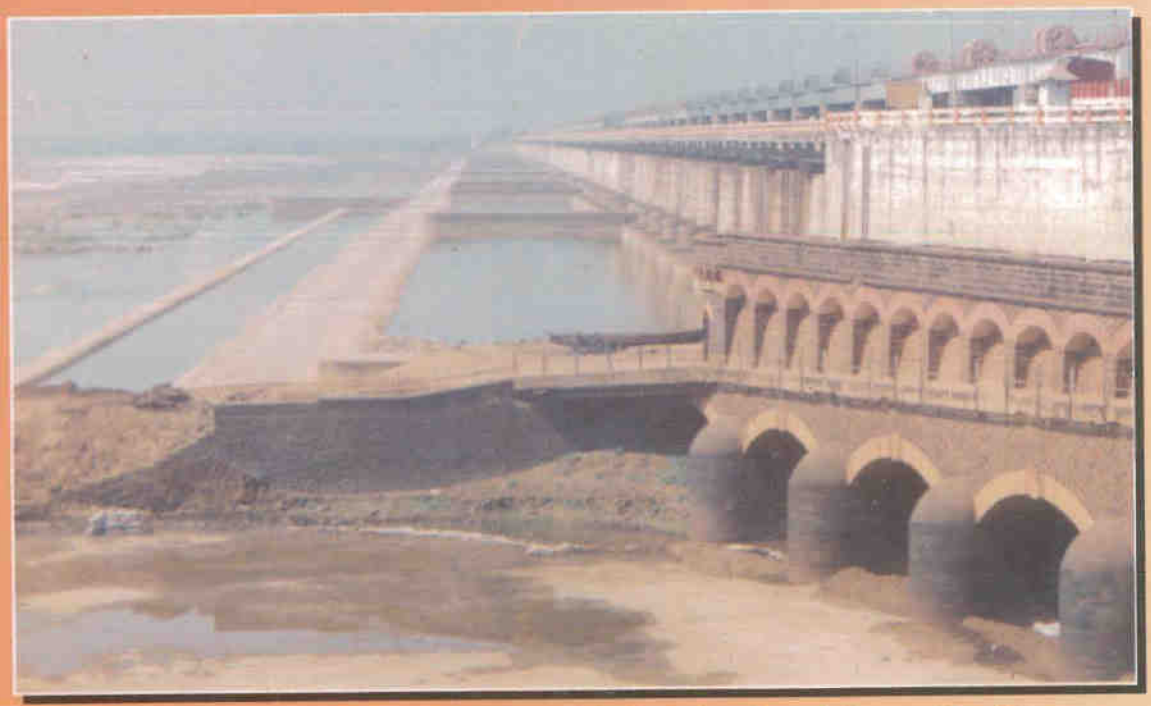
History of Irrigation Development in Andhra Pradesh



The down stream view of Dowlaiswaram arm of the Sir Arthur Cotton's barrage, Dowlaiswaram

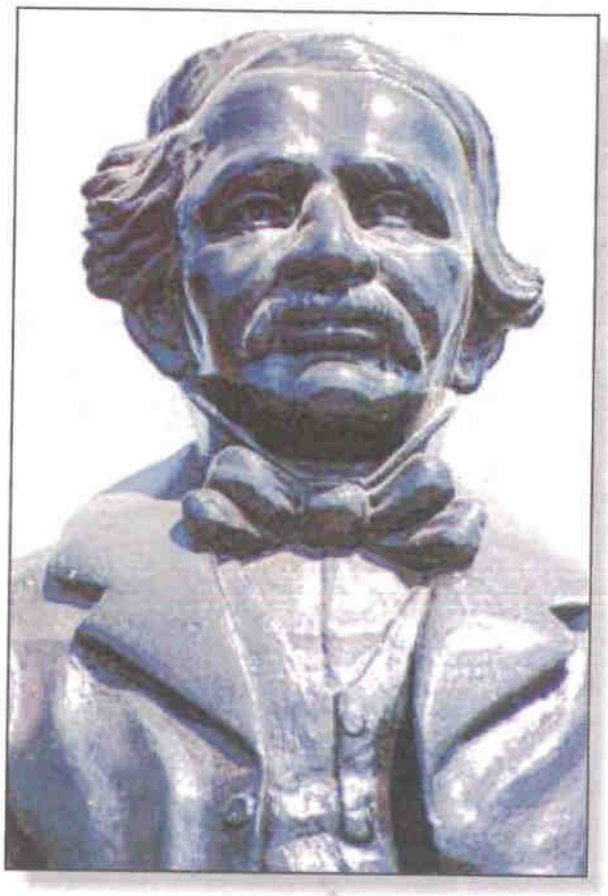
(Author : Prof. A Mohana Krishnan)

इनसिड - INCID

भारतीय राष्ट्रीय सिंचाई एवं जल निकास समिति
(जल संसाधन मंत्रालय, भारत सरकार द्वारा गठित)

INDIAN NATIONAL COMMITTEE ON IRRIGATION AND DRAINAGE
(Constituted by the Ministry of Water Resources, Government of India)

New Delhi
March, 2004



Sir Arthur Cotton

Nagarjuna Sagar Dam, (Nalgonda Dt.)

History of Irrigation Development in Andhra Pradesh

(Author : Prof. A Mohana Krishnan)

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FOREWORD

Irrigation has been always at the root of a surviving strategy in the history of mankind since its earliest beginning. Irrigation in India has a very old history and history is not a mere transition to posterity. It is a great teacher to those who strive to transform the society for the better. The efforts of past builders and engineers to develop innovative, safe and sound engineering designs are a fine expression of their irrepressible zeal to favourably manoeuver the vagaries of nature for overall development of humanity. A study of these efforts would present a fascinating insight into the innovative techniques of harnessing the precious water resource adopted by our forefathers in their search for survival in a period, technology was still nascent and a scientific approach unheard of. Decisions were based on requirements and site selection by thumb rule and still the product, the water storage structure, stood the test of time providing the much needed water to the inhabitants during scarcity days.

In pursuance of its objectives and functions, Indian National Committee on Irrigation and Drainage (INCID) has taken up the work of publishing the historical appreciation of development of irrigation and drainage in the country, which will disseminate relevant information related to the subject. INCID has already published the first such document "History of Irrigation Development in Tamil Nadu", under the centrally sponsored research programme of river valley and flood control schemes. The present document, "History of Irrigation Development in Andhra Pradesh", brings out irrigation practices and management adopted during different periods in the state of Andhra Pradesh

The painstaking task of preparing a report of this nature was entrusted to Dr. A. Mohanakrishnan, Former Chief Engineer, Tamil Nadu, and presently Chairman, Cauvery Technical Cell, Government of Tamil Nadu, who had earlier authored the INCID publication "History of Irrigation Development Tamil Nadu". Based on the data collected from various resources the report prepared by Dr. Mohanakrishnan was sent to Government of Andhra Pradesh and various organizations like, Central Water Commission, Planning Commission etc. for their comments. The INCID Sub-Committee-I on "Irrigation Performance Assessment, History, Training and Research & Development", during its meeting held on 3rd June, 2003 discussed the draft report and suggested that a small sub-committee comprising officers of Central Water Commission, Planning Commission and INCID may look into and finalize the report taking into account comments received from various organizations and of the Committee members on the report before getting it printed.

The present publication contains 17 chapters covering the development of irrigated agriculture right from the pre-Mughal period, through the British period and the period after independence. The report also covers future perspectives of irrigation development in Andhra Pradesh.

INCID is grateful to Dr. A. Mohanakrishnan and his associates for documenting available information in this report. The efforts put in by Shri C.D. Khoche, Consultant, INCID and concerned officers of Central Water Commission and Planning Commission in editing the text are very much appreciated. Thanks are also due to the Ministry of Water Resources, for providing requisite grants. The assistance rendered by the INCID Secretariat and particularly by Shri Vimal Kumar Gaur, D.E.O. (Gr-I), in preparing the typescripts of the publication is gratefully acknowledged.

Special thanks are due to Shri D. Datta, Chairman and Managing Director, WAPCOS (India) Limited for his support to INCID and providing all infrastructure facilities to INCID secretariat in publishing this document.

It is hoped that this report will be useful as a reference book to all concerned in the Water Resources Sector, particularly to those working in various State Irrigation Departments/ Agencies.

(R. JEYASEELAN)
Chairman INCID and
Central Water Commission

PREFACE

Soil is the womb of all production in this planet and water is the key element that runs round like the blood stream to make production happen. While the precipitation is the only source of water on this earth it is largely variant in space and time. Of course it is the natural precipitation that sustains all growth in the wild, where mortality is of no concern. Irrigation supplements rain in ensuring that production loss is minimum

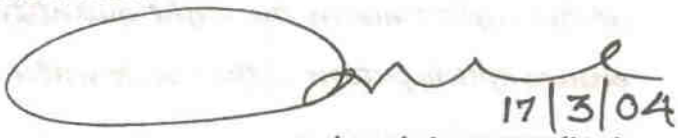
Man has been practising irrigation ever since he started growing food for his sustenance and has been all the time searching for a source and a means of conducting the water from the source to the place of use. Managing the water that is conveyed from the source such that it is applied to the crops grown, at the right time in the right quantity, is a later development to ensure optimization of the use of water that is becoming scarce.

Irrigation, which developed as an art in ancient times, is now being fast recognized as a science and an irrigation engineer is always proud to help the farmer "to grow two blades of grass while he was growing only one". Irrigation is a fascinating field for the practicing engineer for he has to grope in darkness when Nature plays truant with him and still has to find ways and means of ensuring a dependable supply to the farmer who cannot afford to lose his investment. He keeps a careful watch over all the water that runs off on the surface and that which moves invisible under the ground and devises ways of harnessing, tapping, storing, conserving and withdrawing to meet the requirement as and when it arises.

To trace the development of irrigation in a particular region over time is an interesting field of activity for an irrigation researcher and when an opportunity came in my way through the kind offer of the Indian National Committee on Irrigation and Drainage (INCID), I agreed and I should say I have done my best in this "History of Development of Irrigation in Andhra Pradesh" to gather, assimilate and present the facts to the extent I could muster. I thank the INCID for this offer.

I acknowledge with thanks the help that has been always forthcoming from my colleagues who have helped me in translating and editing my manuscripts in computers to go into the print.

I solicit the kindness of the readers to ignore any deficiencies seen and offer comments if any for improving this text to the INCID for their consideration.



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A. MOHANAKRISHNAN

About the Author

Professor Angadu Mohanakrishnan, graduated in Civil Engineering from the College of Engineering, Guindy, with first class honours in 1948 and later took his Master of Science in Engineering in 1961. Later, he was awarded the degree of Doctor of Science (Honoris Causa) by the Anna University, Chennai, on 4th September, 1997.

He joined the Public Works Department of the erstwhile Madras State (now Tamil Nadu) in June, 1948, and was responsible for planning, design and execution of the canal systems of major irrigation projects taken up in the Five year plans in the State. He worked for five years in the College of Engineering, Guindy, as Professor of Civil Engineering, handling subjects like Hydraulics, Fluid Mechanics, Irrigation, Dam Construction, Water Management, etc. He retired as Chief Engineer, Public Works Department, Government of Tamil Nadu, in December, 1984.

After retirement, he is continuing as Irrigation Advisor with the Government of Tamil Nadu and built up the Irrigation Management and Training Institute (IMTI) with financial assistance from USAID at Thuvakkudy and was appointed as its first Director for a period of two years. Later he acted as the State Co-ordinator for the USAID Project with the WAPCOS (India) Ltd.. He was also Chairman of the Expert Committee on Telugu Ganga Project. Since 1990 he is working as the Chairman of Cauvery Technical Cell to present the case of Government of Tamil Nadu before the Cauvery Water Disputes Tribunal. Being Advisor to the Government, he is being consulted on all aspects of water resources in the State including interstate problems.

He has authored five technical books including the present publication and contributed more than 60 technical papers on irrigation and water resources to journals and other organizations. He is a life member of Institution of Engineers (India), Central Board of Irrigation and Power (CBIP) and Indian Water Resources Society (IWRS). He is also a member of Engineering Reform Committee constituted by the Government of Tamil Nadu for suggesting reformation of the Public Works Department and in the Expert Committee on Rainwater Harvesting and to prepare Action Plan for 2050 for the State for an Integrated Development of Water Resources.

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CHAPTER 1

ANCIENT IRRIGATION IN INDIA AS EVIDENCED BY LITERATURE

From the dawn of the civilisation, India has been primarily an agricultural country. Agriculture still continues to be the main occupation of its people. Vast areas are cultivated and crops raised once or twice a year depending upon the availability of water. The terrain gets uneven rainfall. There are areas getting enormous rainfall and there are also large tracts presenting the look of a desert and getting only a few centimeters of rain for the entire year. Years of scarcity are sometimes followed by periods of excessive rainfall. Thus, the rainfall is seldom normal and even, throughout the length and breadth of this great country, INDIA.

The dependence of agriculture on the rainfall renders cultivation precarious and hence there have been very serious droughts, at times causing famines, which brought untold miseries to the people of the land. Vayu Purana, which gives genealogies of early rulers and their exploits, refers to one of the earliest droughts. In Mahabharatha (3000 B.C), the second great epic of India, mention is made of a very serious drought during the reign of Emperor Mandhata, of the race of Ikshvakus.

Another famine occurred during the sovereignty of Trisanku, father of the famous king Harishchandra, the Truthful. Severe famines are also recorded one about the time of king Dasaratha, father of Rama, the hero of the epic Ramayana, and the other about 160 years before the Mahabharatha war, during the reign of King Shantanu, ruler of Hastinapur. Such being the case, planned irrigation not only creates confidence in the farmers, but also gives assured development to the nation.

From the references in the epics Ramayana and Mahabharatha, we learn that the ancient Indians were also clear on land and soil classification such as fertile, infertile, cultivable and wasteland and black, yellow, red, gravelly and building soils and their agricultural productivity.

There is historical evidence to the effect that irrigation sources were developed and existed in India even from the early days of human civilization.

The Vedic texts, which are more than 3000 years old, contain valuable references on water including the concept of the 'hydrological cycle'. Water has been given the prime of place while conducting any ritual. The Epics handed down to us have a number of references to the source of water and the prosperity brought in by timely rainfall to a kingdom. Similarly Puranas like the Linga Purana and the Brahmanda Purana contain verses referring to clear concepts of rainfall, evaporation, and condensation, cloud formation and the whole cycle, also stressing the fact that water is never destroyed or lost but only converted from one form to the other. Our ancient seers believed in yagnas purifying air, water and environment as a whole and helping in causction of rainfall.

There are references in Vedas to the construction of anicuts across perennial rivers, excavation of canals from such rivers and to tanks and wells. In the Rigveda four types of waters are mentioned, viz. waters which come from the sky or rain water; those which flow in rivers and streams: those which are obtained by digging and those which ooze out from springs. Rigveda mentions the term 'avata' which signifies a "well'. In the lexicon of Nighanta as many as fourteen types of wells are mentioned. Another passage mentions about 'kulya' an artificial river or canal, reaching a lake.

In Yajurveda mention is made of canals and dams. They are termed as Kulya and Sarasi respectively. Sarasi denotes a big reservoir of water as a lake.

Atharvaveda gives description of digging canals from the rivers. River is simulated to a cow and canal to a calf.

Deep dug wells whose bottom is completely dark due to their depth are mentioned in Jaiminiya-Brahmana, a work connected with Samaveda.

Kausika Sutra also explains the rituals of the opening ceremony of letting water into a canal. "A gold plate was laid at the mouth of the canal on which a frog tied with blue and red threads was made to sit. The frog was then covered with mos (sevela) and water was let in".

