

KRISHNA RIVER WATER SHARING ACCORD

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Introduction

The ongoing Krishna river water sharing accord (Bachavat Tribunal Award) is due for review from the year 2000. A new Tribunal is constituted to look in to the issues of river water sharing. This article discusses some of the requirements of Andhra Pradesh (AP) state to be taken care by the new Tribunal while allocating river water among the riparian states.

River water sharing agreement under implementation

1. Bachavat Tribunal has awarded 800 TMC, 695 TMC and 565 TMC as permanent allotment to AP, Karnataka and MR respectively out of 2060 TMC 75% dependable water available in the river. The 75% dependable water is calculated based on the 78 years water-gauging data measured at Vijayawada after adding water used from upstream river.
2. The water allocation is done based on prevailing usage, ongoing and proposed project wise requirements in the basin states subject to availability of water in the river. All the projects for which water allotment is made are completed and fully utilizing the allotted water.
3. AP is also permitted to utilize the excess water available in the river above the 2060 TMC availability without permanent rights.
4. Every state is permitted to export Krishna river water to other river basins.
5. Under Godavari water allocation agreement, Karnataka and Maharashtra (MR) are allowed by AP to use 21 TMC and 14 TMC respectively from its committed Krishna water allocation. Karnataka and MR are eligible for this additional water when Central Government approves Polavaram Project on Godavari River.
6. All the three riparian states also agreed to part 5 TMC each (total 15 TMC) to Tamil Nadu for Chennai drinking water supply.
7. The break up of water allocation to AP as per Bachawat award is shown in Table-A.

Water requirements considered by National Water Development Agency (NWDA)

Government of India entrusted NWDA to examine feasibility of interlinking peninsular rivers to transfer water from surplus river basins to water deficit river basins. In this article NWDA data given in their web site: <http://nwda.gov.in> is used. NWDA considered the following criteria to quantify the water requirements in river basins.

1. Each sub basin in a river basin area is taken as basis for evaluating water requirements.
2. The culturable or cultivable area available in a river sub basin is considered as criteria for water requirements and allocation.
3. In a water surplus river sub-basin, irrigation water requirement is limited to cater 60% of culturable area. In case the irrigation requirement of existing, ongoing and proposed projects as stated in state master plan is less than 60% of culturable area, 50% of the enhanced water allotted is considered for future medium projects and the remaining 50% under future minor schemes.
4. In a water deficit river sub-basin, irrigation water requirement is calculated by considering minimum 30% of culturable area for irrigation requirement. In case the irrigation area identified under existing, ongoing and proposed projects as stated in state master plan is less than 30% of culturable area, 50% of the enhanced water allotment is considered for future medium projects and the remaining 50% under future minor schemes.

5. Ground water is considered to cater 50% of domestic water consumption. The regeneration flows are considered as 10% from major and medium irrigation projects with annual utilization exceeding 3 TMC. The regeneration flows from domestic and industrial uses are 80% of water met from surface water.
6. Based on data from the year 1951 - 52 to 1983 - 84, NWDA projected the 75% dependable water availability in Krishna River as 2191 TMC whereas 2060TMC availability is considered for water allocation by Bachavat Tribunal earlier. The 50 % dependable water in the river is projected at 2562 TMC. The water availability at various places in the Krishna river basin as per NWDA data is given in Table-A.
7. The details of irrigation water requirements in Krishna and Pennar river basins are given in Table-C & Table-D. Based on the above criteria, the irrigation requirements from Krishna river water by Maharashtra and Karnataka are calculated as 508.42 TMC (excluding 112.43 TMC water diversion to Arabian sea for power generation) and 866.43TMC respectively reducing the water availability to 703.88 TMC (less by 122 TMC) in AP.

