Chapter 5
Water Resources and Hydrology

5.1 General

Planning for water resources development in a basin requires careful assessment of the available water resources and reasonable needs of the basin in foreseeable future for various purposes such as drinking, irrigation, hydro-power, industries, navigation etc. Hydrological studies are carried out to assess the available quantity of water in a given basin. This chapter deals with the assessment of water balance in the Godavari basin upto the Inchampalli dam site, in the basins lying enroute the link alignment, in the Krishna basin upto the Nagarjunasagar dam site and simulation study of Inchampalli reservoir.

5.2 Hydrological Analysis

NWDA has prepared water balance study reports at Inchampalli dam site on river Godavari, Nagarjunasagar dam site on river Krishna and of the basins lying en route the link alignment. The methodology adopted by NWDA for computing the water balance of a sub-basin is discussed in the following paragraphs.

5.2.1 Surface Water Availability

Observed flow data at the G&D site and the rainfall observed at various raingauge stations in and around the catchment of a sub-basin are collected. Year-wise upstream utilisations are added to the observed flows to get virgin yields. Weighted rainfall for the catchment upto the G&D site and for the whole sub-basin are worked out. Using these virgin flows and weighted rainfall upto the G&D site, a rainfall - runoff relationship (linear/non-linear) is developed by statistical methods. Using the best-fit equation and weighted rainfall for the entire sub-basin, monsoon yields are computed. To the monsoon yields, non-monsoon yields are added for arriving at annual gross yields for the entire sub-basin. The annual gross yields thus arrived at are arranged in descending order, from which 50% and 75% dependable annual gross yields are obtained. The overall surface

water available in a sub-basin is arrived at by summing up the yield (at 50% and 75% dependabilities separately), and imports and by deducting the exports if any, from the sub-basin.

5.2.2 Water Requirement

The requirements of water at the ultimate stage for various uses viz. irrigation, domestic, industrial and hydro-power are worked out as follows:

a) Irrigation Needs: The requirements for irrigation are worked out for all the existing, ongoing and proposed major, medium and minor projects in a sub-basin. For this purpose, all the projects planned by the states as per their Master Plans are considered. The designed annual utilisation is considered for the existing and ongoing projects. The requirements for future projects are determined by adopting intensities of irrigation as 150%, 125% and 100% for major, medium and minor projects respectively. For assessing the crop water requirements by climatological approach, the potential evapotranspiration values for various stations as given in the IMD scientific report No.136 (1971) are adopted. In the case of a deficit basin, if the ultimate annual irrigation considering all the existing, ongoing and future major, medium and minor projects works out to less than 30% of the maximum culturable area of the sub-basin, the requirements are calculated by increasing the annual irrigation to 30% of the maximum culturable area of the sub-basin. And in the case of a surplus basin, the annual irrigation at the ultimate stage is increased to 60% of the maximum culturable area. 50% of such increased annual irrigation is considered to be under future medium projects and the remaining 50% under future minor schemes.

b) Domestic Needs: The requirement of water for domestic consumption by the rural and urban human population and for the livestock is estimated by projecting the rural, urban human population and the livestock of the catchment to 2025 AD using the available census data. Per capita per day water requirement of 70 litres, 200 litres and 50 litres is considered for the rural and urban human population and livestock respectively as per the recommendations of the Ministry of Works and Housing in their manual "Water Supply and Treatment". The requirement of 50% of the rural human population and of the entire livestock is considered to be met from groundwater and the requirement for the remaining 50% of rural population and the entire urban population is considered to be met from surface water.

However, in the water balance reports being revised now, the population projections are made to 2050 AD instead of 2025 AD.

c) Industrial Needs: In the absence of relevant data to estimate precisely the industrial water needs, industrial requirement is taken to be equivalent to the total domestic requirement for human population and livestock. The entire industrial requirement is considered to be met from surface water.

d) Hydropower Needs: Requirement for the hydropower is taken to be the evaporation losses at the reservoirs. Wherever the evaporation data of the projects is available, the same is made use of and wherever the data is not available, the same is worked out from the surface area of water in the reservoir, assuming suitable evaporation values.

5.2.3 Regeneration

The regeneration is considered as (a) 10% of the net utilisation for irrigation from all the existing, ongoing and future identified major and medium projects, and (b) 80% of the domestic and industrial uses to be met from the surface water.