Manu the earliest law-maker writes in his work that a king who wishes to conquer his enemy should first of all destroy the dams (tataka) in his territory. Again while laying down rules for the demarcation of the boundaries of different provinces; Manu says that dams, wells, and pools should be constructed on the boundary lines. Further he ordains punishment for a man who damages any part of a dam or puts hindrances in the channels connected with it. Vishnugupta Kautilya (3rd century B.C), the Prime Minister of Chandragupta Maurya, in his Arthashastra or book on polity, gives the advice that "when on war, the tracts of land of the enemy should be flooded with water by breaking the lakes, dams and embankments".

According to other ancient writers, the digging of a tank is regarded as the greatest of the seven meritorious acts of a man that are meant to provide water for the society, prapa, kupa, vapi, kulya, padmakara, tataka or dam.

Brihaspati, another expert and a writer on polity, states that the construction and repair of dams is a pious work and its burden should fall on the shoulders of the rich men of the land. Vishnu Purana also enjoins merit to a person who effects repairs to wells, gardens and dams.

Rishi Narada, a great writer on polity, once came to the court of Emperor Yudhisthira (3150 B.C) and enquired about the welfare of his State. One of his questions was: "Are the farmers sturdy and prosperous? Are their dams full of water and big enough and distributed in different parts of the kingdom, and does agriculture any more depend on rains only?"

The Vishnu Purana enumerates the four sources of atmospheric moisture as "the glorious sun, the rivers, the earth and the living creatures".

Panini, the grammarian, has mentioned two types of wells: Karkandhu and Shakandhu. The latter was the type of well used by the Shaka tribe or possibly used the Persian-wheel. He also mentions wells on the banks of the river Vipasa or Beas. Those dug on the right bank of the river were permanent wells, and those on the left bank were temporary ones subject to annual inundation. These wells seem to have been of great historical importance.

In a Pali work called Dhammapada a stanza speaks of nettikas; and the commentary explains the term as "builder of canals and aqueducts". It thus appears that irrigation canals and aqueducts were not unknown in India even in the pre-Mauryan period when the Dhammapada must have been composed.

Megasthenes, the Greek Ambassador, who came to India in 300 B.C. during the reign of Chandragupta, wrote that there were plenty of irrigation sources in India and the Indians were raising two crops in a year.

By the time of Kautilya (3rd century BC) Indians had developed the methods and instrumental devices for measuring rainfall. The rain gauge was referred as "Varshaman". A reference to the variation of rainfall in the different parts of the country is seen in the 'Artha Sastra' of Kautilya. There is also a suggestion on the possible forecast of rain, which is essential for agricultural operations. "A forecast of such rainfall can be made by observing the position, motion and pregnancy of the Jupiter, the rising and setting and motion of Venus and the natural or unnatural aspects of the Sun from the movement of Venus" - Kautilya's writings.

In his famous "Meghadutam" poet Kalidasa (100 BC) defines cloud as an assemblage of smoke, electricity, water and air.

Amarakosha, a work composed in the 4th century A.D., distinguishes between provinces watered by the rains (devamatrika) and those irrigated by rivers (nadimatrika).

Dalhana (12th century A.D.) in his commentary on the medical work of Sushruta has differentiated between various types of water reservoirs and water channels. According to him Ganges etc., should be called nadi and Sindhu and Sona as nada. A natural tank is named as Sara and that constructed by man is called tataga or a dam.

In Sanskrit literature pranali, kulya, sarasi, nika, nala, and nalika are the words used for different types of canals and channels. There also occurs another word 'tilamaka' which denotes "a channel which leads the water from the hillside over the fields which rise in terrace one above the other". Similarly, the word 'kunda' and 'tala' are used for small and big tanks and the words 'tataka' and 'sarasi' for big reservoirs. According to the lexicographer Amara (4th century A.D.) Kulya is a small artificial stream.

Hemadri in the Danakhanda of his Chatur-varga Chintamani quotes a verse from Devipurana, which indicates difference between a kupa and a vapi, and again quotes from Vishnu Dharmottara that dams and nadivahas as small channels were used for watering the fields. Pali, vipali and many more words are mentioned in Devipurana as quoted by Himadri, in the context of watercourses. Pali possibly denotes a dam or an embankment and vipali must be smaller in dimension or subsidiary to Pali. The term pala for an embankment is still used in the Bundelkhand area.

Vishwa Vallabha written by Chakrapani is a great book on construction of Reservoirs. The great Buddhist works in Pali "Jalabindu", "Jalavashana" and "Jaladeepika" are now in Amsterdam Library, Netherlands. Even copies of these books are not available in India.

From the above it is evident that irrigation was given a lot of importance in this country even in the pre-Christian era.

CHAPTER 2

HISTORICAL REVIEW OF THE EMERGENCE OF THE STATE OF ANDHRA PRADESH

In order to appreciate the historical development of any aspect of living of the people of a nation or State, more so the development of irrigation for agriculture, which is the primary occupation of the people in this country, it would be helpful if a historical review of the emergence of the State as a political entity in its present form is made. An attempt is made to present such a review in this chapter.

The Deccan is one of the oldest inhabitant regions of the world. The antiquity is believed to go back to about 300,000 years, the Paleolithic age. Most part of the Deccan has been under the rule by the Andhras some time or other.

The origin of Andhras as a race is lost in antiquity. Some say they are part of the Dravidian people. It is believed that Andhras is a north Indian tribe expelled from the Aryan fold as they deviated from the Aryan culture. There is a reference to Andhras in "Aitareya Brahmana" a part of the Rig-Veda (BC 1230 to BC 1000). Andhras are referred to as a powerful race having their suzerainty over the Deltas of Godavari and Krishna. All these may be in pre-Mauryan age.

But it could be seen from the edicts of Asoka that Andhra was a part of the Mauryan Empire in Asoka's time perhaps brought under their control by Chandra Gupta Maurya.

A Chronological Table of Suzerainty in South India as traced by the great historian of our times, Prof.K.A.Nilakanta Sastri in his "A History of South India from Pre-historic Times to the Fall of Vijayanagar" is given at Annexure-I.

It was the Satavahanas who brought peace and stability to the Deccan during their rule for about five hundred years (BC 221 to AD 218) by creating an empire, which comprised besides the present Andhra Pradesh, parts of Maharashtra, Gujarat, Madhya Pradesh, Orissa, Karnataka and even Tamil Nadu. Satavahana rulers called themselves, Satakarnes replaced Prakrit language by Sanskrit, patronised Vedic religion and practiced casteism rigidly. Both Hinduism and Buddhism coexisted in perfect harmony during their time.

Satavahanas were good administrators, divided the kingdom into Provinces and maintained Grama as the lowest unit under the control of a Gramani. Agriculture was the mainstay with the large river wealth in the region and their main source of revenue was land revenue. Amaravathi on the banks of Krishna was chosen as their capital and the famous Budddhist stupa at Amaravathi with 51 metres diameter at the base and 31 metres height of dome is said to have been started in BC 200, and completed in AD 200. Their rule over five centuries was one of the glorious epochs of ancient Indian History, south of Vindhyas.

When the Satavahana rule came to an end by the first quarter of the third century several small feudatory families rose to power in different parts of Andhra and till about AD 600 it was a dark period in History.

From AD 600 - 950 relatively larger States emerged and held sway. The Chalukyas of Badami (Vatapi) rose and spread their power over the entire country between the two seas, south of Vindhyas. They successfully halted the Harsha Vardhanas to the north of Vindhya and restricted Pallavas to the south of Deccan.

The origin of Chalukyas is not clear. They could have come down from the north and established their kingdom at Badami taking advantage of the confusion that prevailed in Deccan with several feudatories fighting against each other. Pulikesi I who ruled from AD 543 to AD 566 is said to be the founder of the Chalukyan dynasty

Pulikesi II (AD 609 - 624) was the greatest of the Chalukyan emperors. He conquered Vengi in AD 611 and sent his brother Vishnuvardhana to rule over the Vengi region.

The dynasty of Vishnuvardhana known as the Eastern Chalukyas ruled over Andhra region for about five centuries from AD 624.

Rashtrakutas thereafter emerged as a great power and captured Badami. They even chased the Eastern Chalukyas from Vengipura further east where they had to found a new capital called Rajamahender on the northern bank of River Godavari, which is the present Rajahmundry.

Around this time, the Pallavas and the Pandyas had occupied the land south of Deccan almost eclipsing the Cholas who were so prominent in the Sangam age. Karikala Chola who built the famous Grand Anicut on Cauvery in the 2nd century AD was the most celebrated of the Cholas of the Sangam age. Claiming descedence from Karikala, Telugu Cholas were ruling in the ceded districts as a minor dynasty in that period. However close relationship is seen to have been maintained between the Cholas and the Eastern Chalukyas of Vengi over a long period strengthened by marital alliances. Around AD 980 when two brothers Sakthivarman and Vimaladhitya fought for the throne at Vengi, Vimaladhithya fled to the Chola Kingdom asking for help from Rajaraja Chola. By this time the imperial Cholas had risen again displacing Pallavas and subduing the Pandyas and Cheras as well. Of course they were kept under check by the Rashtrakutas in the north.

Rajaraja Chola being shrewd not only helped Vimaladhitya to ascend the throne at Vengi but also gave his daughter Kundavi in marriage. Vimaladhitya ruled as Eastern Chalukya king at Vengi till his death in AD 1011. His son Rajaraja Narendra also married a Chola princess Ammangadevi and their off spring Rajendra occupied the Chola throne titling himself as Kulothunga I (AD 1070 - 1122) when there was no male descendent from the Chola dynasty. Of course he married the only female issue of the Chola dynasty Madhuranthaki. A new dynasty called Chalukya-Cholas thus came to power in the Chola country through maternal descent. After AD 1075, Kulothunga I annexed Vengi but continued his rule from Gangaikonda Cholapuram in the present Tamil Nadu and thus the eastern Chalukyan Kingdom and the Chola kingdom merged for some time.

In the mean time, the Rashtrakutas started losing their power and the Chalukyas of Kalyani revived the Chalukyan sovereignty over Deccan during the eleventh and twelfth centuries AD, while the Eastern Chalukyas of Vengi continued friendship with Cholas.

The Kakatiyas established a feudatory kingdom with Warangal as their capital around AD 1000 and they could emerge as a powerful force only during the thirty-seven years long rule of Rudradeva-I (AD 1158-1195). He waged wars against the Chalukyas of Kalyani and liquidated them and also many other feudal chiefs around. Rudradeva can be said to have formed the first independent Andhra kingdom with Warangal as capital and with the northern and western Telengana and parts of the coastal Andhra.

Ganapathi Deva (AD 1199-1262) who succeeded him was the greatest of the Kakatiya rulers. He annexed Velanadu and Vengi regions and went upto Kalinga. Of course, his advance towards south was halted by Pandyas, who became very powerful during this period and came up to even Kanchi subduing Cholas and Pallavas. In his long rule extending over sixty years, he stabilised his powers, introduced good administration at the village level by appointing Niyogi Brahmins as Karnams, gave equal status to other castes like Reddis, Kammas, Velamas and gained their cooperation. Ganapati Deva is credited to have built the large irrigation tanks like Ramappa, Parakala Kesamudra, Lakshmanavaram, and Ghananapuram. Rudrasamudram another big tank is said to have been built earlier by RudraDeva-I. Rudramba (AD 1262 - 1289), daughter of Ganapati Deva who was well trained by him, succeeded him and ruled for twenty-seven years. She was the first and the only woman to rule over Andhra. She was good in enlisting the cooperation of all her feudatories who were given full freedom to govern their territories.

The Andhra Kingdom which was thus getting well shaped by the Kakatiya dynasty got rudely shocked and badly disturbed with the Muslim invasions to the south first in AD 1303, then in AD 1309 and five more times before AD 1323 when Kakatiya kingdom was finally annihilated. Allauddin Khilji, Malik Kafur, Qutubuddin and the Tuglakhs did massacres and plundering and totally spoiled the well run Kakatiya kingdom resulting in anarchy in the region. Some Nayaks led by Prolaya Vema Reddi freed parts of Andhra from Muslim occupation and started the Reddi kingdom of Kondavidu, which provided an interlude for about a century.

The Vijaya Nagar Empire (AD 1336 - 1678) emerged as the last great Hindu Empire not only in South India but also in the entire country. This empire was founded by the two brothers Harihara and Bukka who fled from Warangal where they were the Minister and Treasurer when the last of the Kakatiya dynasty was killed in the Muslim invasion.

Contemporarily the Bhamani kingdom of Gulbarga, a Muslim State, had also sway over Deccan.

For the next three to four centuries, the orthodox Telugu Hindu Vijayanagar Empire and the fanatic Muslim Bhamini Kingdom existed side by side in Deccan all the time fighting with each other and wasting their energies and wealth. Finally the Vijayanagar rulers could not fulfill their ambition of establishing a resurgent Hindu India and had to fall to the cruel massive force of the Muslim rulers and get absorbed in the Mughal empire of Delhi.

Sri Krishna Deva Raya (AD 1509 - 1529) was the greatest of the Vijayanagar rulers. He was a great warrier who expanded his kingdom and an able administrator as well. He was connoisseur of art and culture and a great patron of literates. Rayalaseema was the core of his empire. He built temples, cities, developed irrigation sources by constructing tanks and digging wells and people were happy in his regime because dharma and justice was upheld.

The Bahmani kingdom which was occupying most parts of the present Telengana area also got disintegrated into five sultanates of which the Sultanate of Golkonda survived long and succeeded in annihilating the Vijayanagar empire and resisting the power of the Mughals of Delhi.

The Qutub Shahi dynasty which ruled from Golkonda for 175 years from AD 1512 to 1687 had to fall to the army of Aurangazeb after a siege for eight months. It was during this period the city of Hyderabad was built (AD 1591) the Hussainsagar lake was formed and the famous Purana pul the 60 feet long old bridge even now in use in Hyderabad across Musi river, was constructed (AD 1578). The Charminar, the landmark of Hyderabad, was completed in AD 1591-92.

When the Mughal Empire weakened after the death of Aurangazib, the Nizam - Ul - Mulk who was the Subedar of the Deccan assumed power and the Nizam's Hyderabad State got thus founded in AD 1724.

By now the influence of the European trading companies that started their operations in the south, the Portugese, the Dutch, the French and the English was felt in the ruling Kingdoms. The French under Duplex and the English under Robert Clive vied with each other in getting the Nizam to their side. Soon the English rose in power, and the British power under the East India Company increased fast from AD 1766. After occupying the coastal areas, the British defeated the Mysore king Tippu Sultan, acquired the northern circars and the ceded districts, eroded the powers of the Nizam and stationed their Resident in Hyderabad. Gradually the parts of the present Andhra got consolidated under the East India Company barring the Nizam State, which was also under the control of their Resident in Hyderabad.

Sir Thomas Munro (AD 1761-1827) was the most loved of the Collectors the Royalaseema area had and he is even now remembered in those parts because of his concern for the common man.

Andhra can never forget the magnificent contribution made by the most illustrious irrigation engineer Sir Arthur Cotton who built the Godavari Anicut in AD 1847 and organised Krishna Anicut in AD 1853, which brought tremendous prosperity to their two Deltas.

After the British Queen Victoria assumed power, a proclamation was issued bringing all the territories acquired and consolidated by the East India Company in the country under the Crown. Nizam State remained a native kingdom with the other territories of the present Andhra coming directly under the British rule as the Madras Presidency, of course with a few zamindars here and there.

Political awakening and the thirst for a separate administrative territory for Andhras can be said to have started even by the end of the nineteenth century as the Indian National Congress got established. Many great leaders took up the cause and while there was total agreement with the views of Mahatma Gandhi and complete support

for the freedom movement there was also a desire to carve out a separate Andhra State for Andhras soon after Independence. Kandukuri Veeresalingam (AD 1848-1919) P.Rengiah Naidu, P.Ananthacharlu, Desa Bhaktha Konda Venkatappuiah, Andhra Ratna Duggorala Gopalakrishnayya, Pattabi Sitaramiah, Kaleswara Rao, Andhra Kesari Tanguturi Prakasam, Dewaru Subbamma, Ponaka Kanakamma, Durgabai Deshmukh were some of the several great Andhra leaders who involved themselves in the freedom movement.

