

Chapter 8

Water and Irrigation Planning

8.1 General

The Godavari (Inchampalli) – Krishna (Nagarjunasagar) link canal off-takes from the foreshore of the proposed Inchampalli reservoir by an approach channel of about 1.300 km long. An initial 35.000 m static lift (stage – I) is proposed at the end of the approach channel i.e. from where the actual link canal commences at RD 0.000 km with full supply level 141.000 m at the head. Three other lifts involved at RDs 18.000, 26.500 and 60.500 kms are 38.000, 23.000 and 11.000 mts respectively to divert 16426 Mm³ of water, annually, through the link canal.

The link canal envisages to provide irrigation to enroute areas in Warangal plateau, Nalgonda and Khammam districts of Andhra Pradesh under the Kakatiya Canal Stage – II and a part of upland areas in Nalgonda district under the Srisaillam Left Bank Canal to meet the deficit in Krishna basin and for further transfer of water to the water short Pennar , Cauvery and Vaigai basins.

8.2 Water Planning

The total divertable water of 16426 Mm³ from the Inchampalli reservoir through the link canal is proposed to be utilized as follows:

		Unit: Mm ³
1.	Irrigation requirement of Kakatiya Canal Stage – II	684
2.	Irrigation requirement of Srisaillam Left Bank Canal	743
3.	En route transmission losses	562
4.	Domestic & Industrial water requirement	237
5.	Further transfer to Nagarjunasagar reservoir	14200
	Total	16426

The details of computation of the above demands are discussed in the following sections:

8.3 Command Area under the Kakatiya Canal Stage – II (RD 284.000 to 346.000 Km of Kakatiya Canal of Sri Ram Sagar Project Stage – II)

The Govt. of Andhra Pradesh has proposed to provide irrigation to an extent of 178055 ha in the drought prone Warangal Plateau (48842 ha), Nalgonda (102991 ha) and Khammam (26222 ha) districts by utilizing 684 Mm³ of water through the Kakatiya Canal Stage – II of Sri Ram Sagar Project Stage – II (RD 284.000 to 346.000 km of Kakatiya Canal).

The Godavari – basin upto Sri Ram Sagar Project would be in water deficit at ultimate development scenario which may lead to shortage of water to the command area of Sri Ram Sagar Project. As such, the above command is proposed to be taken over by the Inchampalli – Nagarjunasagar link canal enroute. To facilitate this proposal, a Lead Canal is proposed for transferring 218 Mm³ of water (32% of the requirement of Kakatiya Canal Stage – II) from the link canal to the Kakatiya Canal in order to provide irrigation to an extent of 56860 ha (Warangal district: 28692 ha, Nalgonda district: 28168 ha) which lies to the right of the link canal using its own distributary system as planned by the Irrigation Department, Govt. of Andhra Pradesh. It off-takes from RD 97.500 km of the link canal where its FSL is 204.900 m. After traversing a distance of 21.850 km, it outfalls at RD 260.700 km of the Kakatiya Canal (FSL of the Kakatiya Canal is 256.145 m) involving a lift of around 55.00 m. The FSL of Lead Canal at its out-fall point is 256.527 m. This lifting is proposed in two stages to suit the topography along the canal alignment, comprising of 40.000 m at its off-take and another 15.00 m at RD 21.000 km. The remaining 466 Mm³ of water required for the balance command area of 121195 ha which lies to the left of the link canal pertaining to the Kakatiya Canal Stage – II (Warangal district: 20150 ha, Nalgonda district: 74823 ha, Khammam district: 26222 ha) would be provided directly from the link canal partly by lift and partly by gravity. District-wise command area benefited under Kakatiya Canal Stage – II is given in Table 8.1.

Table 8.1
District-wise Command Area under Kakatiya Canal Stage-II

Sl.No	District	Command area (ha)		
		On right side of the link canal	On left side of the link canal	Total
1	Warangal	28692	20150	48842
2	Nalgonda	28168	74823	102991
3	Khammam	-	26222	26222
	Total	56860	121195	178055

The link canal while passing through the enroute command area is crossing three major branch canals of the Kakatiya Canal. The particulars of the branch canals are given in Table 8.2.