5.2.4 Water Balance

The total water requirement of a sub-basin, worked out on the methodology outlined above, is deducted from the overall surface water availability at 75% and 50% dependabilities to determine the water balances (surplus/deficit) at those dependabilities respectively.

5.3 Hydrological and Water Balance Studies of Godavari Basin upto Inchampalli Dam Site

This para deals with the assessment of surface water resources of Godavari basin between Sri Ram Sagar Project and Inchampalli dam site.

The Inchampalli dam is proposed on Godavari just downstream of the confluence of Indravati River with the Godavari River. The water balance studies in respect of different sub-basins of the Godavari basin upto Sriramsagar dam have revealed that the water available in the Godavari

basin upstream of the existing Sriramsagar project is not fully sufficient to bring the available culturable area in that part of the basin under irrigation. Further, it is observed that the yield available below Sriramsagar project is such that it gives rise to sizeable surplus water after meeting all the surface water requirements. Transfer of this surplus water available in the lower reaches of the Godavari to the water-short areas in its upper reaches may not be economically viable. Hence for the purpose of the water balance studies at Inchampalli, the Sriramsagar project it self is considered as the starting point of the Godavari basin for computation purpose.

5.3.1 Computation of Gross Annual Yields

The catchment area of river Godavari between the Sriramsagar and the Inchampalli dam sites is 177249 Km^2. The catchment includes middle Godavari sub-basin below Sriramsagar project, Maner, Penganga, Wardha, Pranhita, Indravati and small part of the Lower Godavari sub-basin upto the Inchampalli dam site. The areas of each of this sub-basin are mentioned in Table 5.1 below:

Table 5.1
Area of the Sub-basins between Sriramsagar Project and the Inchampalli Dam Site in the Godavari Basin.

Sub-basin	**Area in Km^2**	**Remarks**
Middle Godavari below the Sriramsagar project	11916	Part
Maner	13106	Full
Penganga	23898	Full
Wardha	24087	Full
Pranhita	61094	Full
Indravati	41665	Full
Lower Godavari upto the Inchampalli dam site	1483	Part
Total	**177249**	

The detailed hydrological studies for individual sub basins were carried out and furnished in respective water balance study reports.

The annual yield series of the above sub basins have been developed for the period from 1951-52 to 1981-82 by adding the year- wise monsoon and non-monsoon yields of each of the sub-basins.

The gross annual yield series for the period from 1951-52 to 1981-82 of each of the sub-basin as estimated above are added to arrive at the gross annual yield series of the Godavari basin between the Sriramsagar project and the Inchampalli dam site. From this the 75% and 50% dependable yields have been assessed and found to be 66193 Mm^3 and 76185 Mm^3 respectively.

5.3.2 Import and Export

There are existing imports of 1692 Mm^3 to the Maner sub-basin and 1206 Mm^3 to the lower reaches of the Middle Godavari sub-basin from the upper reaches of the Middle Godavari sub-basin through the existing Sri Ram Sagar Project Stage – I. A quantity of 652 Mm^3 of water is proposed to be diverted from the Sabari sub-basin to the Indravati sub-basin through the ongoing upper Kolab major project. There are proposals for importing 234 Mm^3 of water to the Pranhita sub-basin and 338 Mm^3 of water to the lower reach of Middle Godavari sub-basin from the Sri ram Sagar Project Stager – II through the Saraswati canal system and 418 Mm^3 to the lower reaches of the Middle Godavari through the stabilization of Kaddam project of Sri Ram Sagar Project Stage – II. Hence, the total import of water into the basin works out to 4540 Mm^3.

There is no existing export of water form any project to outside the basin. It is proposed to export 3136 Mm^3 of water from the Indravati sub-basin to Tel sub-basin of Mahanadi basin and 655 Mm^3 of water from the Penganga sub-basin to Upper Godavari sub-basin of the Godavari basin. Thus the total export considered in the present study is 3791 Mm^3. In addition to this, there is a natural export of 1499 Mm^3 and 1831 Mm^3 at 75% and 50% dependability respectively from Indravati sub-basin to the Sabari sub-basin of the Godavari basin through Jauranala. This natural export is also considered.