The Madras Mahajana Sabha, the Vandemataram and Swadeshi Movement, the Andhra Mahasabha, the Justice Party were some of the organisations through which fight for Andhra State can be said to have been launched.

Quite a number of Andhra leaders found place in the ministry when the Justice Party formed the Government at Madras in AD 1920 when Diarchy was introduced and later when the Congress Party formed the Government in AD 1937 under Sri C. Rajagopalachari Pitti Theagaraja Chetty, the Raja of Panagal; Sri K.V. Reddi Naidu, Rajah of Bobbli; Bezwada Gopala Reddi, V.V.Giri, T.Prakasam are some of them.

Dethroning the Nizam through Police Action by the Indian Army, the Hyderabad state including Telangana was merged with the mainstream of Indian Union.

The fast unto death undertaken by Potti Sriramulu on the 19th October 1952 at Madras and his death on the 15th December 1952 created an explosive situation and led to Sri Pandit Jawaharlal Nehru, Prime Minister, declaring in the Lok Sabha that the Government of India had decided to form the Andhra Pradesh.

On the 1st October 1953 the Andhra State was inaugurated by Sri Nehru, with Kurnool as the temporary headquarters and with Tanguturri Prakasam heading the Ministry. When the demand for the creation of other linguistic States gained momentum and when the trifurcation of the multi lingual Hyderabad State was in the offing, the hopes of Andhras to aim at Vishalandhra grew brighter.

The present Andhra Pradesh was inaugurated on the 1st March 1956 by Shri Jawaharlal Nehru again with Sri Neelam Sanjiva Reddi heading the first ministry and Hyderabad as the State Capital.

It is unfortunate that even though most of the historians record the developments made by the Kings, Rajas, Chieftains and others during their periods in certain areas like general administration, construction of public choultries, temple structures, improving educational facilities, trade and commerce and so on and their patronage of art, culture and literature, their heroic adventures in war and peace, we do not see much of information given in the development of irrigation and irrigation structures. Here and there construction of certain minor irrigation tanks and wells are referred to. This is perhaps for the reason that irrigation development and maintenance has been mostly taken care of by the people themselves in their villages through their cooperative effort. There were many philanthropists who had gifted money and land for the upkeep of the irrigation systems and the villagers by themselves took care of the irrigation operation and maintenance. The well irrigation is of course always an individual effort and the tank irrigation also admirably suited that type of management. Construction of major structures, which required an organisation at the ruler's level was rare and such constructions took a more important place in the scheme of development from about the middle of the nineteenth century by which time the British administration took over.

CHAPTER 3

ANDHRA PRADESH - GENERAL FEATURES

The State of Andhra Pradesh as it is now constituted is the fifth largest State in India covering an area of 2,75,075 sq.km a little over double the size of the State of Tamil Nadu to the south of it. The State's geographical extent is nearly 8% of the total geographical area of India. The population of the State is 75.73 million (2001 census) living in about 207 towns and 27,221 villages. The State's population is 7.37% of the country's population and the population density is 275 per sq.km as against the country's average of 324 per sq.km. A table giving district wise population, decadal growth rate, density and literacy rate in the State based on 2001 census is enclosed (Table 3.1)

Topography

Topographically, the State can be divided into four regions.

(1) The alluvial delta,
(2) The Deccan plateau south of river Krishna,
(3) The Deccan plateau north of river Krishna and
(4)The Eastern Ghats region

The seven coastal districts of Srikakulam, Visakhapatnam, East Godavari, West Godavari, Krishna, Guntur and Nellore lie in the coastal belt, which comprises the alluvial delta. The belt is 80 kms wide and extends for a distance of 965 kms along the coast at an elevation of less than 150 m above sea level. The Eastern Ghats form the western fringe of this belt. This region is of course the most fertile and contributes substantially for food production.

The Deccan plateau south of the river Krishna is an arid tract and lies at an altitude of 15 to 610 m above sea level and comprises the upland taluks of the coastal districts of Guntur and Nellore and the four Royalaseema districts of Kurnool, Cuddappah, Anantapur and Chittor. The topography is undulating with a high rate of erosion. The underlying geological formations are crystalline and hard sedimentary rocks. The Royalaseema districts are proverbially known as the dry tracts of the State.

The Deccan plateau north of river Krishna is an extensive plateau with an average elevation of 366 m above mean sea level, comprising, in addition to the upland taluks of the coastal districts of Krishna and west Godavari, the Telengana area of the former Princely State of Hyderabad. Telangana consists of nine districts namely Hyderabad, Nizamabad, Adilabad, Medak, Warangal, Khammam, Nalgonda, Karimnagar and Mehboobnagar. The plateau is traversed by the Krishna and the Godavari rivers.

The Eastern Ghats region consists of thickly forested hills rising to an altitude of 1067m above mean sea level, comprising the districts of Srikakulam, Visakhapatnam and East Godavari.

Map 3.1 is the political map of the State of Andhra Pradesh showing the districts.

Water Resources

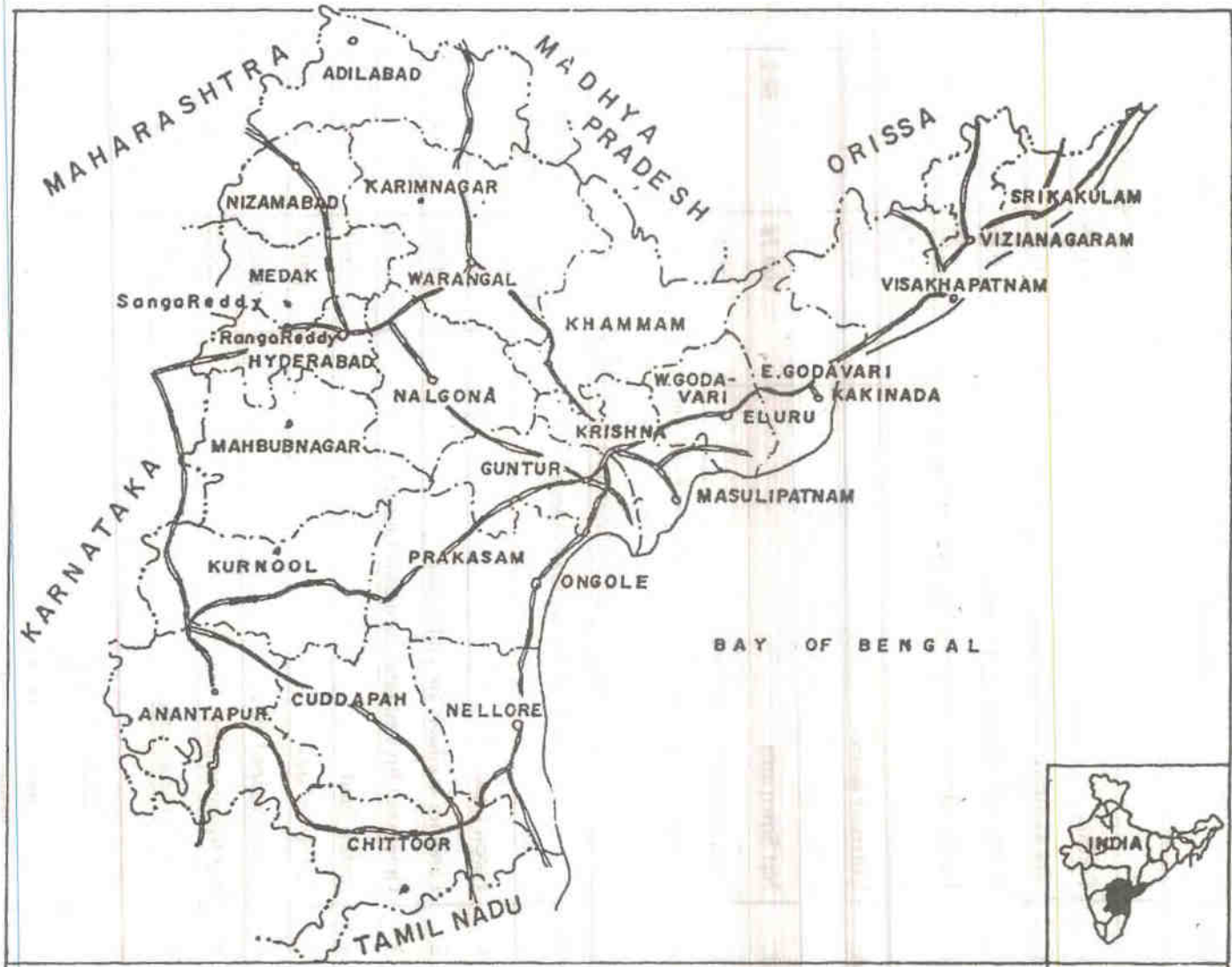
Andhra Pradesh has considerable water resources; three of the major rivers of India viz. the Krishna, the Godavari and the Pennar flow through it. There are, besides 37 medium and minor river basins, 19 North of the Godavari and 18 south of the Krishna. Important among these are the Vamasadara, Nagavalli, Gundla Kamma and Manneru river basins. To sustain the large population engaged in agriculture and to step up food production, utilisation of the vast potential in these river systems is imperative.

Table 3.1: DISTRICT WISE POPULATION DISTRIBUTION, DECADAL GROWTH RATE, DENSITY AND LITERACY RATE IN ANDHRA PRADESH – 2001

S.No.	State/District	Area (Sq.km)	Population in 2001			Decadal Growth rate		Density (Persons/sq.km.)		Literacy Rate (%)					
			Persons (lakhs)	Males (lakhs)	Females (lakhs)	1981-91 (%)	1991-2001 (%)	1981-92	1991-2002	Persons		Males		Females	
Andhra Pradesh		275045	757.28	382.87	374.41	24.20	13.86	242	275	44.08	61.11	55.12	70.85	32.72	51.17
1.	Adilabad	16105	24.79	12.46	12.33	26.95	19.06	129	154	32.96	53.51	45.05	65.56	20.60	41.38
2.	Nizamabad	7956	23.43	11.62	11.81	21.31	14.98	256	294	34.18	53.26	47.33	66.27	21.35	40.57
3.	Karimnagar	11823	34.77	17.38	17.39	24.68	14.47	257	294	37.17	56.00	50.79	67.86	23.37	44.19
4.	Medak	9699	26.62	13.47	13.15	25.60	17.29	234	274	32.41	53.24	45.15	65.52	19.25	40.68
5.	Hyderabad	217	36.86	18.95	17.91	39.76	17.18	14497	16988	71.52	79.04	78.90	84.11	63.55	73.67
6.	Rangareddi	7493	35.07	18.06	17.01	60.32	37.41	341	468	49.07	66.31	60.43	75.02	36.91	57.03
7.	Mehbubnagar	18432	35.07	17.80	17.27	25.87	13.97	167	190	29.58	45.53	40.80	57.87	18.03	32.83
8.	Nalgonda	14240	32.38	16.47	15.91	25.11	13.55	200	227	38.00	57.84	50.53	70.19	24.92	45.07
9.	Warangal	12646	32.31	16.38	15.93	22.54	14.63	219	252	39.30	58.41	51.68	70.01	26.08	46.54
10.	Khammam	16029	25.65	12.99	12.66	26.50	15.78	138	160	40.50	57.72	50.04	67.04	30.53	48.16
11.	Srikakulam	5837	25.28	12.56	12.72	18.46	8.93	398	433	36.22	55.94	49.14	67.90	23.52	44.19
12.	Vizianagaram	6539	22.45	11.20	11.25	17.00	6.36	323	343	34.19	51.82	45.93	63.00	22.47	40.73
13.	Vishakhapatnam	11161	37.90	19.04	18.86	27.50	15.36	294	340	45.51	59.45	56.13	68.84	34.60	49.99
14.	East Godavari	10807	48.73	24.46	24.27	22.70	7.30	420	451	48.79	65.49	55.32	69.97	42.26	61.00
15.	West Godavari	7742	37.96	19.06	18.90	22.39	7.92	454	490	53.38	73.95	55.75	78.43	43.30	69.45
16.	Krishna	8727	42.18	21.51	20.67	21.33	14.05	424	483	53.16	69.91	60.55	74.57	45.54	65.05
17.	Guntur	11391	44.05	22.20	21.85	19.57	7.27	361	387	46.35	62.80	56.54	71.32	35.85	54.17
18.	Prakasam	17626	30.55	15.50	15.05	18.44	10.72	157	173	40.30	57.86	53.14	69.78	27.06	45.60
19.	Nellore	13076	26.60	13.41	13.19	18.73	11.18	183	203	47.61	65.90	58.04	74.45	36.99	57.24
20.	Cuddapah	15359	25.73	13.03	12.70	17.47	13.48	148	168	48.12	64.02	63.14	76.98	32.35	50.76
21.	Kurnool	17658	35.12	17.87	17.25	23.50	18.14	168	199	39.97	54.43	53.24	67.36	26.04	41.07
22.	Anantapur	19130	36.39	18.59	17.80	24.81	14.31	166	190	42.18	56.69	55.92	68.94	27.61	43.87
23.	Chittoor	15152	37.35	18.83	18.52	19.14	14.54	215	247	49.75	67.46	62.61	78.29	36.44	56.48

Source : Census of India – 2001, Series 29, Andhra Pradesh, Paper 1 & 2 of 2001

Map 3.1



MAP 1. POLITICAL MAP OF ANDHRA PRADESH

Land Resources

The land utilisation of the State is presented below.

Table 3.2 Land use pattern in Andhra Pradesh – 1998-99

S.No	Category	Area	Percentage to total
		(Lakh hectares)	
1.	Forests	61.99	22.8
2.	Not available for cultivation	47.01	16.9
3.	Permanent Pastures and other grazing land.	6.86	2.8
4.	Land under miscellaneous tree crops and groves	2.41	0.9
5.	Cultivable waste	7.74	2.6
6.	Current Fallows	23.33	8.9
7.	Fallow land other than current fallows	15.28	5.6
8.	Net Sown area	109.78	39.5
9.	Area sown more than once	26.47	

Source: Land use Classification – 1998-99, Ministry of Agriculture, Government of India.

Table 3.3 Land Utilisation as in 1998-99

S.No	Land use in Andhra Pradesh	Area '000' ha	CMIE Page No.
1	Forest Land	6199	12
2	Land not available for cultivation	4701	14
3	Other uncultivated land excluding fallows	1701	16
4	Fallow land	3861	18
5	Net Sown area	10978	20
6	Gross Cropped area	13625	22
7	Net Irrigated area	4538	30
8	Gross Irrigated area	6092	32
9	Net Irrigated area by source Tanks 810 Wells 1897 Canals 1634 Others 197	4538	44

Source: Publication of CENTRE FOR MONITORING INDIAN ECONOMY PVT. LTD. (CMIE), Agriculture – December, 2002.

No study on the availability of shallow ground water aquifers has been carried out on a systematic basis though some random investigations have been made through the National Rural Water Supply Scheme. However the utilisation of ground water at shallow depths through irrigation wells is an age old practice in all the non deltaic tracts; this practice is widely prevalent in the Telangana and Royalaseema areas. The ultimate irrigation potential in the State is estimated at 140 lakhs ha which constitutes about 8% of the nation's potential.