Table 8.2
Particulars of the Branch Canals

Sl. No	Name of branch canal, ayacut & length	RD at off-take at Kakatiya canal (km)	Length upto its crossing with link (km)	Particulars of link canal at the crossing		
				RD (km)	FSL (m)	NSL (m)
1	Thallampadu (52409ha, 71km)	310.020	18.600	162.700	201.697	203.527
2	Chinna Nemulla (22700 ha, 39 km)	334.507	17.400	177.700	200.570	209.017
3	Viblapuram (65969 ha, 72 km)	345.932	19.300	192.700	199.532	221.342

Hence, by utilising the above branch canals and other distributary system as planned by the Irrigation Department, Govt. of A.P., the command area which lies to the right and left side of the link canal can be irrigated as described above. The designed cropping pattern and climatological delta are considered to compute the month-wise gross irrigation requirements.

8.4 Command Area under Srisaillam Left Bank Canal (SLBC)

Govt. of Andhra Pradesh has proposed to provide irrigation to 109250 ha of endemically drought prone upland areas in Nalgonda district by lifting 743 Mm³ of water from the Nagarjunasagar reservoir through Alimineti Madhava Reddy Lift Irrigation Scheme (AMRLIS). This area has originally been proposed under Srisaillam Left Bank Canal. About 72 MW of power is needed to lift the water to a static head of about 92.00 m to command the area. The water balance status of the Krishna basin upto Nagarjunasagar Dam indicates water deficit of 1525 Mm³ at 75% dependability at the ultimate stage of development and the deficit is proposed to be met from the link canal demand. In order to economise and effective use, a part of the Nagarjunasagar command area enroute the link canal is proposed to be taken over by the link command as the proposed Inchampalli – Nagarjunasagar link canal is passing through this command area. In the present proposal, it is assessed that out of 109250 ha, an extent of 51304 ha that lies to the left side of the proposed link canal spreading between the link canal and the existing NSLB canal could be irrigated enroute directly by the link canal by utilising 349 Mm³ of water. The canal distributor network system of the AMRLIS as planned by the Irrigation Department and being executed can be utilized without major modifications to irrigate this command area. The balance requirement of 394 Mm³ of water will be lifted from the Nagarjunasagar reservoir utilizing the existing pumping system to cater to the irrigation needs of the balance ayacut of 57946 ha that has been proposed under AMRLIS high level canal. Because of this present proposal, the power needed to lift the water to bring the ayacut under irrigation can be reduced by about 45%. The designed cropping pattern and climatological delta were considered to compute the month-wise gross irrigation requirements.

The district-wise area benefitted under the link canal is given in Table 8.3.

Table 8.3
District-wise Area Benefitted under the Link Canal

S.No.	District	Ayacut benefitted (ha)
1	Warangal	48842
2	Nalgonda	212241
3	Khammam	26222
	Total	287305

8.5 Transmission Losses

The transmission or conveyance losses in the link canal during its course from the Inchampalli reservoir to Nagarjunasagar reservoir have been estimated month-wise considering 0.60 cumec per million square metre of wetted area of the canal as per the Bureau of Indian Standards code and the annual losses on this account considering 300 days of canal operation work out to 562 Mm³.

8.5 Existing Irrigation in the Proposed Command Area

The link during its course passes through Godavari and Krishna basin areas covered by Karimnagar, Warangal and Nalgonda districts of Andhra Pradesh where the existing irrigation facilities are meagre. The Govt. of Andhra Pradesh has proposed to provide irrigation to an ayacut of 178055 ha in the drought prone Warangal plateau, Nalgonda and Khammam districts by the Kakatiya canal stage – II of SRSP Stage – II and an ayacut of 109250 ha of the upland areas in Nalgonda district by Alimineti Madhava Reddy Lift Irrigation Scheme (AMRLIS). The ayacut proposed as above by the State Govt. of A.P. is planned to be taken over enroute for irrigation by the link canal partly by lift and partly by gravity from the water diverted through the link canal. The gross command area which could be provided with en route irrigation as mentioned above is to be 503746 ha and that of the total ayacut is to be 287305 ha.

8.6.1 Existing Irrigation Facilities in the Command Area

The existing sources of irrigation are mainly wells and tanks, indicating that the agriculture in the area is mainly rain-fed. The existing irrigation in the proposed command is about 43% of the gross cropped area. Out of the total area presently being irrigated is 80% by wells, 12% by tanks and the rest is by other sources. There is no existing irrigation by canals

in the proposed command area. The canal systems planned by the irrigation department, Govt. of A.P. Viz. the Kakatiya Canal Stage – II of Sri Ram Sagar Project Stage – II and the High & Low Level Canals pertain to AMRLIS (Srisaïlam Left Bank Canal) are under progress in the proposed command area. The source-wise irrigation particulars in the proposed command area during the year 1997-98 as assessed from mandal-wise statistics are presented in Table 8.4.

