

# Dams of South India

by

Pankaj Kumar Sharma

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# Dams of South India:-

Their type, location, role and importance with respect to water resources utilization along with challenges involved in effective operation of these dams due to Inter-state issues, a typical situation of India, where only states (local government) have constitutional power to manage water within their jurisdiction and role of central government (federal government) is limited to providing technical and financial assistance to State Governments.

## Introduction:

### Where is South India?

The geographical area depicted by phrase “South India” is not defined officially. It is perceived as an area south of peninsular deccan plateau consisting mainly of the Indian states of Tamil Nadu, Karnataka, Kerala, Andhra Pradesh and Telangana as well as the union territories of Andaman and Nicobar, Lakshadweep and Puducherry. The geography of the region is diverse with two mountain ranges - the Western and Eastern Ghats, bordering the plateau heartland. Godavari, Krishna, Kaveri, Tungabhadra and Vaigai rivers are important non-perennial sources of water. Bengaluru , Chennai, Hyderabad, Kochi, Coimbatore, Mysore and Thiruvananthapuram are the largest urban areas.

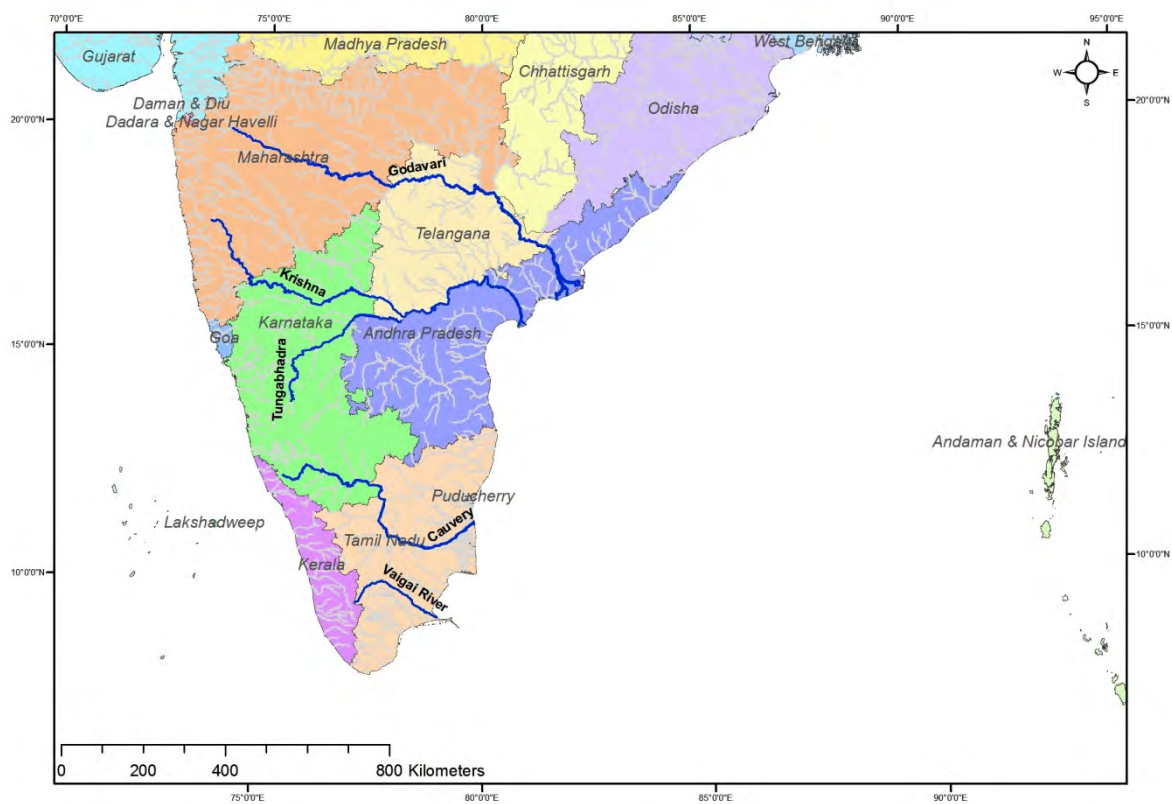


Figure 1: Major States and river of South India



Figure 2: Major States and Cities of South India

### Status of Large dams in South India:

The National Register of Large Dams in India provides details information about large dams (as per International Commission on Large Dams - ICOLD definition) in the country.