Agro Climatic Zones

The strategy of agro-climatic planning aims at scientific utilisation of the available resources, both natural and man made. The potential for growth and diversification would be fully exploited taking a holistic view of the climate, soil type, topography, water resources and irrigation facilities. Accordingly, the country has been divided into 15 regions based on the commonality of agro climatic factors. Andhra Pradesh falls under two zones viz (i) Southern Plateau and hill region and; (ii) East-Coast Plains and hill region. The districts coming under the above zones are as under:

Table 3.4 Listing of districts, based on agro climatic factors:

Southern Plateau and hilly region		East Coast Plains and hills
Adilabad	Rangareddy	Prakasam
Chittoor	Karimnagar	Srikakulam
Cuddappah	Khammam	Visakhapatnam
Kurnool	Medak	Vizianagaram
Mahaboobnagar	Nalgonda	West Godavari
Nizamabad	Guntur	
Warangal	Krishna	
East Godavari	Nellore	

Further, on a micro level, based on various agro-climatic factors, the State has been divided into the following zones:

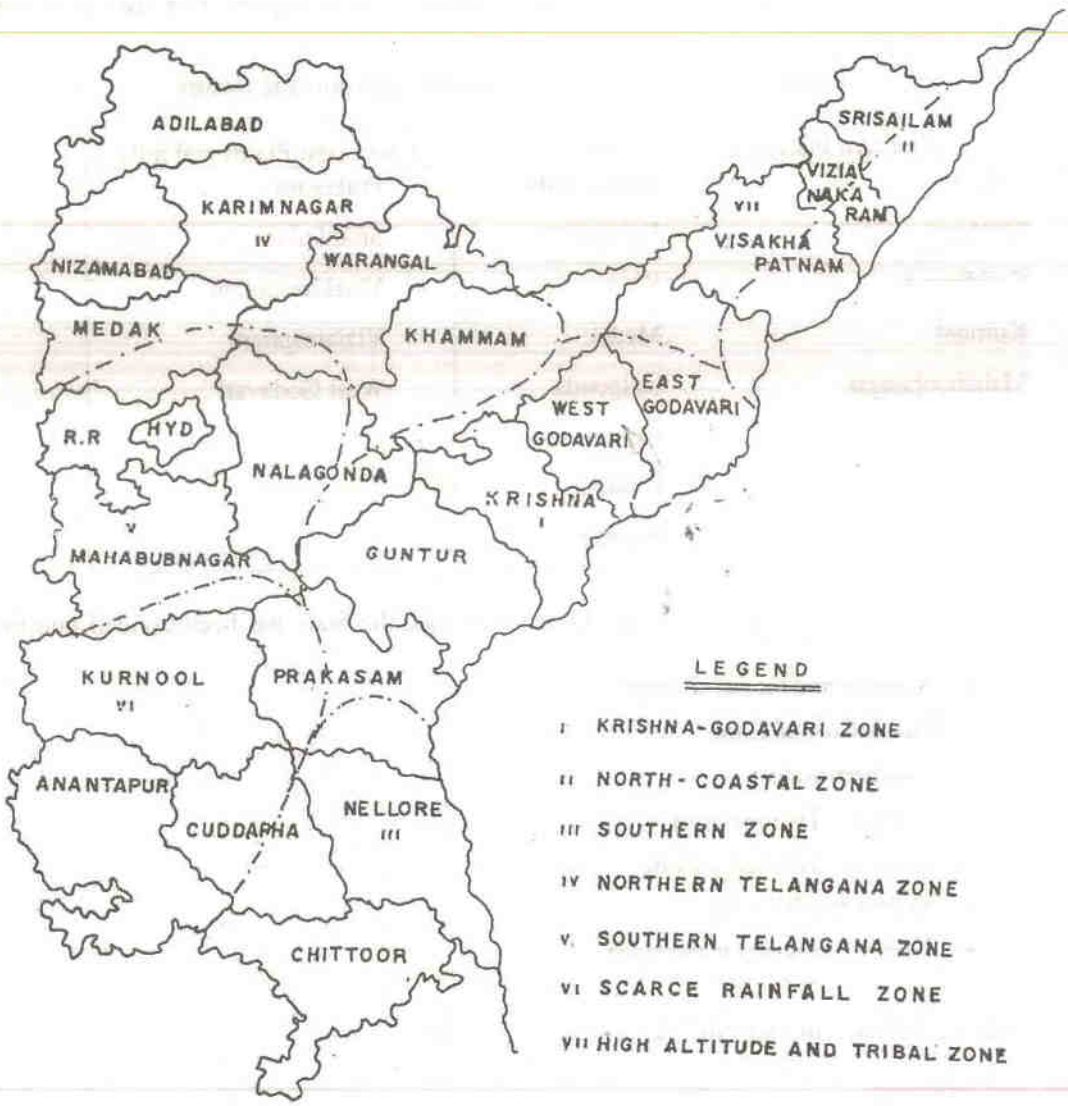
i. Krishna and Godavari zone
ii. North Coastal Zone
iii. Southern zone
iv. Northern Telangana zone
v. Southern Telangana Zone
vi. Scarce rainfall zone
vii. High altitude and tribal areas

The above zones are depicted in Map No. 3.2

Soil Types and Drainage

The major portion of the State is covered by red soils, which are generally deficient in organic matter and rich in phosphoric contents and poor in plant nutrients and moisture holding capacity. A great part of the Telangana and Royalaseema districts and the upland portion of Nellore, Guntur, West Godavari, East Godavari, Visakhapatnam and Srikakulam are covered by red soils.

Map 3.2



AGRO-CLIMATIC ZONES OF ANDHRA PRADESH

The next largest portion in extent is made up of black soils, which are rich in calcium and potash but poor in nitrogen. Adilabad, Krishna, Warangal and Khammam in Telangana region have a good belt of this type of soil along the course of the river Godavari. Mahaboobnagar and Krishna district as also Kunderu basin of Cuddappah and portion of Guntur district have a fair amount of black soils.

The coastal alluvium stretches as a narrow belt all along the coast. Though limited in extent and obviously concentrated in delta region of Godavari and Krishna, the deltaic alluvium is rich in plant nutrients and suitable for paddy cultivation.

The least in areal extent are the laterite soils, which are poor in organic matter and plant nutrient. They are porous and usually well drained. The laterite pockets occur in Srikakulam, Visakhapatnam, East Godavari and Nellore districts as well as on the western edge of Medak district.

Meteorological Data.

The State enjoys rainfall both from south-west as well as north-east monsoons. The average annual rainfall ranges from 750 mm in the semi-arid belt to about 1250 mm in the north-eastern portion of the State. The coastal area receives an average rainfall of 1100 mm. The State average is 896 mm. Nearly two third of the annual rainfall in the coastal districts and in the Telangana area falls during the southwest monsoon. The north east monsoon is the heaviest in the Nellore and Chittoor districts, though during this period precipitation also occurs elsewhere in the State. The south-western districts of the State which comprise the Rayalaseema area lie in the rain shadow of the western ghats while the northern districts of the State viz. Srikakulam and Visakhapatnam receive heavy rains as a result of the westward movement of low pressure area accompanied by cyclones mostly during the north east monsoon period. The distribution of average in the four distinct climatic seasons is as under:

A.	Pre-monsoon season	(March to May)	73 mm
B.	South-west monsoon season	(June to September)	602 mm
C.	North East Monsoon season	(October & November)	203 mm
D.	Post monsoon	(December to February)	18 mm
	Total State Average		896 mm

The State experiences hot summer and mild winter. In general, the climate of Andhra is of 'Tropical monsoon' type. The humidity is high in the coastal belt with an average of 70 to 80% in the morning throughout the year and decreasing in the afternoon by 10 to 15%. The high humidity of 70 to 80% prevails in the morning over Royalaseema during July to November. In Telangana also the humidity in the morning is very high exceeding 80% from July to September. The average summer temperature ranges between 37° C and 40° C. The peak of the summer is reached in the month of May when temperature goes upto 50° C and even higher in areas such as Ramagundam and Vijayawada. Areas such as Anantapur and Chittoor districts enjoy a mild summer as in the coastal areas. The lowest winter temperature ranges between 16° C and 19° C and temperatures are somewhat higher during winter along the coast.

Crop production, Cropping Pattern and Water Requirements of Major crops

Andhra Pradesh accounts for nearly 10% of the rice, 7% of the Jowar, 15% of the groundnut seeds, 6% of the sugarcane and 31% of the tobacco produced in the country as in 1997-98. It holds a monopoly in the production of castor and virginia tobacco. It is also the largest producer of chillies in India. About 73% of the cultivated area of the State, are under food crops. Because of the extent of fertile delta and coastal areas, paddy is the predominant crop and covers 23% of the cropped area. Though the area under paddy in the State is 8 per cent of the total area in the country under this crop, it accounts for as much as 10.3% of the total rice production. Andhra Pradesh is the third biggest rice producer in the country. Other important food crops are Jowar, Maize and Ragi. Among the commercial crops the most important are tobacco, castor, sugarcane, groundnut, cotton, and chillies and as has been mentioned above Andhra leads in the production of tobacco, castor and chillies. No less than four fifth of the tobacco crop in the State comes from the four districts of Guntur, East Godavari, Krishna and Kurnool. The production and productivity of Principal crops are shown in Table below:

Table 3.5 Production of Principal crops in Andhra Pradesh and share in All India

YEAR 2000-01 Unit: 000' tonnes

Sl. No	CROP	Production in		Share of Andhra Pradesh	Rank	Area '000 ha	Yield Kg/ha	CMIE* Page No.
		All India	Andhra Pradesh					
1	Rice	84871.2	12458.0	14.7	1	4243.0	2936	59
2	Jowar	7715.8	619.0	8.0	3	677.0	914	67
3	Maize	12067.9	1581.0	13.1	2	528.0	2994	80
4	Ragi	2741.9	105.9	3.9	5	92.5	1145	88
5	Gram	3522.4	106.2	3.0	6	163.5	650	115
6	Arhar	2262.4	219.2	9.7	5	513.5	424	122
7	Food grains	195915.9	16027.8	8.2	3			137
8	Groundnut	6222.8	2034.8	32.7	1			161
9	Sunflower	733.0	168.0	22.9	3			210
10	Sugarcane	299210.0	18000.9	6.0	5			353
11	Tobacco	490.0	100.0	20.4	3			361

***Source:** Publication of Centre for Monitoring Indian Economy Pvt. Ltd (CMIE), Agriculture – December 2002.

Of the total gross area cropped about one third of the area is irrigated while the remaining two thirds is rainfed. The irrigated dry crops (non paddy crops) are sown mostly in the Tungabhadra valley. In the new major and medium projects wet and irrigated dry localised areas are generally in the ratio of 1:2. Of the total gross cropped area in the State, 80% is under food crops and the balance 20% under other crops. The average yields of some principal crops are as given below:

Table 3.6 Average yield of crops

Yield in kg / ha

S.No.	Name of crop	Average yield
1	Food grains	1610
2	Pulses	486
3	Oil seeds	774
4	Cotton	316

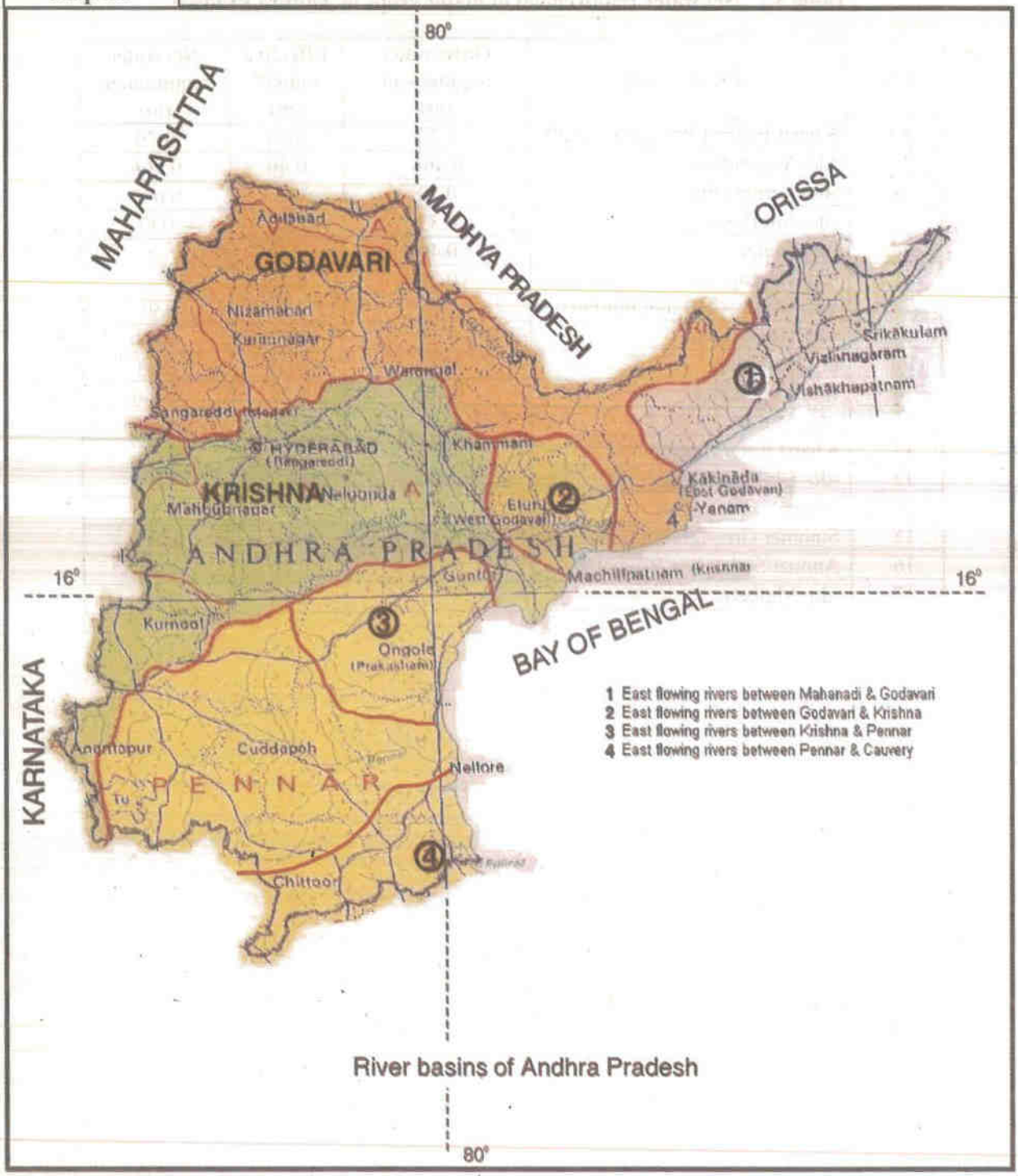
The irrigation water requirement of crops depends upon many factors like crop type, soil type, climate, rainfall, sunshine hours and cultivation practices. The two common forms used in this connection are net irrigation requirement and gross irrigation requirement. The net irrigation requirement refers to the quantity of water required to be applied for successful growth of crop during its life period exclusive of effective rainfall during that period.

The net irrigation requirement for major crops during different seasons are set out in Table 3.7. An average rainfall of 785 mm during Kharif season and 219 mm during Rabi is taken for working out the effective rainfall. Effective rainfall is defined as the amount of rainfall which is useful for meeting the evapo transpiration needs of crops or which is useful to plant for its growth and production. It is estimated based on the Evapo transpiration /precipitation ratio wherein the average monthly effective rainfall is related to the consumptive uses and means monthly rainfall.