5.3.3 Computation of Various Requirements
(a) Irrigation needs

Surface water needs for irrigation have been assessed by considering the ultimate annual irrigation. The surface water requirement for irrigation from all the existing, ongoing and future major, medium and minor projects is given in Table 5.2.

Table 5.2
Surface Water Requirement for Ultimate Irrigation in the Catchment of Godavari Basin between SRSP & Inchampalli dam Site

State	Project Category	Annual	
		Irrigation (Ha)	Utilisation (Mm^3)
Maharashtra	Existing	389960	2018
	Ongoing	854809	6206
	Proposed	1717577	11619
	Sub-total	2962346	19843
Andhra Pradesh	Existing	599986	5841
	Ongoing	37222	266
	Proposed	298956	2033
	Sub-total	936164	8140
Madhya Pradesh(Undivided)	Existing	135806	904
	Ongoing	342992	3612
	Proposed	1059709	6465
	Sub-total	1538507	10981
Orissa	Existing	6704	68
	Ongoing	86048	656
	Proposed	134743	1035
	Sub-total	227495	1759
Total	Existing	1132456	8831
	Ongoing	1321071	10740
	Proposed	3210985	21152
	Grand total	5664512	40723

b) Domestic needs

The requirements of water for domestic consumption computed by projecting the rural and urban human population and the livestock by 2025 AD are given in Table 5.3. The domestic requirement for the entire urban population and 50% of the rural population to be met from surface water sources works out to 1753 Mm^3.

Table 5.3
Domestic Water Requirement in Godavari Basin between SRSP and Inchampalli dam site by 2025 AD

Category	Population ('000')	Daily needs per Capita (Litres)	Water requirement (Mm^3)
Rural	36051	70	921
Urban	17708	200	1293
Livestock	27623	50	504
Total			**2718**

c) Industrial needs

In the absence of relevant data on the industrial water needs, the industrial needs by 2025 AD have been assumed to be of the same order as that of domestic water requirement which is 2718 Mm^3. This is proposed to be met from surface water resources.

d) Regeneration

The regeneration from irrigation uses at 10% of the net water utilisation from all the existing, ongoing and identified future major and medium projects and from all imports is 2715 Mm^3.

The regeneration at 80% of the domestic and industrial water uses to be met from surface water resources are 1402 Mm^3 and 2174 Mm^3 respectively.

e) Hydropower needs

The total evaporation losses of all the hydel projects have been taken as hydropower needs which work out to be 3387 Mm^3.

f) Water Requirement of Inchampalli Project

Since the proposed Inchampalli multi-purpose project is located just at the proposed diversion point, its requirements are also to be considered in the water balance study.

This project envisages irrigating a culturable command area of 121459 ha. Assuming an intensity of irrigation of 150% and the net delta (excluding evaporation losses) as 0.65 m which is worked out based on climatological approach in the lower Godavari revised water balance report, the total irrigation requirement of this project worked out to 1184 Mm^3. The evaporation losses of this project are estimated as 1642 Mm^3. The total consumptive surface water requirement for the Inchampalli project comes to 2826 Mm^3.

5.3.4 Water Balance

The water balance has been worked out by deducting the ultimate water requirements for various uses like irrigation, domestic, industrial and others from the overall availability duly considering the regeneration, import and export. The computation of surface water balance of the Godavari basin upto Inchampalli dam site is given in Table 5.4.

Table 5.4
Surface Water Balance in Godavari basin between SRSP and Inchampalli dam Site

Availability		**(Mm^3)**
Gross annual yield		
(a) at 75% dependability		66193
(b) at 50% dependability		76185
Surface water export (-)		4540
Surface water import (+)		3791
Surface water export through jauranalla project (-)		
(a) at 75% dependability		1499
(b) at 50% dependability		1831
Overall Availability		
(a) at 75% dependability		65443
(b) at 50% dependability		75103
Surface water requirement (-)		
(a) Irrigation	40723	
(b) Domestic	1753	
(c) Industrial use	2718	
(d) Hydro-power needs	3387	
(e) Consumptive use from Inchampalli project	2826	
Sub Total	51407	51407
Regeneration (+)		
(a) Irrigation	2715	
(b) Domestic	1402	
(c) Industrial use	2174	
Sub Total	6291	6291
Surface water Balance		
a) 75% dependability		20327
b) 50% dependability		29987

The water balance study at the Inchampalli dam site shows a net surplus of 20327 Mm^3 at 75% dependability.