Table 8.4
Source-wise Irrigation in the Proposed Command Area during
the Year 1997-98

Unit: ha

Sl. No	District	Area irrigated by					Total
		Canals	Tanks	Wells	Lift	Other Sources	
1	Warangal						
	Kharif	0	3707	16221	0	0	19928
	Rabi	0	1454	10588	0	0	12042
	Annual	0	5161	26809	0	0	31970
2	Nalgonda						
	Kharif	0	4260	31121	5050	0	40431
	Rabi	0	4837	41597	5934	73	52441
	Annual	0	9097	72718	10984	73	92872
3	Khammam						
	Kharif	0	2203	9303	563	71	12140
	Rabi	0	241	2566	64	0	2871
	Annual	0	2444	11869	627	71	15011
	Total						
	Kharif	0	10170	56645	5613	71	72499
	Rabi	0	6532	54751	5998	73	67354
	Annual	0	16702	111396	11611	144	139853

8.6.2 Current Agriculture Scenario and Existing Cropping Pattern

The total area available for cultivation in the proposed command area as planned by the irrigation department, Govt. of A.P. is about 411872 ha comprising of 255264 ha under the Kakatiya Canal Stage – II and 156608 ha under the Srisaïlam Left Bank Canal. The net sown area is 253679 ha, of which 69093 ha is cultivated during both Kharif and Rabi seasons, 131506 ha exclusively in Kharif and 122173 ha in Rabi season.

The principal crops grown in the area are paddy, bajra, maize, red gram, groundnut, cotton and chillies during the Kharif season and paddy, jowar, maize, groundnut and chillies during the Rabi season. Paddy, grams, groundnut and cotton are the main crops being cultivated in the proposed command.

8.7 Proposed Irrigation in the Command Area

8.7.1 Soil and Land Irrigability Classification

The proposed command area under the Kakatiya Canal Stage – II of SRSP Stage-II was assessed for irrigability classification by NRSA making use of the thematic maps generated by them from the satellite data of the area. The land irrigability classification details of the proposed command area under the Kakatiya Canal Stage – II based on the characteristics of both soil and lands available in the area as per the report prepared by NRSA are as follows:

- 1) Out of the geographical area covering the proposed command area in the parts of Warangal, Nalgonda and Khammam districts of A.P., 58.52% has been categorised under the land irrigability class 2, 32.67% is accounted under the class 3 and small portions of the areas are covered under the class 4 (3.37%), class 5 (4.32%) and class 6 (1.12%).
- 2) Class 2 indicates the area of land with moderate limitations for sustained use under irrigation whereas class 3 indicates area of land with moderately severe limitations. Class 4 shows the area of land with severe to very severe limitations for sustained use under irrigation. Class 5 and 6 denote the areas not suitable for sustained use under irrigation temporary or otherwise i.e. not suitable for irrigation.
- 3) The total GCA in the proposed command area of the Kakatiya Canal Stage – II is 314308 ha. Out of this, 255264 ha of the command area is considered to be the possible command area which could be provided with irrigation. After reducing the areas occupied by forests, scrubs and barren land, the net ayacut available for irrigation is 178055 ha.

The gross command area under Srisaillam Left Bank Canal is 189438 ha and the cultivable command area is 156608 ha. The net ayacut available

for irrigation is 109250 ha. The predominant soils in the area are Red soils. Under this group, loamy sands, sandy loams, sandy clay, silky soils are covered. These soils are well suited for irrigation.

8.7.2 Layout of Branch Canals / Distributaries and Their Commands

The proposed link canal takes over the command areas under the Kakatiya Canal Stage – II and the Srisaillam Left Bank Canal whose distribution net works are under various stages of completion. Thus it is proposed to utilise the distribution system as planned and being executed by the Irrigation department, Govt. of A.P.

It is planned to divert about 218 Mm³ of water to the Kakatiya Canal Stage – II through a Lead Canal and the remaining 466 Mm³ of water will be diverted directly from the link canal in order to irrigate the entire ayacut of Kakatiya Canal Stage – II by utilising its own canal network system. Mainly, there are three branch canals, namely (i) Thallampadu (ii) Chinna Nemulla and (iii) Viblapuram which covers the major portion of the ayacut under the Kakatiya Canal Stage – II. The branch-wise net irrigable areas are given in Table 8.5.