Table 3.7 Net water requirement of major crops in Andhra Pradesh

S.No	Season / crop	Gross water requirement (m)	Effective rainfall (m)	Net water requirement (m)
1	Kharif Paddy (785 mm rainfall)	1.20	0.50	0.70
2	-do- Vegetables	0.466	0.40	0.066
3	-do- Ground nut	0.50	0.453	0.047
4	-do- Sunflower	0.35	0.25	0.10
5	-do- Maize	0.40	0.40	--
6	-do- Greengram	0.25	0.25	--
7	Rabi Paddy (219 mm rainfall)	1.05	0.14	0.91
8	-do- Groundnut	0.50	0.10	0.40
9	do- Sunflower	0.35	0.05	0.30
10	-do- Vegetables	0.466	0.10	0.366
11	-do- Maize	0.40	0.075	0.325
12	Kharif Rabi/Turmeric	1.10	0.55	0.55
13	-do- Chillies/Cotton	0.70	0.475	0.225
14	Summer Groundnut	0.55	0.05	0.50
15	Summer Greengram	0.30	0.025	0.275
16	Annual/Sugarcane Bi-annual	2.00	0.70	1.30
17	-do- Mulberry	1.20	0.55	0.65

Map 4.1


80°
MAHARASHTRA
MADHYA PRADESH
ORISSA
GODAVARI
Adilabad
Nizamabad
Karimnagar
Warangal
Srikakulam
Vizianagaram
Vishakhapatnam
Sangareddy (Medak)
HYDERABAD (Rangareddi)
Khammam
KRISHNA
Nalgonda
Mahbubnagar
Eluru (West Godavari)
Kakinada (East Godavari)
Yanam
ANDHRA PRADESH
16°
Guntur
Machilipatnam (Krishna)
16°
Kurnool
Ongole (Prakasham)
BAY OF BENGAL
KARNATAKA
Anantapur
Cuddapah
Nellore
PENNAR
Tu
Chittoor
1 East flowing rivers between Mahanadi & Godavari
2 East flowing rivers between Godavari & Krishna
3 East flowing rivers between Krishna & Pennar
4 East flowing rivers between Pennar & Cauvery
River basins of Andhra Pradesh
80°

CHAPTER 4

RIVER BASINS IN ANDHRA PRADESH

Andhra Pradesh is fortunate in that in its present form it is blessed by Nature with large water wealth which is helping the State to be not only self sufficient in food but also to spare to the neighbouring States of Tamil Nadu and Karnataka and other parts of the country.

It has in its fold three major river basins, the Godavari, the Krishna and the Pennar besides 37 more medium and minor river basins (Map 4.1). The water potential in all these basins is substantial. Abundant flows in the river systems of course results in good ground water recharge. The ground water availability of the State as per Central Ground Water Board assessment (2001) is 35.28 billion cubic metre (BCM) or 1246 TMC and the present utilisation stands at 23.80%.

The Godavari Basin

The river Godavari is the largest river system in the peninsular India and is termed as Dakshina Ganga. It rises in the Nashik district of Maharashtra and flows over a distance of 1445 km before it infalls into the Bay of Bengal in Andhra Pradesh. Its catchment area is spread over 312,812 sq.kilometres in the States of Maharashtra (48.6%), Madhya Pradesh including Chattisgarh (20.7%), Karnataka (1.4%), Orissa (5.5%) and Andhra Pradesh (23.8%)

Though large part of its yield is contributed by the hilly regions of Maharashtra and Madhya Pradesh its utilisation is more in Andhra Pradesh where the river after entering the plains has carved a delta alluvial and rich for agricultural production.

Major tributaries joining this river in the Andhra Pradesh limits are Penganga, Pranahita, Sabari and Indravathi joining on the left and Manjira and Manair joining on the right. This mighty river contributes about 85 BCM (3000 TMC) annually on 75% dependability and carries high floods now and then. The maximum flood observed at Dowleshwaram anicut was l, 05,000 cumecs (37,08,075 cusecs) on 16.8.1986.

The Krishna Basin

The river Krishna takes its source from a spring in the sacred place called Mahabaleshwar in Maharashtra and runs for 1400 km before it joins Bay of Bengal in Andhra Pradesh. Its catchment extends over an area of 258,948 sq.km in the States of Maharashtra (26.8%), Karnataka (43.8%) and Andhra Pradesh 29.4%).

Draining the slopes of the western ghats the river carries abundant flow, cuts through the eastern ghats in deep gorges and emerges into plains in Andhra Pradesh to create a very fertile Delta in the estuary which continues to be the granary for the State and also yields the largest tabacco production in the country.

The main tributaries of the river are the Koyna and the Bhima in Maharashtra joining on the left, the Ghataprabha and Malaprabha and Tungabhadra mostly lying in Karnataka joining on the right and the Musi and Muneru, lying in Andhra Pradesh joining on the left again. Of these it is the Tungabhadra stream that contributes heavily to the yield of the river. Only after its confluence near Kurnool, the river Krishna swells, widens its bed and flows over sandy bed in the plains.

The yield at Vijayawada anicut on 75% dependability has been asessed as 58 BCM (2060 TMC) and its share among the three basin States is a highly contentious issue on which there is already an award under the Inter State Water Disputes Act, l956 called the Bachawat Award, which is slated for review after 2000 AD.

The discharge of this river is highly fluctuating, the maximum recorded being as high as about 45,300 cumecs (16 lakh cusecs) with the minimum coming down to even 3 cumecs in some years in summer months.

One unique geographical feature that is striking is the lay out of the Godavari and Krishna basins in the State so close, adjacent and contiguous such that with the development of the irrigation systems in the two basins in their Deltas it is just possible to interlink them for irrigation supplies and navigation, the low ridge between them being inconspicuous. It can also be seen that these two Deltas and their estuaries stand out from the normal coastline pushing out small bulbs with the building up of their alluvial deposits. It is therefore no wonder that the coastal districts of East Godavari, West Godavari, Krishna and Guntur are among the most fertile in the State.

The Pennar Basin (Uthara Pinakini)

The Pennar, the poor cousin of the Godavari and the Krishna in Andhra Pradesh and a counterpart of the river of the same name (Dakshina Pinakini) flowing through Tamil Nadu, rises in the Chennakesava Hills of Karnataka draining their northern slopes. The river runs for 597 km before it infalls into the Bay of Bengal in Andhra Pradesh. This is also an inter-state river with a catchment of 55,213 sq.km of which 12% lies in Karnataka and 88% in Andhra Pradesh.

The Principal tributaries are Jayamangala, Kunderu (Kumudhavalli) on the left and Sageleru and Cheyyeru on its right.

Though this basin is influenced by both the southwest and northeast monsoons the basin lying in semi arid tract is frequently drought prone. The average monsoon rainfall in the upper region is only in the order of 540 mm which increases only towards the coast to about 1040 mm. The variation in the annual yield of the river is also high and the surplus over Sangam Anicut at the end varies from about 10.5 BCM (370 TMC) to even 0.3 BCM (12 TMC). The annual flow at 75% dependability may be assessed as 3.75 BCM (97 TMC).

Medium and Minor River Basins

There are 37 of these in the State, 19 to the north of the Godavari basin and 18 to the south of the Krishna basin. A statement of the estimated water potential in all the river basins in Andhra Pradesh including the three major river basins is given in Annexure-II. It may be seen therefrom that the total yield in all the river basins in the State at 75% dependability is estimated as 77.75 BCM (2746 TMC), which works out to 4.6% of the country's water potential.

CHAPTER 5

IRRIGATION DEVELOPMENT IN ANCIENT TIMES IN ANDHRA PRADESH

That irrigation is an ancient art practiced from pre-historic times in many parts of India is a known fact and the parts now constituting Andhra Pradesh, had their own share of very early attempts to create irrigation structures by the people and the rulers, within their own means and capabilities. When agriculture was the mainstay for the people to meet at least their own food needs and when it often faced crisis with the monsoon, playing truant, the natural instinct drove them to seek some means of watering their crops from the available sources. We get some glimpses of such efforts and their results from the ancient scriptures and literature as already referred to in the introductory chapter.

Rivers are worshipped in India as God's gifts even today. For ancient people they were of great awe and reverence. The three major rivers passing through Andhra Pradesh, the Godavari, the Krishna and the Pennar are mighty and large and could not have emboldened even the mightiest among the ancient people to bund them across and store and draw for their requirements. They could approach them and pick up small quantities of water from them for the local use only when they were in low flows; but stand out, farther off, for fear of being washed away when they carried the floods. In the deltas there were some feeble attempts to practise inundation irrigation with the fertile silt and the deep moisture left.

Thus, in these circumstances the people evolved the best and most suited methodology of creating small storage tanks in the Deccan plateau of Andhra Pradesh, the maidans of Karnataka and the gently sloping plains of Tamil Nadu. These tanks were formed by just throwing an earth bund across shallow valleys to harvest the rain water and store for immediate use and allow the surplusses to pass down the contour to be picked up by similar tanks formed lower down. Thus, most of these tanks were created in chain and formed the best and most dependable source for irrigation in the commands in between the tanks. From available information it is seen that these were essentially the creation of the people, the beneficiary, with the local chieftains or rulers helping them now and then. They were and are being maintained and managed by the beneficiary themselve as a tradition. The minor irrigation tanks are thus shining examples of participatory approach and also of the adage that 'the small is beautiful'.

As in the neighbouring States of Karnataka and Tamil Nadu, Andhra Pradesh also has got historic evidence of the existence of numerous such minor irrigation tanks from the ancient times. Of course wells for lifting ground water for use in irrigation have been, existing from ancient times and several devices for lifting were also in vogue.

Satavahanas who ruled in Deccan after the Mauryan Empire for about four and half centuries from about BC 230 to about AD 230 were first identified as Andhras. The Ikshavakkus who ruled over the Krishna Guntur region under the Satavahanas and the Satavahanas themselves were much interested in the development of irrigation and agriculture.

The Chola and Pallava dynasties, which ruled parts of the present Tamil Nadu between third and 10th Centuries were frequently extending their suzerainty much farther towards north covering parts of the present regions of Andhra Pradesh. Their efforts in spreading the minor irrigation tank system on these areas to help the conquered villages are clearly manifested in the epigraphical sketches and historical records left by them.

The Rashtrakutas, the Eastern Gangas and the Chalukyas of Kalyani and the Kakatiyas of Warrangal who came after them patronised irrigation but left it in the hands of the beneficiaries for maintenance and management. There is no clear evidence to list all the irrigation structures that have been developed during this period.

A few examples of such ancient structures, some of which are still in use, can however be cited.

8th Century: Gudimallam Tank:

Gudimallam tank carrying a sluice is situated at Gudimallam near Renigunta Railway Junction. It is referred to in an inscription of the Ganga-Pallava King Dantikrama Varman, which registers a gift of land, the income from which was to be spent in removing silt from a second tank in the same village. Those who look after the gift are assured of acquiring the merit of a horse sacrifice (Aswamedha yaga).

9th Century: Avilalieri

This tank is reported to have been created in AD 867 in Avilala near Chandragiri, Chithur district by Vikramaditya Mavalivanarayar a subordinate of Nandhivarma Pallava III.

10th Century : Punganur tank:

This tank near Chittoor was formed in AD 967 by one Anaiyavarman, a subordinate of Parthivendravarman.

11th Century: Almanda Tank

The copper plate grants, registering the grant of land, of the Eastern Ganga King Anantavarman, mentions the consecration of a tank. This tank was perhaps near about Almanda in the Sringavarapukota taluka of the Vizegapatnam (Visakapatnam district).

Raja Tataka

The Achyutapuram copper plate grant of Indravarman, which registers the grant of a village to a Brahmana, refers that this village was situated near the Raja-Tataka tank or "the king's tank". This grant was made on the occasion of the consecration of a tank, which was considered to be quite an important ceremony. The exact location of the tank is not clearly known.

13th Century: Pakhal Lake:

The Pakhal lake, a lovely sheet of water surrounded by dense forest is situated 50 km east of Warangal and was constructed by Jagadata Mummandi, a son of Bayyana Nayaka, Minister of the Kakatiya king, Ganapatideva in AD 1230. This tank has an earthen dam 1311 m (4300 ft) long with a water spread of 237 million square feet. The original ayacut under the source was 3600 ha (8891 acres). However an extent of about 6070 ha (15,000 acres) is being irrigated every year even now. The unique system of this is that number of pick-up weirs across surplus course are constructed by dropping the irrigation channels and picking them up to cater to the tail end needs of irrigation system. This has got added benefit of recycling the regenerated water.

Ramappa Lake

This lake is situated at a distance of 7 km from Warangal and was constructed by the King Ganapati Deva of Kakatiya Dynasty. An inscription of the lake furnished the cyclic year AD 1136 of Sri Mukha Samvatsara Chaitrasudda Asthami, Bhanuvaram corresponding to March 31st, 1213 as the date of construction. This lake has an earthen dam of 610 m (2000 ft.) length with a water spread of 2320 ha (250 million sq.ft). The original ayacut was 638 ha (1577 acres) and is being irrigated under the earthen mats across the seepage course. These mats might have been constructed in the earlier periods of Kakatiya Dynasty only.

Laknavaram Lake

This lake is situated at a distance of 70 km from Warangal. This lake was also constructed in AD 1213 by Kings of Kakatiya Dynasty. This lake was formed by closing three narrow valleys each with a short bund and a hill forming natural bund for length of 610 m (2000 ft.) and with a water spread of 2250 ha (242 million sq.ft.) Further the peculiar aspect of this lake is that there is only one sluice called "Tower sluice". From this sluice the water flows through a natural valley for about one-kilometre up to a pick up earthen dam called "Saddimadugu".

The irrigation channels start from this pick up dam. The original ayacut under the source was 2572 ha (6353 acres) and subsequently the ayacut increased to 3522 ha (8700 acres). The present actual irrigation is 4130 ha (10,200 acres).

Bayyaram Cheruvu

This tank is reported to have been formed in the first quarter of the 13th century by Mailambika, daughter of Kakatiya Mahadeva and Bayyamamba the younger sister of Ganapatideva.

Narayanaputteri, Viranarasingadeva putteri

These tanks near Puttur in Chittoor District are said to have been created by the Chola King Raja Raja III (AD 1216) who did not spare efforts in increasing irrigation facilities and creation of storage tanks.

The significant contribution made by the Kakatiyas of Warrangal (AD 1000-1326) creating new irrigation structures however require special mention.

The areas, where there was no supply of water from the rivers like the Tungabhadra, the Pennar (north), the Krishna and the Godavari, had necessarily to depend on the storage reservoirs and deep-sunk wells. Lithic records, literary compositions and the remains of extinct irrigation works of the period bear ample testimony to the care with which the irrigation facilities were provided by the Kakatiyas. Inscriptional evidence shows that there existed a large number of artificial tanks with suffixes such as samudra, cheruvu, and kere or kereya. Here the suffix samudra may stand for a large reservoir; whereas the village tank was known either as cheruvu or teruvu and its Kannada equivalent kere was also used to denote a village tank.

It must, however be noted that the State undertook no direct responsibility for the construction and maintenance of irrigation works. Nor do we find mention of a public works department or of officials appointed for the purpose in the records of the period.

However, influenced profoundly by the belief that such an act of charity would acquire religious merit, the Kakatiya rulers, the nobles and officials, and wealthy people busied themselves in the construction of tanks and thus the whole of the Kakatiya country was studded with several irrigation projects of varying sizes. The Motupalli inscription of Ganapatideva records that Prola I (AD 1030-1075) excavated a tank called Kesaritatakam, which was like "representative of the ocean and the collection of all waters that were originally created". Beta II (A.D.1075-1110) is the first Kakatiya ruler to embark on the construction of large irrigation works. He, according to inscriptions, constructed two tanks called Setti -kere and Kesari-samudra and is said to have performed in that connection the ceremony of Varuna-pratista (the installation of Varuna, the presiding deity of the element - water), to ensure that his reservoirs might always be full. The Hanumakonda inscription of Rudradeva (AD 1084) states that he, having destroyed the forest and fort of the king Choda-daya, dug an enormous and beautiful tank in the centre of the city. An undated record from Kazipeta mentions that Prola II (A.D.1110-1158) constructed a tank known as Sarisamudra.