5.3.5 Existing/contemplated utilisations upstream of Inchampalli dam site.

Since it is proposed to divert the surplus water from Inchampalli through Inchampalli – Nagarjunasagar link, the contemplated utilizations downstream of Inchampalli dam site will be met from contributions of lower Godavari sub-basin, Sabari sub – basin and the water received from Mahanadi through Mahanadi – Godavari link.

5.4 Hydrological and Water Balance Studies of Sub-basins Lying enroute the link

The link canal traverses through the sub-basins namely Muneru, Palleru, and Musi of Krishna basin before outfalling into Nagarjunasagar dam. The water balance studies conducted by the NWDA indicate the sub - basins are water deficit in nature. Thus no water is proposed to be diverted from these rivers. The abstract of the details of water balance studies of the above enroute sub- basins are furnished in Tables 5.5, 5.6, and 5.7.

Table 5.5
Surface Water Balance in Muneru Sub-basin

Availability	(Mm^3)	
Gross annual yield		
(a) at 75% dependability		1271
(b) at 50% dependability		2092
Surface water import (+)		2789
Surface water export (-)		Nil
Overall Availability		
(a) at 75% dependability		4060
(b) at 50% dependability		4881
Surface water requirement (-)		
(a) Irrigation	3817	
(b) Domestic	161	
(c) Industrial use	281	
(d) Hydro-power needs	Nil	
Sub Total	4259	4259

Regeneration (+)		
(a) Domestic	129	
(b) Industrial use	225	
(c) Irrigation	250	
Sub Total	604	604
Surface water Balance		
a) 75% dependability		405
b) 50% dependability		1226

Table 5.6
Surface Water Balance in Palleru Sub-basin

Availability	**(Mm^3)**	
Gross annual yield		
(a) at 75% dependability		449
(b) at 50% dependability		602
Surface water import (+)		2546
Surface water export (-)		Nil
Overall Availability		
(a) at 75% dependability		2995
(b) at 50% dependability		3148
Surface water requirement (-)		
(a) Irrigation by in basin and imported water	2861	
(b) Domestic	37	
(c) Industrial use	62	
(d) Hydro-power needs	Nil	
Sub Total	2960	2960
Regeneration (+)		
(a) Domestic	30	
(b) Industrial use	50	
(c) Irrigation	221	
Sub Total	301	301
Surface water Balance		
a) 75% dependability		336
b) 50% dependability		489

Table 5.7
Surface Water Balance in Musi Sub-basin

Availability	(Mm^3)	
Gross annual yield		
(a) at 75% dependability		854
(b) at 50% dependability		1197
Surface water import (+)		1440
Surface water export (-)		Nil
Overall Availability		
(a) at 75% dependability		2294
(b) at 50% dependability		2637
Surface water requirement (-)		
(a) Irrigation by in basin and imported water	2228	
(b) Domestic	687	
(c) Industrial use	789	
(d) Hydro-power needs	Nil	
Sub Total	3704	3704
Regeneration (+)		
(a) Domestic	550	
(b) Industrial use	631	
(c) Irrigation	127	
Sub Total	1308	1308
Surface water Balance		
a) 75% dependability		(-) 102
b) 50% dependability		241

5.5 Hydrological and Water Balance Studies of the Krishna Basin upto Nagarjunasagar Dam Site

The catchment area from the source of the Krishna river upto the Nagarjunasagar dam site includes the independent catchments of 8 upper sub-basins i.e., Upper Krishna, Middle Krishna, Ghataprabha, Malaprabha, Upper Bhima, Lower Bhima, Tungabhadra and Vedavathi and part of the Lower Krishna sub-basin upto Nagarjunasagar dam site. The

catchment extends over an area of 220705 km^2 which works out to 85.2% of the total catchment area of the Krishna basin and lies in the states of Maharashtra (69425 km^2), Karnataka (113272 km^2) and Andhra Pradesh (38008 km^2). The hydrological studies in respect of all the above sub-basins have been carried out by NWDA and the annual yield series of each sub-basin have been developed. The annual gross yield series of the catchment of Krishna basin upto Nagarjunasagar dam site for the period from 1951-52 to 1983-84 have been arrived at, by summing up the annual yield series of the Lower Krishna sub-basin upto Nagarjunasagar dam site to the annual yield series of the 8 upstream sub-basins. From this series, the 75% and 50% dependable annual gross yields are determined to be 58423 Mm^3 and 67346 Mm^3 respectively.