Implications of NWDA norms:

1. 60% of the culturable area can be brought under irrigation in any sub basin with the available river water or imported water from other river basins provided feasible projects are identified in the master plan. The water required to irrigate 60% of culturable area in AP is given in Table-E.
2. Most of the future irrigated area identified by NWDA in Krishna, Pennar and other small river basins is falling under minor & medium projects where the reliability of assured water supply is not satisfactory. These irrigated areas need water augmentation from the major rivers to achieve assured water supply.
3. The areas located in western ghat parts of Karnataka and MR do not need surface water irrigation facilities as this area is least drought prone and also receives excess rainfall of the order of 200 cm annually. These areas need to be considered as equal to surface irrigated areas under culturable areas.
4. Presently major lift irrigation projects up to 200 meters lifts have become accepted practice. Most of the river water flow is during monsoon months in the peninsular rivers. At least 60% of required water for irrigation is to be stored in reservoirs to feed canals during the non-monsoon months. Thus the feasibility of any (lift or gravity) irrigation project solely depends on creation of adequate capacity storage reservoirs. Substantial additional water allocation is identified under proposed and additional irrigation in MR and Karnataka. These future projects would not be feasible unless adequate storage capacity is created.
5. In case Karnataka and MR are able to construct adequate additional storage capacity to completely utilize allocated water, AP would also benefit from these additional reservoirs as down stream riparian state. Already 1765 TMC storage capacity is created in the river basin. The flood flows from Karnataka and MR can be moderated by these storage reservoirs to release in to the river uniformly through out the monsoon period. The water available during monsoon months at uniform flows (Jurala, Rajolibanda and Tungabhadra dams) can be pumped to Pumped Storage Scheme (PSS) reservoirs and later used for irrigation

requirements of uplands in Telangana and Rayalaseema regions in AP. (In this context, readers are requested to refer to the article “Godavari River Water Utilization in Andhra Pradesh” <http://jalayagnam.com/?action=articles> for more details). Thus there is better feasibility to create irrigation facilities in uplands with optimum pumping power. Adequate water is available in Godavari River to divert in to Krishna River for its low lands (up to 160 m MSL) irrigation. Thus 90% of the cropped area in the state can be brought under irrigation with the water available from Krishna and Godavari rivers. The various pumping power requirements are projected in Table-A. The total pumping power required is less than 50% of the present power consumption by the agriculture pump sets in the state.

TABLE-B: WATER AVAILABILITY IN KRISHNA RIVER

In Billion Cubic Meters

Project	Almatti	Srisailam	N. Sagar	Pulichintala	Prakasam Barrage
Water Requirements					
Maharashtra					
Irrigation	5.385	14.403	14.403	14.403	14.403
Westward diversion	1.911	3.185	3.185	3.185	3.185
Sub Total	7.296	17.588	17.588	17.588	17.588
Karnataka					
Irrigation	8.524	24.151	24.151	24.151	24.151 / 24.545*
AP					
Irrigation	-	5.005	5.676	11.845	18.000 / 23.339*
Total	15.820	47.138	47.809	53.978	59.739 / 65.472*
Irrigation	13.909	43.953	44.624	50.793	56.554 / 62.287*
Westward diversion	1.911	3.185	3.185	3.185	3.185
Water Availability					
75% dependable water	21.405	57.398	58.423	60.353	62.073
Excess / (Deficit)	5.585	10.260	10.614	6.375	2.334 / (3.399)*
50% dependable water	24.041	66.428	67.346	69.889	72.583
Excess / (Deficit)	8.221	19.290	19.537	15.911	12.884 / 7.111*

* Including export to other river basins.

1. NWDA has projected 2191 TMC (131 TMC more) availability at 75% dependability and 2562 TMC availability at 50% dependability in Krishna river.
2. The water availability data at Bhima dam, Narayanpur dam, Tungabhadra dam, Rajolibanda barrage and Jurala dam is not available from NWDA web site.
3. NWDA projected irrigation water requirement (including export to other river basins) of Karnataka and Maharashtra states are 866.44 TMC and 508.43 TMC respectively to achieve irrigation facilities for one third of culturable area in Krishna basin area of Karnataka and Maharashtra states. Maharashtra is also diverting 112.43 TMC to Arabian Sea for power generation.
4. The regenerated water available from irrigation use is approximately equal to evaporation in reservoirs and net surface water usage for domestic & industries.