Among the Kakatiyas, Ganapatideva (A.D.1199-1262) was the most prominent ruler who was responsible for the construction of several irrigation works in different parts of the Kingdom at Nellore, the Telugu-Chola capital in the south, at Ellure in the Krishna-Godavari delta, the Ganapatipuram to the south-west of Ekasila-nagaram (Warrangal), and at Vidisa to the west of the same city. The magnificent lake at Pakhal, about 30 miles north of Warangal is an outstanding testimony for his abiding interest in the tank building activity. According to a pillar inscription, which stands in the middle of the bund, the lake was the fruit of effort put forth by Jagadala Mummadi, the younger brother of Ganapatideva. This lake is still in good condition catering to the needs of the people in that area. The Ramappa Lake and the Ghanpur Lake were also founded or ascribed to the reign of this ruler. The Hanmakonda Niroshtyakavya inscription states that

"In the country (Andhradesa) are hundreds of tanks and thousands of rivulets, and they indeed appear to be the ocean and its consorts respectively".

Besides the rulers, the chieftains and nobles vied with one another in the construction of tanks, canals and sluices. In this direction the interest shown by the members of the noble families like the Malyalas and the Recherlas was spontaneous and tremendous. Similarly the Kayastha chieftains increased the agricultural prospects in the districts of Cuddapah and Kurnool in the south by the provision of new irrigation facilities. The Tripurantakam inscription dated A.D.1923 (Kurnool) states that Ambadeva constructed three tanks, the first one called Kumarasamudram and the other two tanks went by the name Tirupurasamudram. Ghodeyaraya - Gangayadeva, the Mahapradhani of Ambadeva, caused the construction of two tanks called Ambasamudram in the name of his master at Bali (Obali) and Utukurru respectively. The two canals, Rayasahasramallakalva from the bed of the Cheyyaru River at Lembakka and Ganda-pendara-kalva at Tadlapaka, were excavated during his time. Likewise, the Rayaguru of Ambadeva, Santasiva Desika caused a tank called Ganapa-samudram to be constructed at Ganapapuram.

In addition to the above, canals were also excavated to feed the tanks from the rivers. The two canals mentioned were evidently dug from the tank to conduct water to the fields. Even otherwise, the tanks received the supply from the monsoon rains collected in the catchment area through streamlets called vagus. To this class may be added the Museti-kalva, Antaragana-kalva, and Krishnaveni-kalva. The mention of Ana-kalva and Kattungommu-kalva in the records signify that they were temporary embankments of earth and stones called anas and Kattungommus. Subsoil water, from springs and uta-kalva or canals dug deep into the earth, was also utilised to fill the tanks in certain areas. Such of the tanks fed by uta-kalva were known as the uta-tatakas. Of course, well irrigation was practised and it was confined to individual parcels of land. To regulate water issuing from the tanks, sluices (tumus) were erected at appropriate places.

During the Kakatiya period, the information regarding the method of construction followed and practised by the tank builders was scanty and so our knowledge in this respect is very poor. However, different methods must undoubtedly have been employed varying with the terrain and locality. In the level plains the embankment, the most important piece of work in the construction of a tank, was always raised by throwing up earth all around the tank bed. In the hilly tract, the task was much easier than in level country, and the group of hills could be easily joined together, as for instance at Buddha-puri, by means of a bund made of stones piled on one above another.

Village or gramam had evolved as the best decentralised unit of administration in southern India from ancient times. Agriculture, the main occupation, was quite conducive to serve a simple local administrative unit with not much of a need for economical and commercial linkages with other areas. Each village was self-sufficient and had in its fold the gramani or the headman of the village who looked after the affairs of the village and was also highly respected by the inhabitants. The carpenter, the potter, the washerman, the barber, the cobbler, the blacksmith, the goldsmith and similar artisans also lived along with the farmer families each following his own avocation and contributing to the welfare of the village community. The irrigation tank and the village temple occupied the central stage in the common purpose activity of the village and were maintained and managed through collective responsibility and individual contribution in kind, cash or labour. This was the scenario of village life in ancient times in Andhra Pradesh too.

More often, the common villager was neither clear nor bothered about the political ruler or chieftain who also changed frequently.

While this tract was under the sovereignty of Mouryas, Satavahanas, Pallavas and Kakatiyas, Chalukyas, Rastrakutas, many local principalities having control over considerable portions ruled with benevolence. Some of them were Renati Cholas, Telugu cholas, Deva Cholas, Banas, Yadavas, Vidumbas, Nolambas, and Kayastas etc. They ruled according to "Dharma" of "Puranas".

From the survey of their capitals and the areas held by them it appears that they were really not rulers. They held only local leadership, of course, maintaining their own personal "Senas" who, when called upon were joining the king and participating in the wars of the empire. There were many occasions when some of these Chiefs declared independence whenever the empire became weak, perhaps not with the ambition of building up an empire or kingdom for themselves, but only to safeguard their position, and subordinate themselves to any one who ever might emerge as the over lord.

The high sounding titles of these local Chiefs which came to light from the inscriptions and literature may have to be treated, perhaps, as only poetic exaggerations. The kings, as well as local Chieftains were never interfering with the activities of the people. As was the case with the Eastern empires, men accepted the State as they accepted the weather. There were no politicians because there were no public affairs. Government was the affair of the rulers. The village was almost a homogeneous and self-contained unit and the village panchayat was looking after the arrangements for all necessities of the village. It was therefore immaterial and the people were just not bothered who the king was. Any change of the dynasty of the king or the local Chieftain, never affected the village life as long as one sixth of the produce (generally) to be paid to the king, was not altered, Unless the ruler out stepped his limits of "DHARMA" especially in the collection of land tax, there was no murmur from the villagers. Even during war, the operations were limited to forts and cities.

The cultivators promptly paid the traditional one sixth of the produce to the State, which the village headman collected and remitted. The rich among them contributed liberally for common activities like desilting the tanks, strengthening the bunds and attending to the repairs of the structures besides the normal divisive collection from all the beneficiaries. Benevolent among the rulers was paying attention to creating new irrigation works and structures. The inscriptions, epigraphical texts and other historical evidences generally lead to the above surmises. Number of donations received and the honouring of the donors by the Kings are also seen mentioned in some of them.

It appears that such private effort was forthcoming only in cases where the people were put to much hardship for want of proper irrigation facilities, due to the local source having fallen into disrepair. In such cases it was not unusual that the ryots affected by such inconvenience made arrangements among themselves to provide the necessary labour for deepening the riverbeds or removing the silt.

If more than one person attended to the repairs, the water from the source was enjoyed in proportion to the expenses incurred by the different parties. "Thus according to an inscription of AD 1410 the annual repairs and other expenses in connection with the wells and other irrigation sources formed under a channel were shared proportionately and it was agreed that the water of the channel was to be distributed in the same proportion". Fueds and hostilities between adjacent villages or between hostile factions were often responsible for damage to irrigation works. Very often pacts were made not to damage trees, wells and irrigational works. Breach of agreement was punishable with the confiscation of a portion of the lands of the culprit to the local temple. A damage of this kind was considered as heinous an offence as the destruction of a child in embryo or man-slaughter. The offender was to be drowned by tying a heavy stone round his neck.

This was in general the scenario of village life during the periods of rule of the Satavahanas, the Pallavas, the Rashtrakutas, the Eastern Gangas and the Chalukyas of Kalyani till about the 10th Century AD.

In the Kakatiya kingdom, there was no separate department to deal with the maintenance of various irrigation works. However, the village was managing the irrigation net work. The village was the basic unit of the whole organisation. A body of village officials collectively called the "ayagars" was managing the affairs of the village. They were: Karnam, pedda-kapu or reddi, talari, purohit, blacksmith, goldsmith, carpenter, potter, waterman (vetti), barber, and shoemaker. The karnam, besides maintaining the revenue accounts of the village, kept the village plan, its boundaries, extent of rent-free lands, groves, gardens, crematories, tanks, wells and canals. He was associated with the headman of the village whose duty was the collection of land revenue due to the State. The vetti or waterman among other tasks, kept a watch over the tank-bund, and regulated the flow of water for irrigating the fields. In some villages the name nirkattu or waterman is found mentioned. For the services rendered by the "ayagars" they were given rent-free land by the villagers or by the State.

CHAPTER 6

IRRIGATION DEVELOPMENT AND MANAGEMENT IN THE MOHAMMEDAN ERA

The Mohammaden Era in India can be taken to have started in the beginning of the millennium with the raids and plundering of the Ghazni Mohammed between AD 997-1030. But by and large the Deccan was not affected by the Mohammaden invasion till 1294 when Alauddin Khilji made the first invasion south of Vindhyas into the Deccan area. His general Malik Kafur penetrated deep south upto the City of Madura plundering and killing thousands of inhabitants and defeating many of the Chieftains and Rulers of the several dynasties holding sway in parts of the Deccan and South India.

From then on there was chaos and instability in the Deccan area with the several self nominated Chieftains holding sway over parts of the area until the Vijayanagar empire got established with the founding of the city of Vijayanagar on the southern bank of the river Tungabadhra by the two brothers Harihara and Bukka and the rival Bhamani Kings ruling over parts of the Deccan concurrently.

The Vijayanagar Empire that ruled Deccan was established with the sole objective of Hindu Renaissance in the South. But this Empire had all the time to struggle against the onslaught of the Muslims of the Bhamani Kingdom and wage wars against them. Also, it was during this period that the European traders - the Portugese, the Dutch, the Danish, the French and the English came in, who also meddled in the internal affairs while they were themselves fighting for supremacy, the English gaining a victory over all the others in due course. The Map 6 - 1 shows the extent of the Vijayanagar Empire in its hey-days.

Both in the period of the greatest of Vijayanagar rulers Sri Krishna Deva Raya (AD 1509-1530) and later when the rulers of the Aravidu dynasty ruled over parts of the Empire, till about 1650 their concentration in administration has been on ensuring peace in the villages and building temples and choultries. Krishna Deva Raya fixed and regularised the sources of revenue without oppressing the subjects, which was followed long after. The administration was mainly through Naiks and other feudatory chiefs who paid the tributes to the Empire. Large endowments were made for the development and maintenance of temples, particularly the Vishnu temples for daily worship, festivals etc. Brahmins were well looked after and were given grants. Similar grants were also made for other temple functionaries including the barbers.

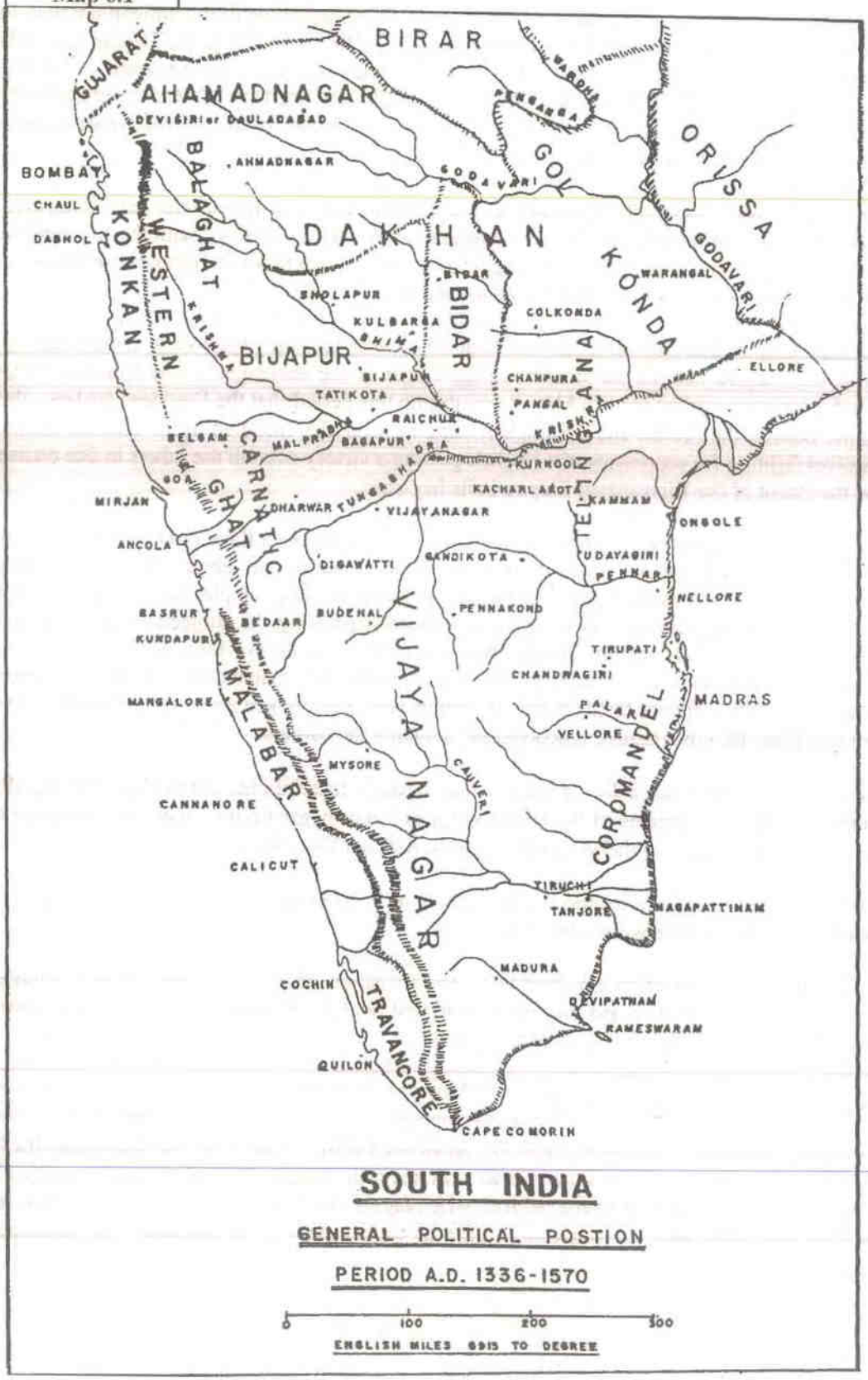
The historians who could trace a lot of information through Inscriptions, chronicles, and travellogues have recorded many of the achievements of the Hindu kings of Vijayanagar Empire, their patronage for arts, musics etc., particularly of the greatest of the Vijayanagar kings, Krishna Deva Raya.

Krishna Deva Raya built a gopura for the Hampi Temple in Vijayanagar; he built the Krishnaswamy temple and also Hazara Ramaswamy temple within the palace itself.

Krishna Deva Raya paid attention for improving the irrigation of the dry lands around Vijayanagar. He constructed in 1521 the great dam and channel at Korragal on Tungabhadra and the Basavaiah channel both of which are still in use and are of great value to the country.

Another great irrigation work of his was the construction of an enormous tank or dammed up lake at the capital which he carried out taking the help of a Portugese engineer Joa de la Ponta whose services were lent to him by the then Governor General of Goa, ALFONSO DE ALBUQUERQUE with whom he maintained the best of trade relation both in war and peace. This is the lake we now see near the town Hospet at that time called Nagalapura. The king built this town in honour of his beloved wife Nagala Devi and it has been his favourite residence for long. This lake was meant both for irrigation and for the water supply of Nagalapura. This is supposed to have been completed around 1520.