Surface water needs for irrigation have been assessed by considering the ultimate annual irrigation minimum of 30% C.C.A. The surface water requirement for irrigation from all the existing, ongoing and future major, medium and minor projects is given in Table 5.8.

Table 5.8
Surface Water Requirement for Ultimate Irrigation in the Catchment of Krishna Basin upto Nagarjunasagar Dam Site

State	Project Category	Annual Irrigation (Ha)	Annual Utilisation (Mm^3)
Maharashtra	Existing	441320	3917
	Ongoing	646974	6007
	Proposed	507713	3219
	Additional Area	209499	1260
	Sub-Total	**1805506**	**14403**
Karnataka	Existing	1363649	12043
	Ongoing	946962	7032
	Proposed	497360	3921
	Additional Area	153645	1155
	Sub-Total	**2961616**	**24151**
Andhra Pradesh	Existing	331391	3335
	Ongoing	104398	845
	Proposed	19984	136
	Additional Area	182616	1360
	Sub-Total	**638389**	**5676**

Total	Existing	2136360	19295
	Ongoing	1698334	13884
	Proposed	1025057	7276
	Additional Area	545760	3775
	Grand Total	**5405511**	**44230**

The requirement of water for domestic consumption computed by projecting the rural and urban human population and the livestock to 2025 AD are given in Table 5.9. The domestic requirement for the entire urban population and 50% of the rural population to be met from surface water sources works out to 3348 Mm^3.

Table 5.9
Domestic Water Requirement in Krishna Basin upto Nagarjunasagar Dam Site by 2025 AD

Category	**Population ('000')**	**Daily needs Per capita(litres)**	**Water Requirement (Mm^3)**
Rural	61605	70	1576
Urban	35077	200	2560
Livestock	37144	50	677
Total	**133826**		**4813**

In the absence of relevant data on the industrial water needs, the industrial needs by 2025 AD have been assumed to be of the same order as that of domestic water requirement, which is 4813 Mm^3.

The regeneration from irrigation uses at 10% of net water utilisation from all the existing, ongoing and identified future major and medium projects having designed annual utilisation of 85 Mm^3 or more is 2789 Mm^3. The regeneration at 80% of the domestic and industrial water uses to be met from surface water resources are 2681 Mm^3 and 3849 Mm^3 respectively.

The total evaporation losses of all the hydel projects have been taken as hydropower needs which is worked out to be 1154 Mm3. The water balance has then been worked out by deducting the ultimate water requirements for various uses like irrigation, industrial, domestic and others from the overall availability duly considering the regeneration, import and

export. Thus, the computation of surface water balance of the Krishna basin upto Nagarjunasagar dam site is given in Table 5.10.

Table 5.10
Surface Water Balance at Nagarjunasagar Dam Site

Availability	(Mm^3)	
Gross annual yield		
(a) at 75% dependability		58423
(b) at 50% dependability		67346
Surface water export (-)		15722
Surface water import(+)		Nil
Overall Availability		
(a) at 75% dependability		42701
(b) at 50% dependability		51624
Surface water requirement (-)		
(a) Irrigation	44230	
(b) Domestic	3348	
(c) Industrial use	4813	
(d) Hydro-power needs	1154	
Sub Total	53545	53545
Regeneration (+)		
(a) Irrigation	2789	
(b) Domestic	2681	
(c) Industrial use	3849	
Sub Total	9319	9319
Surface water Balance		
a) 75% dependability		(-)1525
b) 50% dependability		7398

The water balance at the Nagarjunasagar dam site shows a net deficit of 1525 Mm^3 at 75% dependability.

5.6 Simulation Studies at Reservoirs

The Govt. of Andhra Pradesh has proposed Inchampalli reservoir with a live storage capacity of 4285 Mm^3 and whereas the total water to be diverted from Inchampalli reservoir is 20946 Mm^3. The large variation between the available storage and the quantum of water to be diverted from Inchampalli

reservoir necessitates building additional storage at upstream, to make the diversion through the link successful. The proposed Bhopalpatnam reservoir could serve this purpose. The regulated releases into Inchampalli reservoir from Bhopalpatnam reservoir after power generation would be made use of for effecting the diversion from Inchampalli reservoir.