Table 8.5
Branch Canals with Their Irrigable Areas in the
Command of Kakatiya Canal Stage – II

Sl.No.	Name of the Branch canal	Ayacut (ha)
1	Thallampadu	52409
2.	Chinna Nemulla	22700
3.	Viblapuram	65969
4.	Other small branch canals	36977
	Total:	178055

As the link canal passes through the command area of the Srisaillam Left Bank Canal, it is planned to provide enroute irrigation to the ayacut between the link canal and the existing NSLBC by utilising 349 Mm³ of water. The balance requirement of 394 Mm³ of water will be lifted from the Nagarjunasagar reservoir to provide irrigation facility to the remaining area under Alimineti Madhava Reddy Lift Irrigation Scheme (SLBC). This entire area under High and Low Level canals of AMRLIS could be irrigated by utilising the branch canal / distributary system.

8.7.3 Suggested Cropping Pattern

The cropping pattern suggested by the Irrigation & CAD, Govt. of A.P. has been adopted without any changes for the proposed command area under the link canal. The intensity of irrigation is considered as 88% and 70% for Kakatiya Canal and SLBC respectively. The proposed cropping patterns in the command areas enroute the link canal under the Kakatiya Canal Stage – II of the Sri Ram Sagar Project Stage – II and the Srisailam Left Bank Canal are given in Tables 8.6 and 8.7 respectively.

**Table 8.6
Proposed Cropping Pattern for Irrigation Under the
Kakatiya Canal Stage – II of SRSP Stage – II**

	Crops	Percentage of Ayacut
A	Kharif	
	Maize	15
	Groundnut	18
	Jowar	28
	Pulses	17
B	Rabi	
	Ground nut	4
C	Two seasonal	
	Chillies	10
	Cotton	8
	Total	100

**Table 8.7
Proposed Cropping Pattern for Irrigation Under the
Srisailam Left Bank Canal (SLBC)**

	Crops	Percentage of Ayacut
A	Kharif	
	Cotton	10
	Chillies	30
	Groundnut	15
B	Rabi	
	Ground nut	30
	Pulses	15
	Total	100

8.7.4 Crop Water Requirement

The crop water requirement has been computed using climatological approach by the Irrigation department, Govt. of A.P. The month-wise gross irrigation requirement based on climatological approach and the net and gross water requirements for the proposed crops under the Kakatiya Canal Stage – II and the Srisaillam Left Bank Canal are computed. The annual water requirement for enroute irrigation is estimated to be 684 Mm³ and 743 Mm³ for the ayacut proposed under the Kakatiya Canal Stage - II and Srisaillam Left Bank Canal respectively. Thus, the total crop water requirement of the proposed command area under the link canal works out to 1427 Mm³.

8.8 Domestic and Industrial Requirements

The requirement of water for domestic consumption in the rural and urban areas and for livestock has been computed by projecting the rural and urban human population and livestock of the proposed command area to 2050 AD by considering the per capita daily requirement of 70, 200 and 50 litres for the rural, urban and livestock population respectively. Suryapet, Khammam (R), Nalgonda and Peddavoore have been considered under urban areas in the proposed command area. There are no towns situated outside the command area within a distance of 20 km on either side of the canal alignment.

The rural and urban population of the command area for the year 2001 have been estimated on proportionate area basis from the mandal-wise census data of 2001. The total population of the command area in 2001 was 13.51 lakh and has been projected to 2050 AD using compound growth rates as suggested by UNO in their 1994 publication. Out of the total projected population, 60.7% is taken as urban population and the remaining as rural population.

The total livestock in the command area as estimated on proportionate area basis from the census data of 2001 is 7.01 lakh and it was projected to 2050 AD as 10.56 lakh.

Water requirement for the entire urban and 50% of the rural population is proposed to be met from the surface water resources and is assessed as 104 Mm³.

In the absence of relevant data to estimate the industrial water needs, it has been assumed to be the same as that of the domestic water requirement, i.e. total of urban, rural and livestock requirements which works out to 133 Mm³. Thus, the total domestic and industrial water requirements of the enroute area to be supplied from the Inchampalli – Nagarjunasagar link canal is estimated to be 237 Mm³.