Objectives of AP in sharing Krishna river water

1. To achieve maximum assured irrigation facilities from all the available water sources in the state with optimum pumping and construction cost.
2. To secure domestic and industrial water requirements with optimum pumping and construction cost.

3. To protect the committed water allotment out of 2060 TMC total availability by Bachavat Tribunal.
4. To get proportionate allotment depending on the total water availability. Presently only AP as down stream state, is suffering from shortage of water when water availability is less than 2060 TMC.
5. A foolproof method of deciding available water and its consumption by all the states is a compulsory requirement. Otherwise AP being lower riparian state would be at loss during bad monsoon years since the reliable water availability is mainly from Western Ghats located in MR and Karnataka.
6. To achieve floodwater moderation / control while entering in to state territory for maximizing power generation and irrigation benefits.
7. To get other states particularly Karnataka, co-operation in deriving maximum benefits from Jurala project and joint projects Tungabhadra and Rajolibanda dams.

The following requirements are to be considered to protect the AP state interests:

1. 38.83% (800/2060) of available water in the river up to 50% dependability (2562 TMC) is allotted to AP.
2. Karnataka and MR can use 21 and 14 TMC respectively out of the share of AP in lieu of Polavaram project.
3. Each state will spare 5 TMC for meeting Chennai water supply requirement.
4. AP can utilize the surplus water above 2562 TMC without permanent rights. AP can use the floodwater in the existing irrigated area, hydropower generation, to prevent the ingress of salinity and to protect the ecology of estuaries of river Krishna where it is joining the Sea.
5. There shall be Krishna river water usage regulatory commission with judicial powers to monitor and resolve the disputes quickly that arise in sharing the water. This commission will have powers to penalize the errant state in the form of money, electricity, future adjustment of water, etc.
6. Krishna river water usage regulatory commission will also monitor the increase in salinity of river water and the ground water in the Krishna delta area or upstream areas due to enhanced / total utilization of the river water and also direct the states to take remedial steps to contain dissolved salts in acceptable limits.
7. This regulatory commission will also undertake the reservoir simulation studies to implement the possible uniform floodwater release downstream from Koyna, Narayanpur/ Almatti, Bhima, Bhadra, Tungabhadra, etc reservoirs. This would facilitate to maximize power generation and irrigation benefits to the down stream states.
8. This commission will monitor the yearly water availability, yearly usage of water by all states, project wise water usage with more than 1 TMC, carry forward storages maintained in the reservoirs, required storage capacity of new projects, feasibility of new projects with out reducing water availability to existing down stream projects, releasing water from the upstream dams on weekly, daily, monthly basis for effective use of flood waters with the available storage capacity in the basin, installation of water metering stations on canals and rivers for effective measurement etc.
9. All the states including TN shall bear the cost of maintaining regulatory commission in proportion to the water allocation. The states shall also bear the cost of infrastructure needed to facilitate the measurement of available water, water usage on daily basis as per the direction of the commission.
10. The monsoon year (1st April to 31st March next year) should be analyzed in three parts such as pre-flooding, flooding (16th July to 15th October) and post-flooding periods. During Pre-flooding period (generally 1st April to 15th July), good amount of inflows takes place in to the

reservoirs located in Western Ghat areas due to pre monsoon and early monsoon rains. There are many reservoirs (Koyna, Dudhganga, Warna, Dhom, Kanher, Radhnagari, Ghataprabha, Malaprabha, Bhadra, Bhira, Bhatgarh, Vir, Panset, Veer Bhaji Pasekar, Khadakvasla, Pawna, Manikaoh, Andhra lake, Khopili, Dimbhe, etc) located in Western Ghats of MR & Karnataka with substantial storage capacity (nearly 420 TMC). The present practice is to impound all the pre-monsoon period inflows in these reservoirs. After these reservoirs are full, then only substantial inflows in the downstream reservoirs (Almatti, Narayanpur, Bhima and Tungabhadra) take place during the flooding period. Further downstream reservoirs in AP get the flood water after these reservoirs are nearly full. Presently the pre-monsoon inflows are not used effectively by storing in upstream reservoirs beyond their immediate irrigation requirements. If the pre-monsoon inflows are promptly released in to downstream projects, the cropping season can be advanced close to the onset of monsoon under all the projects. Since the 95% to 100% dependability inflows in the reservoirs fed by Western Ghat tributaries are in excess of their water storage capacity, these reservoirs would be overflowing by the end of flooding period. Thus there is no possibility of less water availability for irrigation from these reservoirs. Prompt usage of pre-monsoon inflows in all the projects will contribute to effective flood control, to maximize power generation and to optimum irrigation benefits. Nearly 100 TMC water can made available during pre-monsoon period at Jurala reservoir without any loss of benefits by Karnataka and MR.