ABSTRACT OF LARGE DAMS (STATEWISE & DECADEWISE)

Sl. No.	State	Year of completion											TOTAL
		UPTO 1900	1901 TO 1950	1951 TO 1960	1961 TO 1970	1971 TO 1980	1981 TO 1990	1991 TO 2000	2001 & Beyond	Year of construction not available	Total completed dams	Under Construction	
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Andaman & Nicobar Islands*					1			1		2		2
2	Andhra Pradesh	1	6	9	11	24	15	9	21	46	142	25	167
3	Arunachal Pradesh								1		1	3	4
4	Assam			1	8	5	2		1		3	1	4
5	Bihar	1		1		5	1	3			24	2	26
6	Chhattisgarh		11	1	18	51	99	37	30	1	248	10	258
7	Goa						3	2			5		5
8	Gujarat	6	57	59	85	151	155	57	44	5	619	13	632
9	Himachal Pradesh				1	2	1	1	12	2	19	1	20
10	Haryana								1		1		1
11	Jammu & Kashmir					2	2	1	6	3	14	3	17
12	Jharkhand			9	5	11	22			3	50	29	79
13	Karnataka	6	24	11	39	49	54	17	14	16	230	1	231
14	Kerala	1	1	9	15	11	10	10	4	0	61	1	62
15	Madhya Pradesh	3	86	35	66	220	301	93	66	28	898	8	906
16	Maharashtra	21	38	24	156	615	455	378	382	0	2069	285	2354
17	Manipur					1		1	1		3	1	4
18	Meghalaya			1	2	2		1	2		8		8
19	Mizoram											1	1
20	Nagaland							1			1		1
21	Odisha	2	2	4	8	54	77	35	13	4	199	5	204
22	Punjab			1			4	6	3		14	2	16
23	Rajasthan	17	14	33	23	29	36	26	15	8	201	10	211
24	Sikkim							1	1		2		2
25	Tamil Nadu	0	10	10	26	26	17	8	19		116	0	116
26	Telangana	6	29	6	13	9	13	6	3	78	163	21	184
27	Tripura					1					1		1
28	Uttar Pradesh	4	24	21	22	16	14	11	3		115	15	130
29	Uttarakhand				5	4	2	1	4		16	9	25
30	West Bengal			1	1	4	16	2	5		29	1	30
	<b>GRAND TOTAL</b>	<b>68</b>	<b>302</b>	<b>235</b>	<b>504</b>	<b>1288</b>	<b>1303</b>	<b>705</b>	<b>655</b>	<b>194</b>	<b>5254</b>	<b>447</b>	<b>5701</b>

\* Union Territory (UT)

From the above list, it can be seen that the South Indian states of Tamil Nadu (116), Karnataka (231), Kerala (62), Andhra Pradesh (167) and Telangana (184) as well as the union territories of Andaman and Nicobar (2), Lakshadweep (0) and Puducherry (0) account for 762 large dams among themselves.

### **Water resources and Inter-State Matters:**

[Ministry of Water Resources, River Development and Ganga Rejuvenation](#) provides information on its website related to "[WATER IN INDIAN CONSTITUTION](#)."

India is union of States. The constitutional provisions in respect of allocation of responsibilities between the State and Centre fall into three categories: The Union List (List-I), the State List (List-II) and the Concurrent List (List-III).

As most of the rivers in the country are inter-State, the regulation and development of waters of these rivers, is a source of inter-State differences and disputes. In the Constitution, water is a matter included in Entry 17 of List-II i.e. State List. This entry is subject to the provision of Entry 56 of List-I i.e. Union List."

### **Entry 17 of List-II i.e. State List:**

Entry 17 under List II of Seventh Schedule provides that "Water, that is to say, water supplies, irrigation and canals, drainage and embankments, water storage and water power subject to the provisions of Entry 56 of List I".

### **Entry 56 of List-I i.e. Union list:**

Entry 56 of List I of Seventh Schedule provides that "Regulation and development of inter-State rivers and river valleys to the extent to which such regulation and development under the control of the Union is declared by Parliament by law to be expedient in the public interest".

Parliament has enacted "[THE INTER-STATE RIVER WATER DISPUTES ACT,1956](#)" in pursuance of the above provisions of constitution to resolve the inter-state disputes related to water.

The ongoing disputes and their status can be seen on website [mowr.gov.in](http://mowr.gov.in) [drop-down menu](#).

Also, [Chapter X of Annual Report 2015-2016 of CWC](#) provides detailed information about Inter-State Water Disputes and steps taken to resolve them.