The provision for drinking water as planned by the Irrigation & CAD, Govt. of A.P. in the command areas of Kakatiya canal stage – II and Srisailem Left Bank Canal are as follows:

A)	Kakatiya Canal Stage – II	
i)	Provision for drinking water @ 1% of irrigation requirement:	6.84 Mm ³
B)	Srisailem Left Bank Canal	
i)	Water supply to Nalgonda town	70.79 Mm ³
ii)	Water supply to 212 villages in the command area and 220 villages proposed under NAP III	4.25 Mm ³
iii)	To habitation under Bibinagar project	32.00 Mm ³
	Total	113.88 Mm ³
		Say 114.00 Mm ³

Hence, the provision made for domestic and industrial water requirement to a tune of 237 Mm³ as per the NWDA guidelines will fully meet the requirements as planned by the Govt. of Andhra Pradesh.

8.9 Transfer to the Nagarjunasagar Reservoir

In addition to meeting the enroute irrigation, domestic and industrial water requirements, the link canal is proposed to transfer ultimately 14200 Mm³ of water to the Nagarjunasagar reservoir. As per the water balance study carried out for the Krishna basin upto Nagarjunasagar dam site (Technical study No WB 139), there will be a surface water deficit of 1525 Mm³ at 75% dependability. In the water balance study of the Godavari basin between Sriramsagar project and Inchampalli Dam site (Technical study No. 99), it has been observed that there will be a surplus surface water of 20327 Mm³ at 75% dependability at Inchampalli dam site after considering all the upstream utilisations and the requirements of the Inchampalli project. Thus, the total surplus water

available at Inchampalli project is 20947 Mm³ which includes 620 Mm³ as required for Inchampalli LBC (150 Mm³) and RBC (470 Mm³).

The annual demands to be met from the surplus waters available at Inchampalli dam site are given in Table 8.8.

Table 8.8
Annual Demands to be met from the Surplus Water
Available at Inchampalli Dam Site

S.No.	Particulars	Annual Utilisation (Mm ³)
1.	Inchampalli LBC & RBC command area	620
2.	Part of NSLBC command area upto Tammileru	1382
3.	Command area under the extension of NSLBC beyond Tammileru	746
4.	Part of NSRBC command area by pulichintala RBC	1623
5.	Transmission losses through I-P link canal	150
6.	Proposed diversion through I-N link canal including transmission losses	16426
	Total	20947

Thus, the requirement to the extent of 3901 Mm³ of surface water for irrigating the command area in the Krishna basin (under the Nagarjuna sagar project) which includes 150 Mm³ towards transmission losses can be met with the diverted water of the Godavari basin. Due to this, Krishna waters can be conserved in the catchment above the Nagarjunasagar reservoir in the water short Krishna basin for further use.

In addition to the above provision at Inchampalli dam site, the Inchampalli – Nagarjunasagar link canal while transferring a quantum of 14200 Mm³ of water into the Nagarjunasagar reservoir for further transfer to the water short Pennar and Cauvery basins, envisages to meet enroute irrigation, domestic and industrial needs.

The monthly distribution of the possible diversions of water from Inchampalli to Nagarjunasagar through the link canal has been decided duly considering simulation studies for the Inchampalli reservoir. With

the monthly diversion pattern so derived and by transfer of water to the Nagarjunasagar reservoir through the Inchampalli – Nagarjunasagar link, it could be expected that all the demands as planned under Kakatiya canal State – II and Srisaillam Left Bank Canal would be met with the required rate of success. Finally a net quantity of 14200 Mm³ water will be transferred to Nagarjunasagar reservoir in order to meet the onward requirements of water short Pennar and Cauvery basins.

8.10 Month-wise Distribution Pattern of Water for Various Demands from Inchampalli – Nagarjunasagar Link

The month-wise distribution pattern of various demands from the Inchampalli – Nagarjunasagar link is shown in Table 8.9.

Table 8.9
Month-wise Distribution of Water for Various Demands From the Link

Unit: Mm³

Month	En route Irrigation		Diversion to N.S. reservoir	Domestic & industrial needs	Transmission losses	Grand total
	Kakatiya canal St-II	Srisaillam LBC				
June	61	-	-	18	3	82
July	74	27	2318	18	86	2523
Aug.	124	75	2344	18	92	2653
Sept.	114	113	2232	18	90	2567
Oct.	136	173	2232	18	94	2653
Nov.	98	125	2242	18	84	2567
Dec.	47	150	759	18	28	1002
Jan.	20	80	394	18	15	527
Feb.	10	-	545	18	22	595
Mar.	-	-	678	25	29	732
Apr.	-	-	456	25	18	499
May	-	-	-	25	1	26
Total	684	743	14200	237	562	16426