11. Every state has full liberty to use the carry forward water storage and other states cannot claim share from this stored water in the subsequent monsoon year
12. Any state or states jointly can divert other river basin water to Krishna River with out sharing this water with other states. There will not be claim of water by non-participating state.
13. No state is prevented to participate and share the benefits and expenditure in augmenting the available river water by cloud seeding and any other future technological developments.
14. Karnataka shall release the shortfall water in to the river from Narayanpur dam such that the water inflow at Jurala dam is 30,000 cusecs for 90 days during every southwest monsoon season. This is to utilize the floodwater for uplands irrigation by pumping constantly available floodwater in to a PSS.
15. Karnataka shall release the shortfall water in to the river from TB dam such that the water available at Rajolibanda barrage is 10,000 cusecs for 90 days during every monsoon season. This is to utilize the floodwater for uplands irrigation by pumping constantly available floodwater in to a PSS.
16. During every monsoon year, the endeavor is to maintain Almatti, Naranpur and Tungabhadra reservoirs full by the time southwest monsoon ends (15th October). At the specific request of AP, if excess water is made available to AP, Karnataka can draw additional water from the AP share of Tungabhadra reservoir storage for its use as per water sharing norms.
17. The flood water release from Narayanpur dam in to the river shall be coordinated with flood forecast in upstream catchments area and the water storage in upstream reservoirs. The floodwater released at Narayanpur dam is to be moderated / controlled not to exceed 80,000 cusecs at Jurala to the extent possible. This will facilitate AP to maximize hydropower generation from the floodwater at Jurala and lower Jurala hydro power stations.
18. Almatti dam or Naryanpur dam would be interconnected with Tungabhadra reservoir to augment the water supply in Tungabhadra reservoir. All the water supplied presently from Tungabhadra reservoir to its left bank canals would be supplied from Almatti dam or Naranpur dam.
19. Karnataka shall permit AP to construct a PSS on the Tungabhadra reservoir with FRL 600 m MSL to supply water to uplands of AP. Karnataka would also permit the construction of canals in Karnataka to reach AP area

20. Karnataka shall allow raising the Jurala dam FRL to its design capacity.
21. Karnataka shall agree to supply / feed canals to irrigate the uplands to the right bank of Krishna River up to Jurala reservoir in Mahboobnagar district.
22. Karnataka shall agree to supply / feed canals to irrigate the uplands to the left bank of Tungadhadra river in Mahboobnagar district.
23. MR shall not divert any water to Arabian Sea for power generation when the total water availability is less than 2191 TMC. However MR can use the existing Koyna and Tata hydropower stations in reversible turbine mode to generate peaking power without any water consumption. These power stations are more than 35 years old, which are fully depreciated assets. Thus the water availability in the river is enhanced by 112.43 TMC (minimum) for irrigation use. It is not reasonable that water is solely utilized for power generation, while down stream states are contemplating lift irrigation projects with high pumping heads (up to 200 meters).
24. The water availability in west flowing rivers in Karnataka is nearly 2000 TMC, which is 57% of total water yield in the state. All the additional water requirements in Krishna basin of Karnataka would be met if 25% of this reliable water were diverted to adjoining Krishna basin. There are many sites / existing reservoirs located on medium rivers in Karnataka part of Western Ghats from where water can be pumped in to adjoining Krishna basin with moderate lifts (less than 100 meters). To meet the additional irrigation water requirement in Krishna and Tungabhadra basins of Karnataka, the state need to augment water availability in Krishna basin by transferring from westward flowing rivers at the cost of hydropower generation.
25. Karnataka to build / develop a run off hydro power station in the down stream of Narayanapur dam to harness the 120 meters available head. This hydro station may also be provided with reversible pumping mode facility. This would facilitate better utilization of river water for power generation and further development of irrigation downstream.
26. AP needs to transfer Godavari river water by pumping in to adjoining Krishna basin for its additional irrigation requirements. AP would be loosing hydropower generation in the existing/ongoing hydroelectric stations at Nagarjuna Sagar, Srisailam, Jurala, Pulichintala by using Godavari water in place of Krishna water.
27. There shall be fresh agreement under “Godavari River Water Disputes Agreement” by all the three states (Maharashtra, Karnataka & AP) to ensure agreed quantity of 75% dependable water at Singoor, Nizamsagar & Sriramsagar dams in AP. Presently upstream states are developing medium & major irrigation facilities in such a way that expected 75% dependable water availability is not possible at these dams. There shall be proportionate sharing of available Godavari River water by these states up to Sriramsagar dam in AP. The Godavari River basin up to Sriramsagar dam shall be brought under the purview of Krishna River water usage regulatory commission.