In this report, following 5 dams out of 762 shall be discussed based on their importance and inter-state issues:

1. Mulla Periyar Dam
2. Parambikulam Aliyar Project (PAP)
3. Krishna Raj Sagar dam
4. Mettur dam
5. Almatti dam

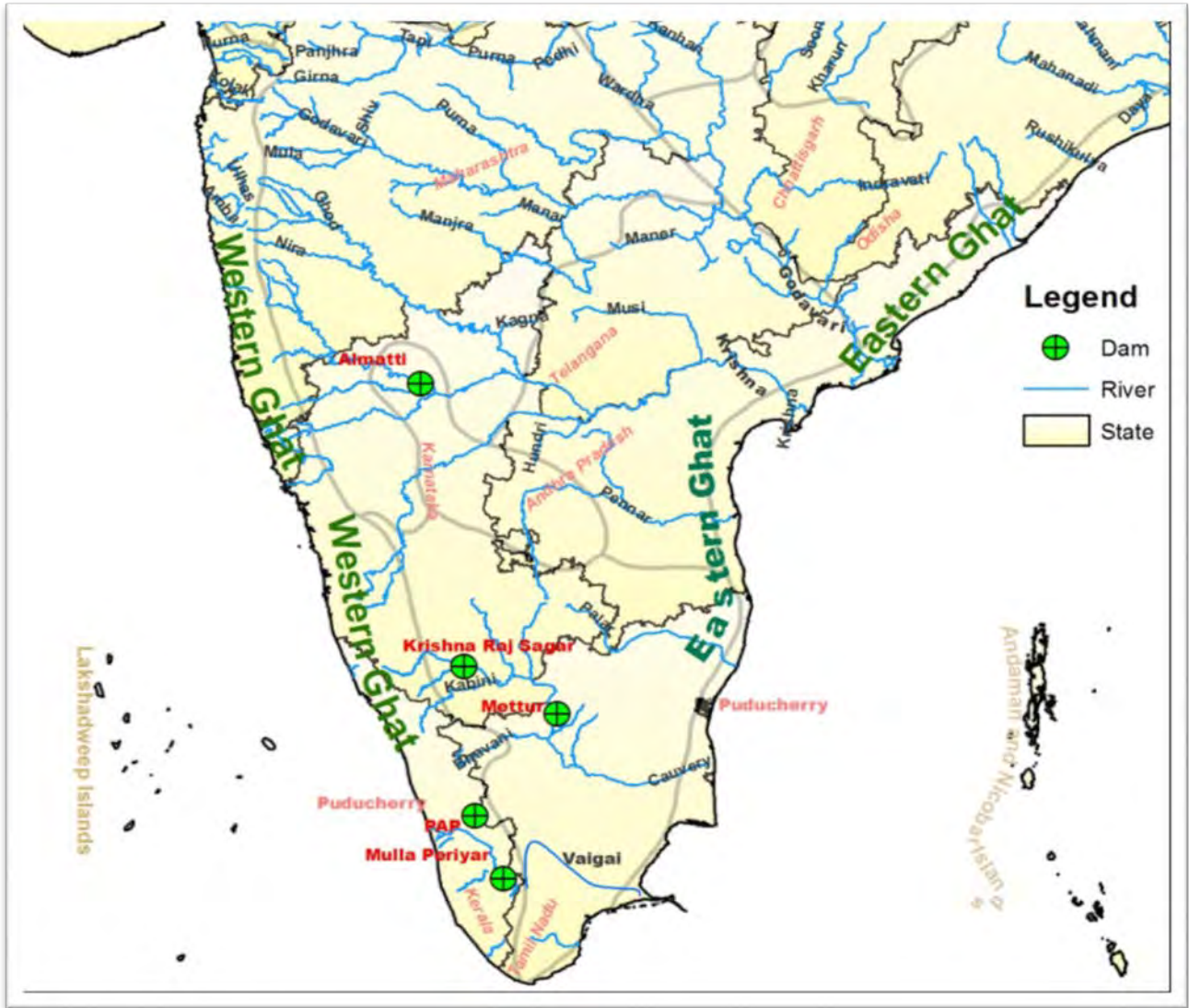
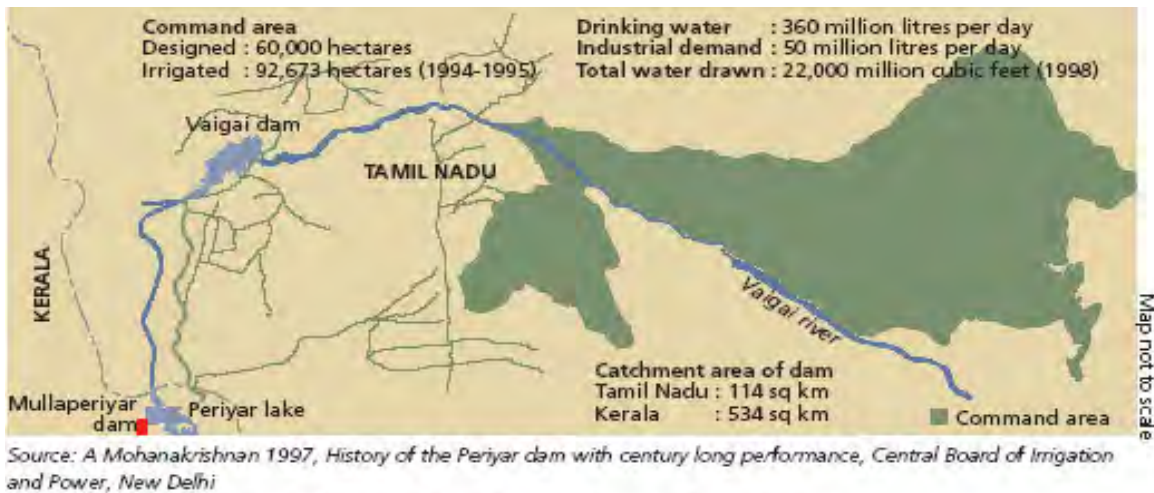