Map 6.1

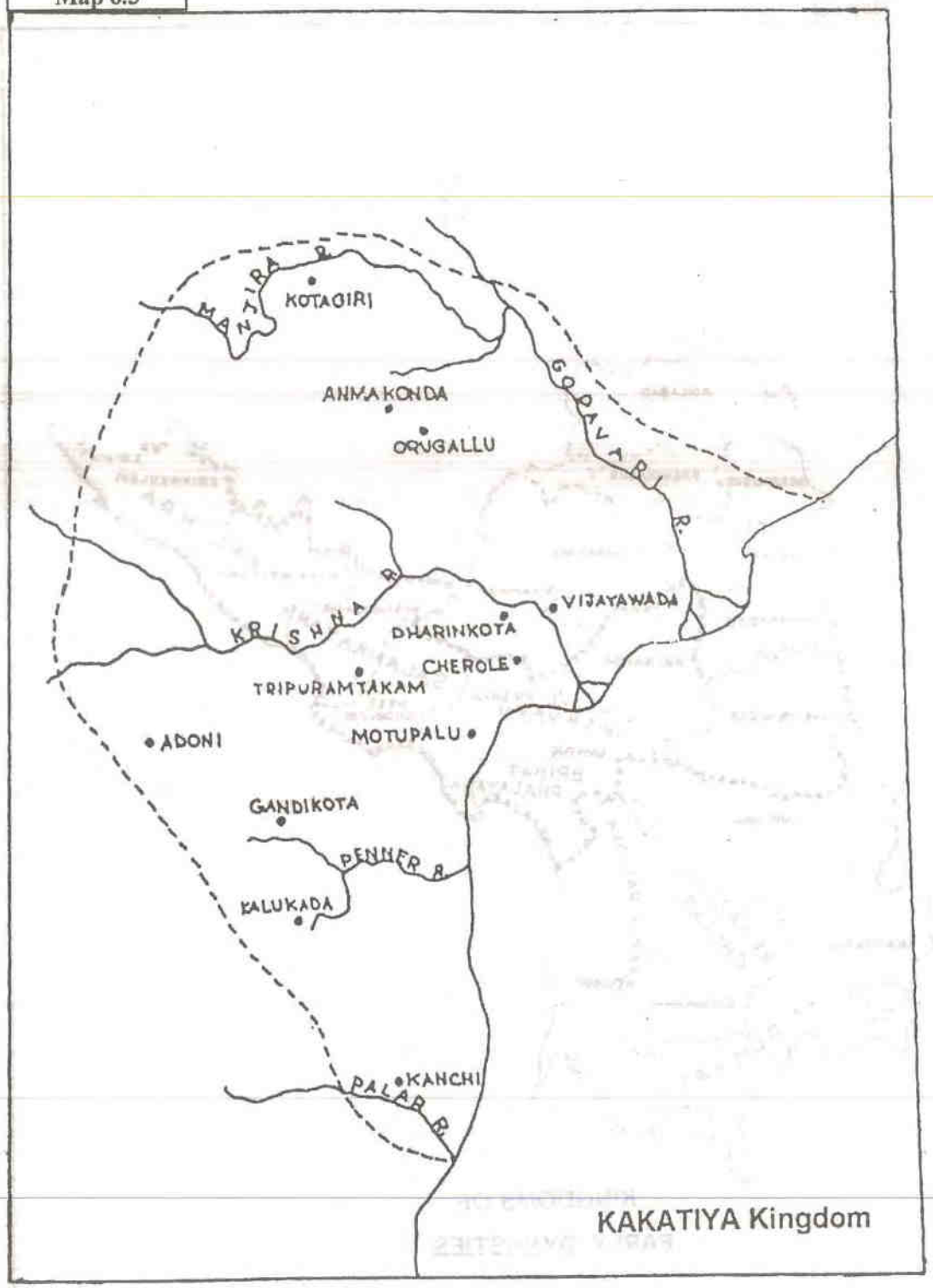

BIRAR
GUJARAT
AHAMADNAGAR
DEVIGIRI or DAULADABAD
WARDHA
PENGANGA
GOA
ORISSA
BOMBAY
AHMADNAGAR
GODAVARI
CHAUL
DABHOL
KONKAN
WESTERN
BALAGHAT
DAKHAN
KONDA
WARANGAL
GODAVARI
BIDAR
SHOLAPUR
KULBARGA
COLKONDA
KRISHNA
BIJAPUR
BHIMA
BIJAPUR
CHANPURA
ELLORE
TATIKOTA
PANGAL
RAICHUR
KRISHNA
BELGAM
MALPRABHA
BAGAPUR
TELINGANA
KURNOOL
GHATS
CARNATIC
KACHARLAKOTA
KAMMAM
MIRJAN
DHARWAR
TUNGABHADRA
VIJAYANAGAR
ONGOLE
ANCOLA
DIGAWATTI
GANDIKOTA
UDAYAGIRI
PENNAR
NELLORE
BASRUR
BEDAAR
BUDEHAL
PENNAKOND
KUNDAPURA
TIRUPATI
CHANDRAGIRI
MANGALORE
MALABAR
VIJAYANAGAR
PALAKAL
MADRAS
VELLORE
MYSORE
CAUVERI
CORMANDEL
CANNANORE
CALICUT
TIRUCHI
NAGAPATTINAM
TANJORE
MADURA
COCHIN
TRAVANCORE
DEVIPATNAM
RAMESWARAM
QUILON
CAPE COMORIN
SOUTH INDIA
GENERAL POLITICAL POSTION
PERIOD A.D. 1336-1570
0
100
200
300
ENGLISH MILES 69.5 TO DEGREE

Map 6.2

KINGDOMS OF
EARLY DYNASTIES

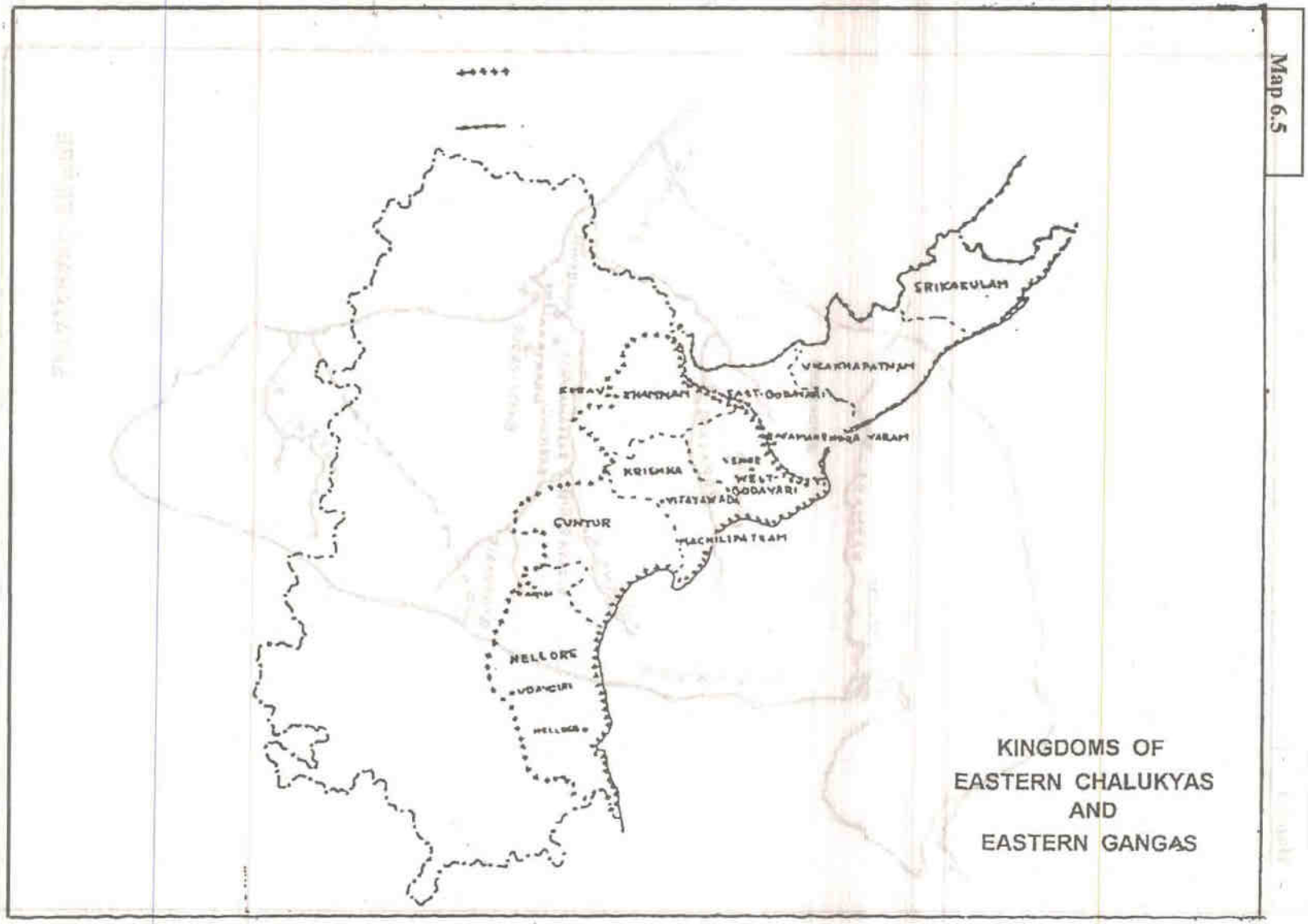
Vishnukundin Dynasty

Map 6.3


MANJIRA R.
KOTAGIRI
ANMAKONDA
ORUGALLU
GODAVARI R.
KRISHNA R.
VIJAYAWADA
DHARINKOTA
CHEROLE
TRIPURAMTAKAM
ADONI
MOTUPALU
GANDIKOTA
PENNER R.
KALUKADA
KANCHI
PALAR R.
KAKATIYA Kingdom

Map 6.4


BARUKACHHA
NARMADA R.
VIDARBHA
MULAKA
GODAVARI R.
ASMAKA
ADARANTA
KALINGA
KRISHNA R.
VIJAYAPURI
DHANYAKATAKA
AMARAVATI
BHATTIPROLU
BANAVASI
CAUVERI R.
SATAVAHANA EMPIRE



Map 6.5

KINGDOMS OF
EASTERN CHALUKYAS
AND
EASTERN GANGAS

The construction of this tank has been referred to by Mr.DOMINGOS PAES, a Portugese traveller who has given a long account of what all he saw when he was in Vijayanagar probably between 1520-22 in his chronicles sent to Portugal about the year 1537. It reads thus

"Besides this the king made a tank there, which, as it seems to me, has the width of a falconshot, and it is at the mouth of two hills, so that all the water which comes from either one side or the other collects there; and, besides this, water comes to it from more than three leagues by pipes which run along the lower parts of the range outside. This water is brought from a lake which itself overflows into a little river. The tank has three large pillars handsomely carved with figures; these connect above with certain pipes by which they get water when they are to irrigate their gardens and rice-fields. In order to make this tank the said king broke down a hill which enclosed the ground occupied by the said tank. In the tank I saw so many people at work that there must have been fifteen or twenty thousand men, looking like ants, so that you could not see the ground on which they walked, so many there were; this tank the king portioned out amongst his captains, each of whom had the duty of seeing that the people placed under him did their work, and that the tank was finished and brought to completion.

The tank burst two or three times, and the king asked his Brahmans to consult their idol as to the reason why it burst so often, and the Brahmans said that the idol was displeased, and desired that they should make a sacrifice and should give him the blood of men and horses and buffaloes; and as soon as the king heard this he forthwith commanded that at the gate of the pagoda the heads of sixty men should be cut off, and of certain horses and buffaloes, which was at once done".

Another Portuguese traveller FRANNO NUNIZ had also sent his chronicle written probably in 1535-37 in which he talked about the rule of many of the Vijayanagar rulers and referred to the contribution of the same Nagalapura tank as follows.

"This King also made in his time a lake for water, which lies between two very lofty Serras. But since he had no means in the country for making it, nor anyone who could do it, he sent his emissary to Goa to ask the Governor to send some Portuguese masons, and the Governor sent him Joao de la Ponte, a great worker in stone, to whom the King told how he wanted the tank built. Though it seemed to this man (mestre, modern maistry) impossible to be made, nevertheless he told the King he would do it and asked him to have lime prepared, at which the King laughed much, for in his country when they build a house they do not understand how to use lime. The King commanded to throw down quantities of stone and cast down many great rocks into the valley, but everything fell to pieces, so that all the work done in the day was destroyed each night, and the King, amazed at this sent to call his wise men and sorcerers and asked them what they thought of this thing. They told him that his idols were not pleased with this work, it being so great and he giving them nothing, and that unless he spilled there the blood of men or women or buffaloes that work would never be finished. So the King sent to bring hither all the men who were his prisoners, and who deserved death, and ordered them there to be beheaded and with this the work advanced. He made a bank across the middle of the valley so lofty and wide that it was a crossbowshot in breadth and length, and had large openings; and below it he put pipes by which the water escaped, and when they wished so to do they closed these. By means of this water they made many improvements in the city, and many channels by which they irrigated rice-fields and gardens, and in order that they might improve their lands he gave the people the lands which are irrigated by this water free for nine years, until they had made their improvements, so that the revenue already amounts to 20,000 pardaos".

Similar tanks were also formed by other less known kings. For instance the Ananthasagara or Porumamilla tank is said to have been constructed in 1369 by the Prince Bhaskara alias Bhavadura of the first Vijayanagar dynasty. It is situated about 4 km to the east of the village called Porumamilla in the Badvel taluk of Cuddapah district. The tank is elongated in shape with a 12 km long bund and a 4 km width of waterspread. The bund consists of four natural hills connected by 3 short earthen dams, riveted with Cuddapah slabs. The western flank thus consists of practically the range of hills, which runs north and south between Porumamilla and Badvel. At the deepest portion the bund is 3.7 m (12 ft.) wide at the top and 45.7 m (150 ft.) at the bottom and about 10 m (33 ft.) deep. The tank has two sources of supply- one natural and the other artificial. The latter was constructed only recently. The natural feeder is a stream called the Maldevi River. The reservoir is provided with four sluices, two of which have been repaired in recent times and provided with screw gear shutters and there are five weirs.

The inscription in two slabs set up in front of the ruined Bhairava temple at Porumamilla throws ample light on the tank building activity of that time. The inscription gives complete details of this tank and place and time of construction. It is also stated that for two years, 1000 labourers were working daily on the tanks and the dam, and 100 carts were engaged in getting stones for walls, which formed a part of the masonry work. Besides, the author mentions the twelve Sadhanas (means) of Porumamilla tank and six doshas (defects) of tanks in general.

The following is the translation of the verses and lines giving these sadhanas (means) and doshas (defects).

Sadhanas

i A king endowed with righteousness, rich happy (and desirous of acquiring) the permanent wealth of fame
ii Brahmana learned in hydrology (pathas sastra).
iii ground adorned with hard clay
iv a river conveying sweet water (and) three yojanas distant (from its source).
v the hill parts of which are in contact with it (i.e., the tank)
vi between these portions of the hills a dam (built) of a compact stone wall, not too long (but) firm
vii two streams (sringa) pointing away from fruit (giving) land (phala-sthira) outside,
viii the bed extensive and deep
ix a quarry containing straight and long stones
x the neighboring fields, rich in fruit (and) level
xi a watercourse (i.e., sluices) having strong eddies (bhrama) on account of the position of the mountain (adristhna)
xii a gang of men skilled in the art of its construction.

with these twelve essentials an excellent tank is easily attainable on (this) earth.

Doshas

i. Water oozing from the dam,
ii Saline soil
iii Situation at the boundary of two kingdoms
iv Elevation (kurma) in the middle (of the tank)bed
v Scanty supply of water and extensive stretch of land (to be irrigated)
vi and scanty ground and excess of water;

This shows that the science of building dams was well advanced in those days.

Phirangipuram tank near Phirangipuram in the Guntur district was built by the Reddi Princess Suramitra between 1409 and 1410.

Haridra Tank is said to have been built in 1410 to get its feed from Haridra river.

An interesting record of 1410 refers to an irrigation channel, built during the reign of Vijayanagara King Devaraya I son of Harihara II. The river Haridra was dammed, by certain Brahmanas at their own expenses and a channel was also led through the same land. This was within the boundary of a temple. It was laid down that of the land irrigated, two thirds should be for the God and one third cost for the repairs were also to be met in the same manner and similarly the distribution of water. Some time later the dam got breached and was rebuilt. This does not seem to have been built in brick and mortar. The Brahmans were in great distress. The unlimited merit of rebuilding it was explained to a military officer who agreed to defray the expenses. It was accordingly restored in 1424.