Conclusion:

There is abundant water availability in AP, Karnataka and MR if the available water in adjoining river basins such as Godavari in AP and west flowing medium rivers in Karnataka are harnessed for irrigation requirements. Presently Karnataka and MR are using the available surface water resources in Western Ghats (Krishna in MR and west flowing medium rivers in Karnataka) for power generation. AP can meet most of its additional irrigation water requirements by harnessing water from Godavari River. Similarly, Karnataka can meet most of its additional irrigation water requirements in Krishna basin by transferring from west flowing medium rivers. MR also can divert the water usage from hydropower generation to its additional irrigation requirements by stopping transfer of Krishna river water to Arabian Sea / west flowing rivers.

When a riparian state wants to create additional irrigation potential, it is required to redefine its priorities in using the available water resources from hydropower generation to irrigation. Each state would be losing partly its hydropower generation in existing hydropower stations and also incurring additional pumping power consumption by transferring water from adjoining rivers to Krishna basin. There is sufficient water in the Krishna river riparian states for meeting all the requirements fully. Each state shall be allowed to create additional irrigation potential depending on the technical feasibility of interlinking the rivers. Instead of trying to maximize its allotment from the available Krishna river basin water, every state needs to cooperate in utilizing available water resources infrastructure to maximize benefits such as flood control and irrigation. A perfect river water sharing accord could be achieved where the state boundaries would not deprive water to any area for its requirements. Only technical and economical factors can be the reasons for not creating irrigation facility.

References:

- “Blue Print for Godavari River Water Utilization in Andhra Pradesh” by N. Sasidhar. Refer <http://groups.google.co.in/group/irrigation-power-energy?hl=en>
- Are Pumped Storage Schemes beneficial for harnessing the Krishna River Water Further? By N. Sasidhar. Refer <http://groups.google.co.in/group/irrigation-power-energy?hl=en>
- National Water Development Agency (NWDA) web site <http://nwda.gov.in>
- “Process to maximize monsoon benefits by cloud-suppression” by N. Sasidhar. Refer <http://groups.google.co.in/group/irrigation-power-energy?hl=en>.
- “Optimisation of power generation from Srisaillam Hydroelectric Power Station” by N. Sasidhar. Refer <http://groups.google.co.in/group/irrigation-power-energy?hl=en>.
- “India’s water wealth” by Prof. K.L. Rao.
- Google earth web site for three dimensional geographical details of river basins.