Figure 3: Location of above five dams in South India

# 1. Mullaperiyar Dam

The Mullaperiyar Dam is a masonry gravity dam on the Periyar river in the Indian state of Kerala. It is located 881 m (2,890 ft) above mean sea level, on the Cardamom Hills of the Western Ghats in Thekkady, Idukki District of Kerala, South India.



*Mullaperiyar dam is in Kerala, Tamil Nadu its main beneficiary*

Figure 4: Mullaperiyar Dam

## Inter State Angle

The control and safety of the dam and the validity and fairness of the lease agreement have been points of dispute between Kerala and Tamilnadu states.

For Tamil Nadu, the Mullaperiyar dam and the diverted Periyar waters act as a lifeline for Theni, Madurai, Sivaganga and Ramnad districts, providing water for irrigation and drinking, and also for generation of power in Lower Periyar Power Station.

For Kerala, safety concerns posed by the 119-year-old dam to the safety of the people of Kerala in the event of a dam collapse, have been the focus of disputes from 2009 onwards. Kerala's proposal for decommissioning the dam and constructing a new one has been challenged by Tamil Nadu.

The details of the legal tussle between Kerala and Tamilnadu over the dam can be perused [at links](#) given at the end of the report.

On directions of Supreme Court, a [Dam Break Analysis](#) of the Dam and its downstream reaches upto Iddukki dam has been conducted by IIT-Roorkee. A summary of their findings is reproduced below:

## Conclusions from the study:

1. The literature suggests the HEC-RAS version 5.1.0 model to be quite popular and standard software developed by Hydrologic Engineering Centre of U. S. Army Corps of Engineers for dam break analysis.
2. The consideration of the overtopping mode of failure along with the following breach parameters (as per FERC guidelines) is reasonable for dam break flood generation:

Elevation of Breach (m)		Average Breach Width (m)	Side Slope of Breach	Breach Development Time (hr)
Initial	Final			
873.26	825.94	195.5	Vertical (1:1)	0.2

Table 1: Dam break model parameters

- The generated peak of the dam break flood hydrograph is estimated at 88911.00 cumecs, which is 10.25 times of the peak of Probable Maximum Flood Hydrograph.
- The depths of flows at different locations within the river reach of 36 km vary from 40.30 m (just below the Mullaperiyar Dam site) to 20.85 at the end of the reach (chainage 36 km from Mullaperiyar Dam).
- The following table shows the resulting maximum discharges, maximum water surface elevations, and time of occurrence of the maximum water surface elevations in the channel.