Simulation studies are required to be carried out to assess the dependability of the reservoirs involved, to cater various demands envisaged for the project. Integrated simulation analysis of Bhopalpatnam and Inchampalli reservoirs has been carried out for the period from 1951 – 52 to 1980 – 81 only due to non-availability of updated data of various water balance studies and irrigation data for different projects.

5.6.1 Computation of gross inflow into Bhopalpatnam H.E Project

The Bhopalpatnam project is a joint venture of Madhya Pradesh (undivided) and Maharashtra and it envisages construction of a masonry dam on Indravati River and an underground powerhouse. The dam is located at about 32 km from Bhopalpatnam town in Bastar district of Chhattisgarh and 80 km from Chandrapur in Maharashtra state. At the dam site, the Indravati River forms the boundary between the Chhattisgarh and Maharashtra states. This project is planned for producing 285 MW of firm power.

The gross annual yields at Bhopalpatnam for the period from 1951-52 to 1980-81 have been estimated on pro-rata basis considering the catchment areas of the entire Indravati sub-basin and that up to Bhopalpatnam. Net annual inflows into Bhopalpatnam reservoir have been worked out by deducting the net surface water requirements of the Indravati sub-basin upto Bhopalpatnam from the gross annual yields available at Bhopalpatnam. The net annual yields at Bhopalpatnam are divided into monthly flows based on run-off data of Pathagudem G&D site (maintained by CWC) situated on Indravati downstream of the project. Based on the monthly yields, yearly working table for the period from 1951 to 1980 and monthly working tables for the period from 1951-52 to 1980-81 are prepared to assess monthly releases / spills from Bhopalpatnam reservoir into Inchampalli reservoir.

5.6.2 Computation of Gross Inflows into Inchampalli Reservoir

Inchampalli reservoir has been proposed on the river Godavari just down-stream of the confluence of river Indravati with Godavari. The requirements between SRSP and Inchampalli (excluding the Indravati river catchment upto Bhopalpatnam dam site) consist of the requirements of Middle Godavari sub-basin below SRSP, Maner, Penganga, Wardha, Pranhita, Indravati sub-basins below Bhopalpatnam and Lower Godavari sub basin upto Inchampalli dam site. The gross annual yield series for the years from 1951-52 to 1980-81 at Inchampalli has been worked out by adding the annual yields of the above mentioned catchment areas. The surplus annual yield series has been worked out by deducting the requirements form the gross yields. The net annual yields at Inchampalli are divided into monthly inflows based on the flow data at Perur G&D site (maintained by CWC) which is located just downstream of Inchampalli dam site. Based on the monthly yields yearly working table for the period from 1951 to 1980 and monthly working tables for the period from 1951-52 to 1980-81 are prepared.

Thus, the inflows into Inchampalli reservoir comprises of (i) the regulated releases and spills from Bhopalpatnam reservoir and (ii) the net flows from the catchment of Godavari basin between Sri Ram Sagar Project and Inchampalli dam site and the flows from the catchment of Indravati river below Bhopalpatnam.

5.7 Demands from Inchampalli Reservoir

5.7.1 Demands of Inchampalli Left and Right Bank Canals

The Inchampalli reservoir as planned by Government of Andhra Pradesh is to meet the irrigation needs of the commands under Inchampalli Left Bank Canal (ILBC) and Inchampalli Right Bank Canal (IRBC). The designed annual utilizations for irrigation under Inchampalli LBC and Inchampalli RBC as proposed by NWDA are:

1. Inchampalli LBC 150 Mm^3
2. Inchampalli RBC 470 Mm^3

5.7.2 Demands of Inchampalli – Nagarjunasagar Link

Inchampalli – Nagarjunasagar link envisages to carry 16426 Mm^3 of water annually to meet the following demands:

(i) 684 Mm^3 and 743 Mm^3 (total 1427 Mm^3) of water for en route irrigation requirements of Kakatiya Canal Stage – II and Srisailam Left bank Canal respectively.
(ii) 237 Mm^3 to meet domestic and industrial water requirements of the areas en route the link canal.
(iii) 562 Mm^3 of transmission losses en route the link canal from Inchampalli – Nagarjunasagar.
(iv) 14200 Mm^3 of water by transfer to Nagarjunasagar to meet the deficits of Nagarjunasagar and for further diversion to other southern river basins.