The first revision of this paper is made available in May 2007

TABLE-A: WATER USAGE FROM KRISHNA AND GODAVARI RIVERS

Project Name	75 % dependable water allocation from Krishna river (TMC)		Requirement at upstream of Srisailam dam (TMC)	From Godavari river (TMC)	50% dependable water allocation from Krishna River (TMC)	Pumping Head (Meters)	Pumping capacity (MW)	Requirement in 100 years. (%)	Average pumping power consumption (Million Units)	Remarks
	Existing	Proposed								
Krishna Delta	180.2	20		160.2			-			
Nagarjuna Sagar (NS) canals	281	14.05		155.95	69.85	75 85	499 253 (-)	70 50	754 273 (-)	Existing PSS
Assistance to NS left bank canal from Edira WPP canal				34			-		-	
NS tail pond right canal				77			-		-	
Srisailam evaporation	33	0		-						
Jurala	17.84	17.84	17.84				-			
KC canal	39.9	39.9	39.9							
TB LLC	29.5	29.5	29.5	-		40	50	100	109	New PSS
TB HLC	32.5	32.5	32.5	-			-		-	
Rajolibanda	15.9	15.9	15.9				-		-	
Medium & minor	170.16	170.16	39.18	-			-		-	

TABLE-A Contd

Project Name	75 % dependable water allocation from Krishna river (TMC)		Requirement at upstream of Srisailem dam (TMC)	From Godavari river (TMC)	50% dependable water allocation from Krishna River (TMC)	Pumping Head (Meters)	Pumping capacity (MW)	Requirement in 100 years. (%)	Average pumping power consumption (Million Units)	Remarks
	Existing	Proposed								
Chennai water supply by Karnataka & MR	10	0	0	15	15	75 85	48 54 (-)	50 50	52 59 (-)	Existing PSS
Additional share by Karnataka & MR	-35	-								Polavaram share
Velugodu		40	40							
Hindri Neeva		10	10							20 shifted
Galeru-Nagari		10	10							20 shifted
Telugu Ganga		10	10	17.6	17.60	75 85	56 64 (-)	0.5 0.5	61 69 (-)	Existing PSS
SLBC		30	30							
TB LLC (Stage II)		20	20							
Jurala LB (lift) with PSS		145.25	145.25		19.58	180	1265	100 50	2408 162	New PSS
Jurala RB (lift)		20	20			40	34	100	74	New PSS

TABLE-A Contd

Project Name	75 % dependable water allocation from Krishna river (TMC)		Requirement at upstream of Srisailam dam (TMC)	From Godavari river (TMC)	50% dependable water allocation from Krishna river (TMC)	Pumping Head (Meters)	Pumping capacity (MW)	Requirement in 100 years. (%)	Average pumping power consumption (Million Units)	Remarks
	Existing	Proposed								
TB HLC -II		47	47			-	-			Almatti to Pennar link
TB Dam PSS		144.03	144.03		21.97	130	920	100 50	1724 131	New PSS
Total availability	775									at 2060 TMC
Possible allotment	825.87	816.13 (-9.74)	650.93		144			at 2191 TMC 75% availability at 2562 TMC 50% availability		
S RBC	19	19								Regeneration flows
NS RBC (Stage II)				50		75	160	85	294	
Pulichintala RBC				50		-				
Between Godavari & Krishna from Edira by WPP canal				27.45						
Between Godavari & Krishna from Edira by PSS				109.7		140	655	100	1414	New PSS

TABLE-A Contd

Project Name	75 % dependable water allocation from Krishna river (TMC)		Requirement at upstream of Srisaïlam dam (TMC)	From Godavari river (TMC)	50% dependable water allocation from Krishna river (TMC)	Pumping Head (Meters)	Pumping capacity (MW)	Requirement in 100 years. (%)	Average pumping power consumption (Million Units)	Remarks
	Existing	Proposed								
Polavaram gravity & WPP canals				247.39		-	-			
Dowlaiswaram Barrage				280.84		-	-			
Adilabad Dt. PSS				141.2		60	361	100	780	New PSS
Edira gravity canal				19.31		-	-			
Total				1395.44			3445		7562	3445 MW new PSS

Notes:

- (-) The 50% dependable water is used for power generation in Srisaïlam hydropower station before using for irrigation from Nagarjuna Sagar reservoir.
- The possible water allotment to AP is calculated as per Scheme B proposed in Bachawat Award for sharing excess / deficit water in proportion to 2060 TMC availability.
- NWDA has projected 2191 TMC (131 TMC more) availability at 75% dependability and 2562 TMC availability at 50% dependability in Krishna river.
- The water requirement of Karnataka and Maharashtra states are projected as 866.44 and 508.43 (excluding 112.43 TMC westward diversions for power generation) respectively. This is to achieve irrigation facilities for one third of cultivable area in Krishna basin area of Karnataka and Maharashtra states as shown in Table-C.
- The regenerated water available from irrigation use is approximately equal to evaporation in reservoirs, net surface water usage for domestic and industries.