Place	Section No.	Location from dam (m)	Maximum Water Surface Elevation (m)	Time of Arrival (minutes)	Velocity (m/s)
Mullaperiyar	1	50	866.90	18	9.47
Vallakkadavu	11	3597	854.35	26	12.41
Vandiperiyar	21	7422	844.77	31	9.36
Upstream of Idukki Reservoir	46	35969	767.26	128	8.50

Table 2: Results of Dam break analysis

- Among the inputs of Manning's roughness (N), Probable Maximum Flood (PMF), dam breach parameters such as breach width and time of breach development and  $\Delta x$  (space) &  $\Delta t$  (time) steps, the Manning's roughness (N) appeared to be the factor most influencing the maximum water surface elevations. Although conservative a value of  $N = 0.034$  was considered to be reasonable for the reach between Mullaperiyar and Idukki Reservoir.
- The sensitivity analysis showed the model generated output to be reliable for chosen timed space steps.

The above study helped in controlling the [mis-information](#) being spread around the area.

Roughly, it was preliminarily estimated that a dam-break would directly affect 32,503 people and 8,942 houses in seven villages situated down the dam. Sixty-nine shelters would have to be built for the safety of people and total cost estimated for the construction was Rs 20 crore.

The above case study is related to [the first and second week of course](#) concerned with dam failure concepts and dam break analysis.

Which further highlights the importance of course on Advance Hydrology.

In 2006, the Supreme Court of India by its decision by a three-member division bench, allowed for

the storage level to be raised to 142 feet (43 m) pending completion of the proposed strengthening measures, provision of other additional vents and implementation of other suggestions.

## 2. Parambikulam Aliyar Project(PAP)

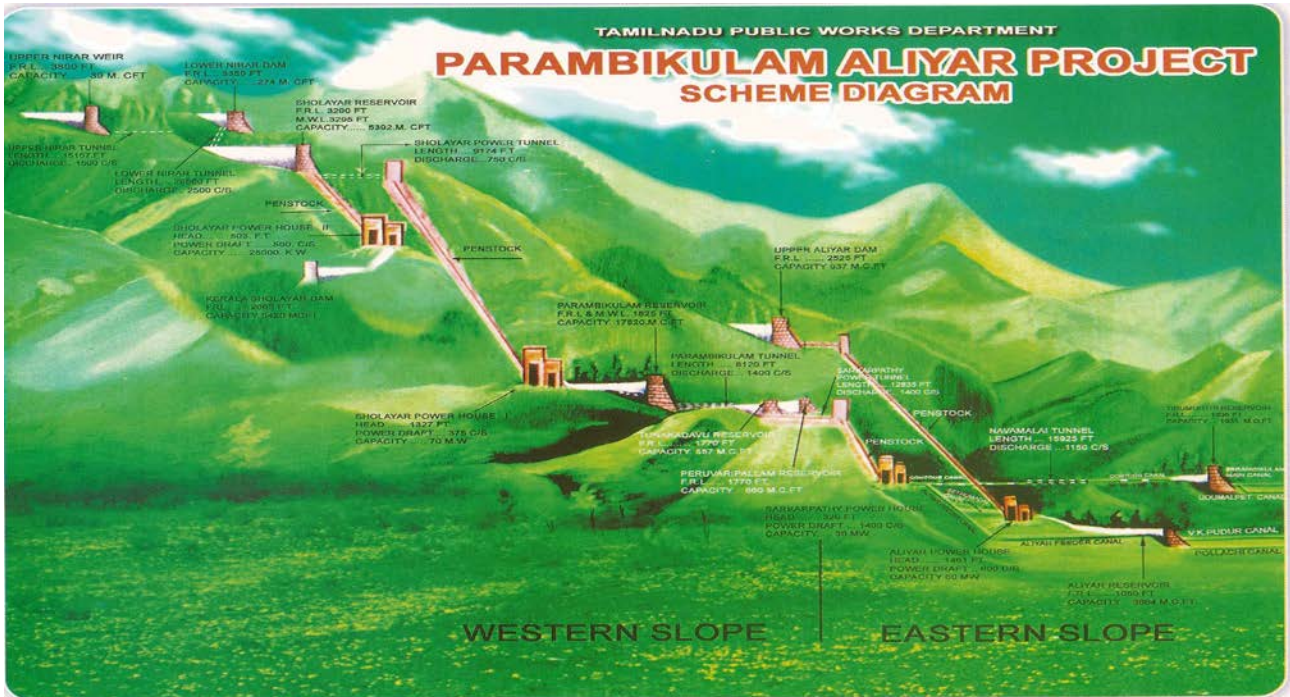


Figure 5: PAP project view

### Inter state angle

In sharp contrast to the above Mullaperiyar Dam , this project is a story of long cooperation between states of Kerala and Tamilnadu.