The computation of all the above demands and their monthly distribution are dealt in detail in Chapter on “Water and Irrigation Planning”.

5.7.3 Demands of Inchampalli – Pulichintala Link

Inchampalli-Pulichintala link is proposed to divert 4370 Mm^3 of water from the Godavari to provide irrigation to areas under the commands of Inchampalli and Nagarjunasagar projects as detailed below:

(i) Command area of the right bank canal of the Inchampalli Joint Project proposed by the Government of Andhra Pradesh.
(ii) Part of the existing command area of the left bank canal of the Project (NSLBC)
(iii) Proposed Command area coming under the extension of NSLBC beyond Tammileru and Part of the existing command area of the right bank canal of the Nagarjunasagar Project (NSRBC)

5.7.4 Arrangement for Diversion of Water through Inchampalli-Nagarjunasagar Link Canal – Its integration with SRSP Stage- II and SLBC

5.7.4.1 Command Area under the Kakatiya Canal Stage – II of Sri Ram Sagar Project Stage – II

Government of Andhra Pradesh has proposed to provide irrigation to an area of 178055 ha in the drought prone Warangal plateau, Nalgonda and Khammam districts by utilizing 684 Mm^3 of water through Kakatiya canal Stage – II of Sri Ram Sagar project Stage – II. The proposal suffers from the fact that enough water is not available at Sri Ram Sagar dam site to cater to these needs. The proposed link canal can cater to the irrigation needs of the command area under Kakatiya canal stage – II partly by lift and partly by gravity. The lift involved is about 55 m for lifting and supplying water from Inchampalli – Nagarjunasagar link to Kakatiya canal. This lift can be negotiated in two stages, first lift with a static head of 40 m at RD 0.00 km and second lift with static head of 15 m at RD 21.00 km. The month wise crop water requirements for the command area of the Kakatiya canal stage – II are worked out based on the cropping pattern designed by the Govt. of Andhra Pradesh.

5.7.4.2 Command Area under Srisailam Left Bank Canal

Govt. of Andhra Pradesh has proposed to provide irrigation to 109250 ha of endemically drought prone upland areas in Nalgonda district by lifting 743 Mm^3 of water from the Nagarjunasagar reservoir through Alimineti Madhava Reddy Lift Irrigation Scheme (AMRLIS). This area has originally been proposed under Srisailam Left Bank canal. Four pumps 18 MW each are installed to lift the water to a static head of about 92.00 m to command the area. As the proposed Inchampalli – Nagarjunasagar link canal is passing through this command area, the same is proposed to be taken over by the link canal. 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 directly by the link canal by utilising 349 Mm^3 of water. The canal distributary network system of the AMRLIS as planned by the Irrigation Department and being executed can be utilized without major modifications to command this area. The balance requirement of 394 Mm^3 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 under the SLBC, computation of month-wise water requirements and computation of crop water requirement for the proposed enroute command area under the Srisailam Left Bank Canal is given in Chapter on "Water and Irrigation Planning".

5.8 Results of Simulation

The simulation of the Inchampalli reservoir is carried out considering the monthly inflows into the reservoir and monthly requirements to be met from the reservoir.

From the monthly diversions through the Inchampalli - Nagarjunasagar link worked out from the simulation studies of Inchampalli reservoir, irrigation, domestic and industrial uses and transmission losses enroute this link canal are deducted to arrive at the net inflows into the Nagarjunasagar reservoir through the link.

The results of simulation of Inchampalli reservoir for a period of 30 years from 1951-52 to 1980-81 in terms of success rate are presented in Table 5.11. The success rate of each demand is computed by dividing the number of years in which the full demands are met by the total number of years of simulation i.e. 30 years.

Table 5.11
Results of Simulation of Inchampalli Reservoir for the Period from 1951-52 to 1980-81 (30 years)

Sl. No	Component	Full demand (Mm^3)	No. of years in which full demand is met	Success rate (%)
1	Inchampalli LBC	150	24	80
2	I-N link diversion	16426	23	76
3	Inchampalli – Pulichintala link including Inchampalli RBC	4370	23	76