Table-C: Surface water requirement projected by NWDA for irrigation in Krishna basin.

State	Project category	River basin area	Culturable area		Annual Irrigation		Annual utilization (million m ³)		
		(100 Ha)	(Ha)	% of basin area	(Ha)	% of Culturable area	In basin	Import	Total
Maharashtra	Existing				441320		3917	-	3917
	Ongoing				646974		6007	-	6007
	Proposed				507713		3219	-	3219
	Additional area				209499		1260	-	1260
	Sub- Total	69398	5686072	81.93	1805506	33.52	14403	-	14403
Karnataka	Existing				1363649		12043	-	12043
	Ongoing				946962		7032	-	7032
	Proposed				497360		3921	-	3921
	Additional area				153645		1155	-	1155
	Sub- Total	113419	8710309	76.80	2961616	34.00	24151	-	24151
Andhra Pradesh	Existing				1914609		14419	1692	16.111
	Ongoing				253956		1916	-	1916
	Proposed				132273		1136	-	1136
	Additional area				182616		1360	-	1360
	Sub- Total	76131	5257000	69.05	2483455	47.24	18831	1692	20523
Total	Existing				3719579		23393	-	23393
	Ongoing				1847892		14955	-	14955
	Proposed				1137346		8276	-	8276
	Additional area				545760		3775	-	3775
	Grand Total	258948	19653381	75.90	7250577	36.89	57385	1692	59077

Table-D: Surface water requirement projected by NWD A for irrigation in Pennar basin at Somasila dam.

State	Project category	River basin area	Culturable area		Annual Irrigation		Annual utilization (million m ³)		
		(100 Ha)	(Ha)	% of basin area	(Ha)	% of Culturable area	In basin	Import	Total
Karnataka	Existing				28842		201	-	201
	Ongoing				21414		152	-	152
	Proposed				40303		33	394	427
	Additional area				16647		160	-	160
	Sub- Total		6626	509000	76.82	107206	21.06	546	394
Andhra Pradesh	Existing				314561		1392	1379	2771
	Ongoing				275304		399	1615	2014
	Proposed				85435		852	-	852
	Additional area				134473		1291	-	1291
	Sub- Total		48587	3028000	62.32	809773	26.74	3934	2994
Total	Existing				343403		1593	1379	2972
	Ongoing				296718		551	1615	2166
	Proposed				125738		885	394	1279
	Additional area				151120		1451	-	1451
	Grand Total		55213	3537000	64.06	916979	25.93	4480	3388

Table-E: Water availability and requirements in Andhra Pradesh

Basins	River basin approximate area (100 Ha)	Culturable area		Water requirement (million m ³) for 60% of culturable area irrigation.		
		(Ha)	% of basin area	In basin useful water availability	Import	Total
Medium & Minor rivers north of Godavari	30534	1716011	56.20	5134	3103	8237
Godavari river	74449	4039000	54.25	49497	(28110)	21387
Medium & Minor rivers between Godavari & Krishna	11500	760000	66.09	700	2948	3648
Krishna river	76131	5257000	69.09	23120	2114	25234
Medium & Minor rivers between Krishna & Pennar	21057	1623000	77.08	1500	6290	7790
Pennar river	48587	3028000	62.32	3934	10600	14534
Medium & Minor rivers south of Pennar river	12810	777000	60.65	1100	2630	3730
Water supply to Chennai	-	-	-	-	425	425
Total	275068	17200011	62.53	84985		84985
() export to other basins				Irrigation water requirement is 8000 m ³ per hectare		