[Parambikulam-Aliyar project](#) (PAP) agreement signed between Tamil Nadu and Kerala on May 29, 1970 has retrospective effect from November 9, 1958. The agreement is aimed at beneficial sharing of waters of the Bharathapuzha, the Chalakudy and the Periyar and implementation of projects by the two States.

It successfully accomplishes the diversion and integration of eight western flowing rivers, six in the Anamalai hills and two in the plains for the benefit for the drought prone regions of Coimbatore and Erode district of Tamilnadu and stabilizing the existing irrigation system in the Chittorrphuzha of Kerala state.



### 3. Krishnarajasagar Dam

## KRISHNARAJASAGAR DAM



- **Height:** 225 meters
- **Length:** 3500 meters
- **Type:** Gravity Dam
- **River:** Kaveri River
- **Location:** Karnataka
- **Capacity (Cubic Km):** 1.4

Figure 6: Krishnarajasagar Dam

The dam was built across river Cauvery in 1924. It is the main source of water for the districts of Mysore. The water is used for irrigation in Mysore and Mandya districts of Karnataka and it is the main source of drinking water for all of Mysore, Mandya and almost the whole of Bengaluru city, the capital of the state of Karnataka. The water released from this dam flows into the state of Tamil Nadu, and is stored in Mettur dam in the Salem district.

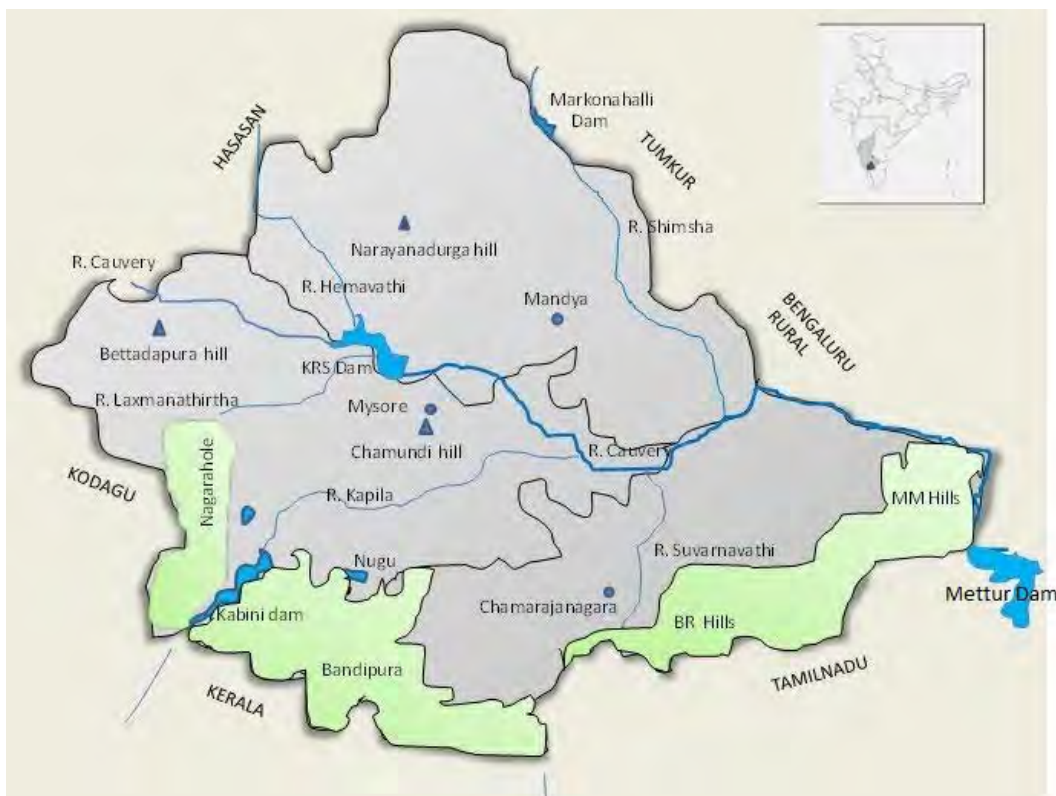


Figure 7: Location of Kabini, Krishnarajasagar and Mettur Dams on Cauvery river

## 4. Mettur Dam

The **Mettur Dam** is one of the largest dams in India and the largest in Tamilnadu located across the river Cauvery where it enters the plains. Built in 1934 took 9 years to complete. Maximum height and width of the Dam are 214 and 171 feet respectively. The Dam receives inflows from its own catchment area, Kabini Dam and Krishna Raja Sagara Dams located in Karnataka.

