓ This innovative mode has facilitated construction of 2 weirs, pump houses, sub station and raising main (L: 7.48 K.M) which inturn is contributing towards harnessing and conveying of 9.50 cumecs of water.

Mitigation Measures

1. Slope and Embankment protection works proposed at the places where depth of cutting more than 3 mtrs in the Western Ghats.
2. Study on bio diversity and impact on flora and fauna entrusted to IISc, Bengaluru and EMPRI Bengaluru
3. Installed Telemetry rain gauges and flow measurement in the project area
4. Taken up afforestation along the entire length of canal
5. Taken up Infrastructure projects like concrete roads, Drinking water projects and Rehabilitation works in lift component area.

Major Challenges

- 1.Total land required is about 8675 acres. Land Acquisition- Direct purchase, SIA, R&R, Time duration- 36-48 months
2. Forest clearance-Alternative land, Afforestation, tree cutting permission.
3. Clearances from other dept (Railways, NHAI, HPCL, KPTCL. etc)
4. Identification of Quarries for Sand, Jelly. etc
5. Obstruction from Locals/Villagers
6. Selection of Agencies/Firm/Contractor/company
7. Contract management
- 8.Capacity Building of Engineers
- 9.Quality Assurance/Quality control
- 10.Construction period is less than 5 months in Malnad Area.

Conclusion

- The Yettinahole project is formulated to divert the unutilized surplus flood water in the upper reaches of west flowing rivers to water deficit Pennar and Palar basin of eastern parts of Karnataka. This will also fulfil the objective of the **National water policy** in achieving *equitable distribution of drinking water which will be fundamental right of citizen*.
- Automated technologies with radar systems to provide accurate and continuous volumetric discharge measurements.
- This system plays a crucial role in effective water management, enabling real-time control, compliance reporting, and optimized water usage.
- Its non-contact flow meter principle ensures reliable and precise data, making it an invaluable tool for various water-related applications. Viz: **Resolving Inter state/ International water disputes & Integrated water resources management**

WEIR-1



WEIR-2



WEIR-3



WEIR-4



WEIR-4



WEIR- 5, PUMP HOUSE & FOREBAY



WEIR-5



WEIR-6



WEIR-7 PUMP HOUSE



WEIR-7



WEIR-8



DC-3 FORE BAY INTAKE



DC-3 PUMPHOUSE & FOREBAY



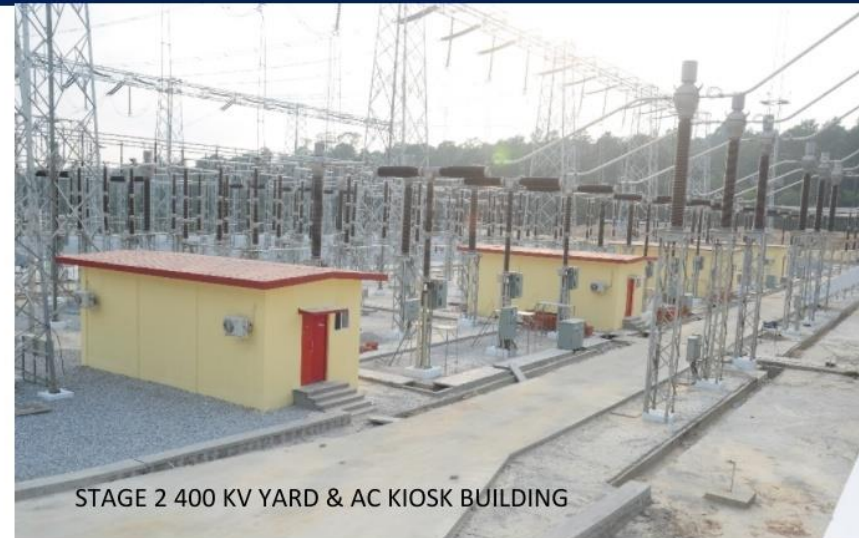
PKG-III PUMPHOUSE



Hemavathy Bridge Ch:6.560 KM



400/220KV Sub Station at Hebbanahalli



PUMPHOUSE PANEL ROOM



DC-4 NEAR HARAVANAHALLI



DC-4 & GRAVITY LEAD OFF CANAL



AQUEDUCT Ch:5.440km to Ch:6.680km



GRAVITY CANAL CH:2.6km to 3.00KM



TG HALL RAMANAGARA FEEDER PUMP HOUSE & FORE BAY OFFTAKING AT CH:244.90 OF





MODIFIED AQUEDUCT DESIGN FOR HEMAVATHY FEEDER CANAL CROSSING AT CH:136.540KM



Launching of pre-cast troughs on pier cap using 500T capacity cranes



Shot on OnePlus
By sathwik hegde

Launching of pre-cast troughs on pier cap using 500T capacity cranes



Launching of pre –cast troughs on pier cap using 500T capacity cranes



Launched of pre –cast troughs on pier cap



Shot on OnePlus

By sathwik hegde

8th R&D Conference on "Global Trends in Water, Power and RE Technologies, CBIP-IIT Roorkee

MAJOR AQUEDUCT NEAR CHELURU YHP, CH:205.00KM to CH: 206.00 KM



Completed Aqueduct near Chelur, Tumkur district



Completed Aqueduct near Chelur, Tumkur district



Thank you!