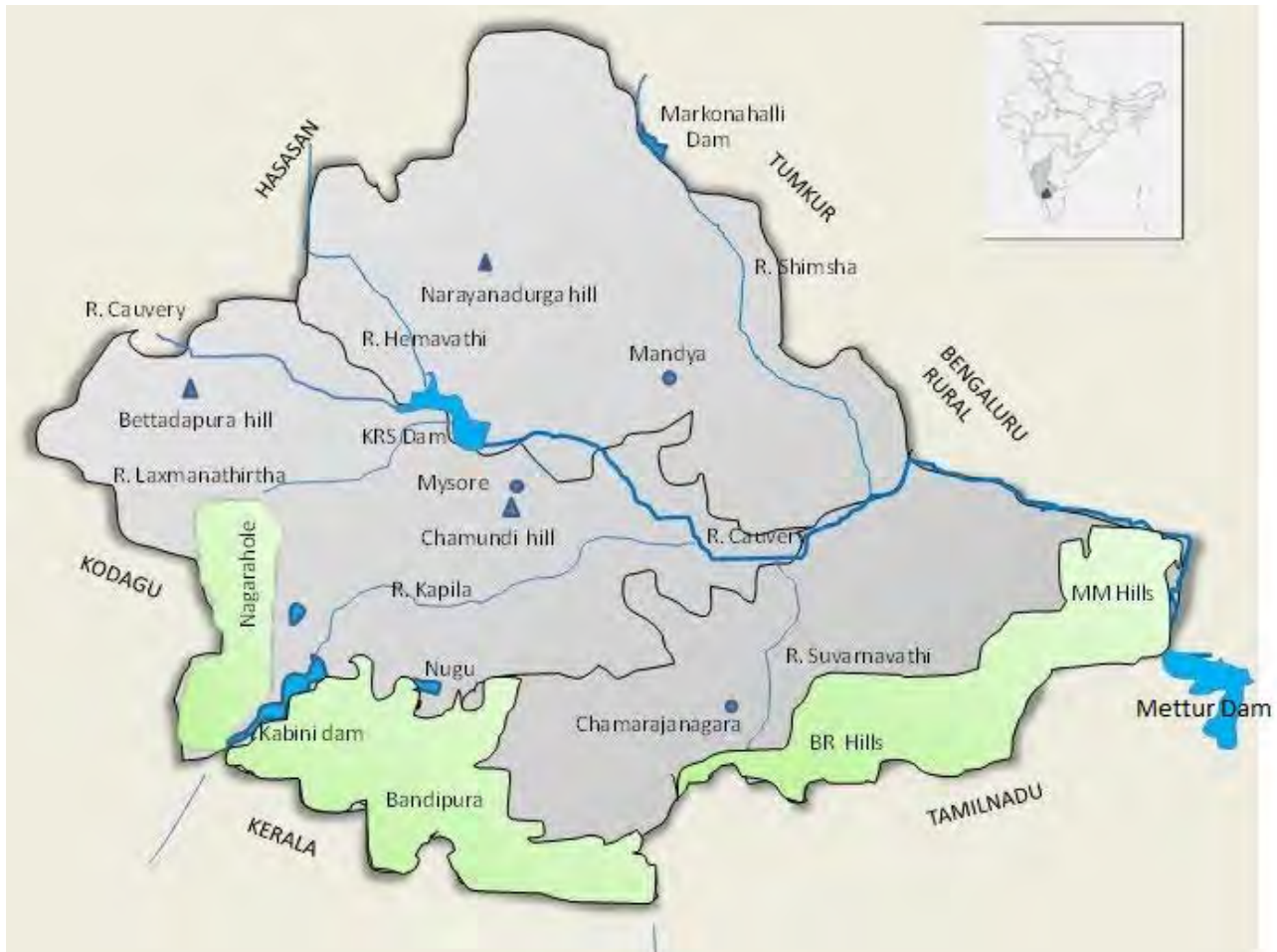


Figure 8: Location of dams on Cauvery river viz Kabini, KRS and Mettur Dam

### Inter State Angle

The above dams on Cauvery river are in dispute between the States of Tamil Nadu and Karnataka. Because of subsequent dams constructed across the Cauvery and its tributaries in Karnataka, namely Harangi Dam, Hemavathi Dam, Kabini Dam, following the KRS Dam; Mettur Dam does not receive much water during lean seasons. As a result, the dam nearly goes dry lean season, often when water is most needed by the farmers and the general public of Tamil Nadu. The orders of court / tribunals are resented by parties concerned and often seen as favouring the other party.

## 5. Almatti Dam

The **Almatti Dam** is a hydroelectric project on the Krishna River in North Karnataka, India which

was completed in July 2005. The Krishna River conflict between Andhra Pradesh, Karnataka, and Maharashtra is still ongoing. Meanwhile by the order of Krishna Water Disputes Tribunal –II also known as Brijesh Kumar Tribunal the dam was authorised to be raised to the height of 524.256 m MSL from 519.6 m with nearly 200 TMC gross storage capacity.

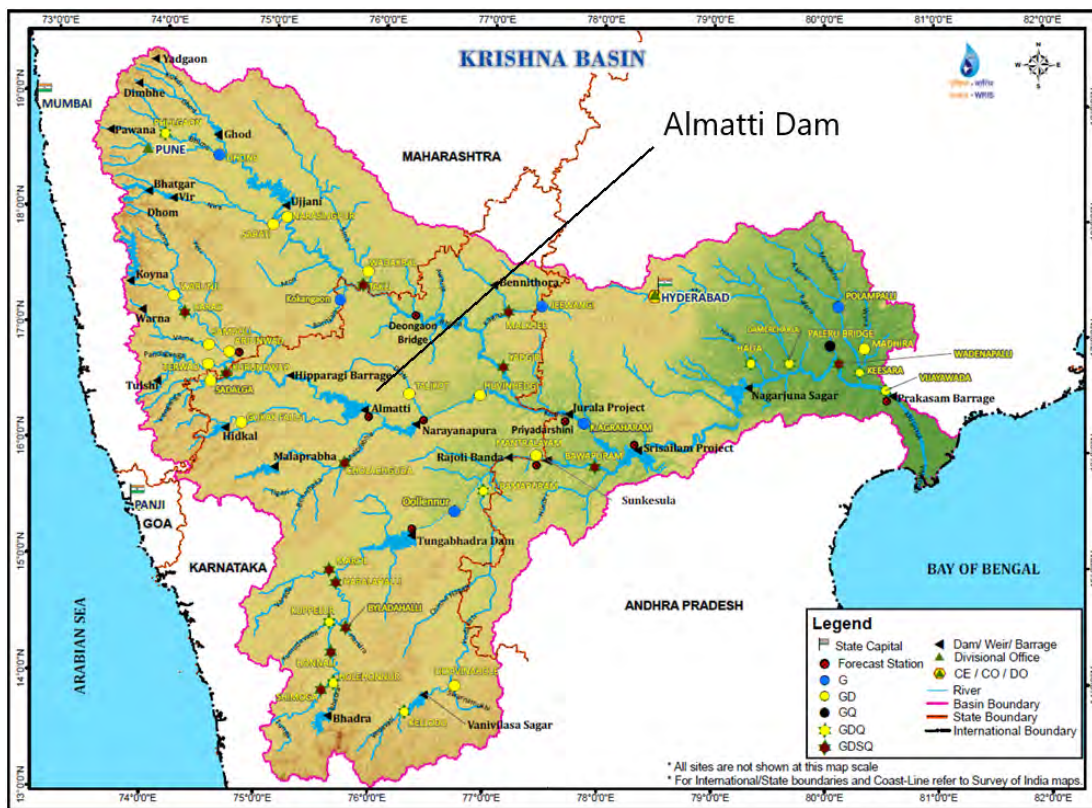


Figure 9: Location of Almatti Dam in Krishna basin

### Inter state angle



Figure 10: Almatti Dam

The total allocation of the 3 States including those made by KWDT-I come to 666 TMC for the State of Maharashtra, 907 TMC for the State of Karnataka and 1005 for the State of Andhra Pradesh. Matter is still sub-judice.

# Summary

India has 2.4% of the World's land, 18% of world population but only 4% of the renewable water resource. If sufficient steps are not taken, the uneven water distribution will increase the possibility of water conflicts with rising population, urbanisation and Industrialization.

The Inter-State River Water Disputes are one of the most contiguous issues in the Indian federalism today.

Hydrological Study and analysis helps in resolving these issues analytically. These study also help in controlling the mis-information being spread in public. Which further highlights the importance of course on Advance Hydrology.

Sources:

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