The Anantasagaram tank in Nellore district was constructed by "Rayasam KONDAMARSHY" in 1519 to irrigate an ayacut of 1600 ha.(4,000 acres). The storage capacity of the tank is only 14 Mcum (0.5 TMC) but below the tank there are about 11 to 12 anicuts. The lower reach farmers use the drain itself as an irrigation canal. The drainage water leaving the fields gets collected in the drain and is re-used for irrigation. If the tank gets filled up, paddy can be grown in about 4048 ha.(10,000 acres). The distribution system is completely managed by farmers.

The historians who are able to trace with great effort the genealogy of the several dynasties which came up, held sway and disappeared with time, and their kings and successors have not been able to trace the history of the

several developments undertaken for the well being of their subjects except that the culture and the living conditions of the people are mentioned in passing.

This may be due to the reason that for most of the time during this period the common man was left to fend for himself and the rulers were engaged in defending the country against aggression or in expeditions for expansion of the empire so that additional revenue could fill in their coffers.

In respect of development of irrigation, it was essentially a community effort. Well irrigation has been all the time and can be only an individual effort. The tank irrigation was the mainstay for the village community. Several thousands of them spread over the vast Deccan plateau had already been formed much earlier than the Mohammedan era and here and there where possibilities existed for construction of larger storages, the benevolent rulers lent their help and got them built seeking the expertise wherever available as referred to in the above narration. A mention on the way these tanks were maintained and tank irrigation was administered will be relevant here.

The tank system devised and laid-on ground not only served irrigation for the village lands but also helped in stabilising the social life in the village. Desabandha Inams were introduced during the Vijayanagar period assigning irrigated lands to the priest, purohit, temple artists, like devadasi, drummers and musicians and other village servants like the barbers, the blacksmith, the dhobis, the neeruganties in the village who were maintaining not only the irrigation system but also the common needs of the village. This stayed for long as the most effective inbuilt system for the integrated social life of the village hereditarily.

During wars, men, women and children not even connected with the army were being killed in large numbers without any mercy. Properties and crops en route were being taken away without compensation (except upto Chola period). They never hesitated to burn the villages. But be they Hindus or Muslims, during war or peace, no irrigation work was touched, disturbed or destroyed. The Kings engaged in war recognised that the irrigation works alone could help sustain rehabilitation and recoup the treasury. Such was the great influence of the irrigation works on the rulers in those days.

The maintenance and repairs of irrigation works received as much importance as their construction. The tanks, channels, sluices and dams which were not built of brick, stone and mortar required great care in periodical cleaning to maintain them in good condition. There was danger of the openings getting choked and consequential damage to the work itself. Frequent removal of silt also was most essential. These works had to be repaired after excessive rainfall which damaged the embankments. Maintenance of such beneficial works was considered a meritorious act. A passage in an inscription of 1413 states: "A ruined family, a breached tank or pond, a fallen kingdom, whoever restores or repairs a damaged temple, acquires merit fourfold of that which accrued from them at first",

Boats were used to remove the silt from dams. An inscription of the year 1367 mentions how a tank in the Arrasikere taluk was maintained. "A buffaloman with his cart was permanently appointed for such work and it was ordered that for oil for wheel, grease, crowbar, pickaxe, etc., for every cart load the original tenants had to pay two Taras and likewise for every load carried of arecanut, betel or oranges had to pay at the same rate".

Removal of silt in a tank was made from endowments given specifically for the purpose. For the repair of breaches in tank-bunds and other accidental damages beyond the control of the villages, money was often obtained from private or State donation. An inscription states: "According to the command of Udaiyar Devarasa Udaiyar, one Akkadeva made arrangements to have the silt removed once a year from the tank at Tenmahadevamangalam in North Arcot. To meet the expenses a small quantity of paddy on the cultivable land collected from the villagers was used". In another record four carts for one tank and two for another are said to have been kept for putting the earth on the bunds annually and keeping them in good condition. In 1375 one Yadava-Narayana gave to all the Brahmanas of Lakshminarayanapura, the property of those who died without heirs in the village for the maintenance of the tank of the place.

A part of the income from dams and canals was used for their maintenance. The right of fishing was leased to bidders. The income was spent on the maintenance of the dams including their deepening by removing silt.

There were special instructions for a fisherman who was in charge of this work: "He should look after the dam and the channel, so that the water flows to the pond without running to waste and in case there was any deficiency of water in the dam and the pond, inform the temple authorities and the villagers of this and with the help of unpaid labourers (vettival) of the village raise the dam and take care of it: that he should receive for this work ma of tax-free land (specified) tune and four nali of paddy from the cultivated lands of the village and a bundle of unthrashed paddy containing about a kuruni: that he should supply the temple authorities with one pady or kari every day: that he should pay annually a channel tax (vaykkal pattam) of six panam: that in place of Pasipattam he should defray the expenses of a festival in the temple: and that in case a large quantity of fish was obtained when removing silt from the pond he should supply kari in addition to the stipulated quantity."

Repairs were never neglected for a long time. Local administrative bodies like the village assembly are often mentioned as making provision for the maintenance of irrigational works. Managements of local temples also looked after their maintenance. The interest in their endowments is often mentioned in inscriptions as having been used for this purpose. In cases where no endowments existed or where they were not properly managed and where no private individuals were charitable enough to undertake repairs at their expense, the village assemblies could grant some land either near the tank to be repaired or from the waste land of the village, over which they seemed to have enjoyed undisputed ownership as an inducement to undertake the work. In course of time the cultivable waste of villages must have dwindled down and in cases where no private enterprise or charity was forthcoming to repair the tanks, it must have been undertaken at the joint expense of the villagers, as they were all to benefit by it. Thus apparently arose the custom of "kudimaramath" in Southern India. According to the Madras Manual of Administration this term means "contribution of labour for petty repairs to irrigation works, which the ryots are bound to give by immemorial custom. There is a law now for enforcing it or collecting its value".

It would be of interest to know how the maintenance and repairs were supervised. In each village there was a committee for the "supervision of Irrigation works". At Uttaramerur in Chingleput district in Tamil Nadu there are two inscriptions belonging to the beginning of the 10th century, which give us full details about the contribution of village assemblies and the mode of selection of committees of which the Committee for "supervision of tanks" was one. This body consisted of six members who held office for 360 days and then retired. If any one who served on the Committee was guilty of any offence, he was removed at once. The duties entrusted to each of these are nowhere clearly laid down. But it may be presumed that all endowments made in favour of tanks were entrusted to the Committee for supervision of tanks and the members invested the money endowments in the best possible way. They perhaps utilised the money in reclaiming wasteland and cultivating it, in order to pay the interest on the endowment from the produce. They had apparently to look after the cultivation of lands granted to tanks. The income from both these sources was applied to meet the charges for the annual or periodical removal of silt in tanks and for repairs so far as funds would permit. Fines to be credited to the tank fund were levied by them.

In respect of distribution of irrigation waters to the various beneficiaries several models were in practice of which a few can be cited here.

River channel system (otherwise called spring channel system) has been the mainstay for most of the villages on either banks of a stream or river. This is an ancient system of drawing water from the river or the riverbed, at a flatter slope than the slope in the river to irrigate river marginal lands away from the river. Often these channels get obliterated with floods. As the water table in the riverbed falls, the channel has to be deepened. These channels have to be protected also from high velocity winds. During the crop season, the channels may have to be redug or deepened. This requires manual effor t. The ayacutdars elect `Pedda' and `Chinna'. The Pedda is President like and the Chinna is secretary cum treasurer like. They have to assess the needs and requisite labour from the farmers proportionally and get the work done. Every farmer co-operates. One who fails may have to face social boycott and may not get water to his fields. Every day the farmers walk along these spring channels from the source to their respective lands and their diversion and use of these waters to their individual holdings is carried out through mutual consent, the Pedda and Chinna however settling disputes that may arise then and there .....

In many of the tank systems and small diversion systems the distribution was taken care of by Neeruganti. Neeruganti system was introduced ages back. A low paid employee distributes available water proportaionately to all the fields in the command of a source. He is paid by the farmers proportionate to their holdings. His employment is heriditory. He has to please all and displease none. He is the best diplomat by force of circumstances. Any farmer, may be a big landlord, otherwise mighty in the village, cannot wet his fields and cannot interfere. The system functions in spring channels etc., and in few pockets in major irrigation projects.

Many tanks have supply channels from the nearby streams. They are open head channels without any diversion work across the stream. On noticing the clouds, the farmers rush with abundant labour force and cattle, heap the stream bed sand into a great heap across the stream, which diverts the first flows into the tank through the open head supply channel and gets washed away with higher floods. This work of forming 'Punu' (diversion bund with bed sand) is repeated as many times as becomes necessary. This could be achieved through collective effort only. Some of the open head channels are provided with anicuts and head sluices in the recent times. Punu system is still being practised. This is similar to the Korambu system adopted in Tamil Nadu State.

All the land belonged to the king at one time. All farmers were only cultivators, individually or collectively. There were times and places when land was redistributed among the families in the village once in five years or so. The population being less, this could be possible. Traditions developed to the extent of leaving common grounds for grazing for anybody's cattle and small irrigated land (say about 100 acres) as common production areas. This is the way collective farming and cattle raising was being done. The vestiges of these collective institutions still exist here and there. Where with a dependable water course, a block of land (about 100 acres) could be irrigated, the cultivation is being carried out by the equal input of labour by all families irrespective of caste, religion, trade or status and the produce also divided among all in the same way. This is called 'Gonchi' system. Such systems are still in vogue in Rayalaseema. This ancient traditional system needs in-depth study.

The role played by the Tirumala Tirupathi Devastanam in developing irrigation in about 150 villages has no such parallel in the country. The investment technique is far superior. The temple is benefited, the farmer is saved and enriched; the donor has the religious merit and financial gain. This is a three-in-one system. 'A' donates rupees 'P', which is invested for the irrigation work in the lands of 'B'. Half the additional produce due to irrigation goes to the temple and the other half goes to 'B', the cultivator, under 'Melvaram' and 'kudivaram' system. The half share received by the temple is invested in the preparation of prasadam and offered to the Lord. One fourth of the prasadam is handed over to the donor 'A'. He is at liberty to give away the due share of prasadam free to anyone or sell. If he sells, he gets every year more than his capital donated once. This is a financial instrument of the medival ages that stayed on in some form or other till now.

The quantum of water received for storage and the ayacut served vary from year to year. The variation is much higher in less rainfall areas. To adjust to these variations, certain traditional arrangements were made. The ayacut is divided into two areas. One area receives water every year and the other area receives water only in good rainfall years when excess water is available. Such secondary area is styled as 'Teervajasti'. The storage spaces i.e., the tank bed area, if not full then the area is permitted to raise crops. When the water in the tank lowers down and recedes crops are raised in a portion of the tank bed area with residuary moisture. These areas are named as 'Neeti munaka pattas'. In some cases the higherup areas of the tank beds are grown with babool trees which survive under partial submersion. In few cases melons are grown in early summer.

CHAPTER 7

IRRIGATION DEVELOPMENT DURING THE BRITISH PERIOD (AD1800 - 1947)

Though irrigation was being practised in India long before the advent of the British on the Indian Scene, the fact was that the early irrigation works with a few exceptions, were not properly maintained, nor was there any sustained effort to extend irrigation to new areas. The efficiency of their maintenance and operation rose or fell with the rise or fall of the fortunes of the rulers concerned. In the North, the canals in the Punjab, Sind and Uttar Pradesh had generally fallen into disrepair and disuse and only a few remnants of the old canals could be incorporated into the canal systems, which were constructed in the nineteenth century. These were parts of some of the inundation canals from the river Indus in Sind and west-Punjab (now in Pakistan), some portion of the Western and Eastern Yamuna canals, as also the Hasli canal in central Punjab, which took off from the river Ravi. The most notable of the ancient irrigation works, which could be utilized, was the Grand Anicut on Cauvery River, which is still functioning, in an improved form, as a river surplusing work at the head of the Cauvery delta canals.

The first efforts of the British were therefore towards the improvement and utilisation of old indigenous works, rather than the construction of new irrigation projects. Three such schemes were undertaken viz.

a. the Western Yamuna canal which utilized the old Feroz Tughluk canal

b. the Eastern Yamuna Canal which also utilised an old, almost abandoned canal on the eastern or left bank of the Yamuna river and

c. The Cauvery delta system, which utilized the old Grand Anicut and the old canal alignments.

All these three schemes proved highly profitable in spite of many shortcomings in designing the works, which had to be rectified later on. It must not, however, be forgotten that these were pioneering works and there were practically no precedents for such large-scale works anywhere in the world from which to learn. The science of the flow of water in open earthen channels was not yet born and those early engineers had to feel their way along. The mistakes they made and the lesson learnt therefrom served as foundations and models of subsequent ventures in the field of irrigation. None of the above mentioned three canals were given a permanent head works, except the Cauvery delta system, where the Grand Anicut already existed. In fact, the first headwork proposed for a canal system was the Godavari Anicut constructed during 1847-52 for the Godavari delta system, which is considered to be a landmark in the history of irrigation in India. Encouraged by the satisfactory financial results of the three early canal systems and the protection they afforded against scarcity conditions and famines to the tracts irrigated by their waters, the Government of India embarked upon such large irrigation projects which have been styled "capital works", the four most important works being the Upper Ganga canal in Uttar Pradesh, the Upper Bari Doab Canal in Punjab and the Godavari and the Krishna Delta projects in Andhra Pradesh. All major irrigation works in India in the beginning were carried out by army engineers known as "Royal Engineers" under the superintendence of a Military Board during the British period.

The four canal systems in northern India namely Western and Eastern Yamuna canals, the Upper Ganga and the Upper Bari Doab Canals were all originally dependent for their supplies from temporary structures erected annually in the river bed. The only canal system which had permanent diversion works was the Cauvery system which enthused SIR ARTHUR COTTON to propose permanent head works at Dowleshwaram for the Godavari system also.

The Godavari Anicut at Dowleshwaram

The river Godavari ranks first in the Southern Peninsula in its water potential and its annual yield is estimated as about 85 BCM (3,000 TMC) on 75% dependability as already mentioned in Chapter 4. For centuries this river has been carrying floods to the Bay of Bengal with very little utilisation of its flows. A few open head channels were drawing the river flows for irrigating about 27,935 ha (69,000 acres) in its delta and there too the supply was irregular with the river flows and water levels fluctuating heavily. There was no guarantee that these open channels could draw adequate supplies throughout the cropping season to ensure a crop.

In 1831 there were heavy floods and the cyclone of 1832 really caused heavy damages to the crops and the channels in the Delta. Closely following in 1833 there was severe famine and it is said that nearly one third of the inhabitants of the delta died in those years of extremes.

The East India Company deputed Sir Henry Montgomery to visit the Delta and give his report on the feasibility of mitigating the suffering of the people and improve the revenue from agriculture. He could see that there was a potential in the waters in the river to ensure prosperity provided irrigation systems could be well developed.

It was the privilege of Captain Cotton to step in, visualise the taming of the river at Dowleshwaram site by constructing an anicut across its 4 km width, to raise the water levels and then create a well defined and scientifically designed canal system to irrigate the entire Delta and also provide a very easy and economical method of transportation of the agricultural produce and for men and materials by designing the canals as navigation canals with adequate locks and other structures in the system.

Sir Arthur Cotton can be said to be the pioneer in the modern development of irrigation through major ventures with the apt adaptation of the science of irrigation engineering that had developed till his time. For the first time the East India Company took a bold decision to launch major irrigation capital works largely impressed by the assurance this great irrigation engineer was able to give to the Government, ensuring adequate revenue on the capital invested by way of tax on irrigated land.

Sir Arthur Cotton was born on the 15th May 1803 as the tenth son of Mr.Henry Calveley Cotton in an antique family well connected with service to the King of England. Six of his brothers made their mark as army and navy officers and two of his brothers Huge Calveley Cotton and General Fredrick Cotton worked in Irrigation works in India like him.

Arthur Cotton joined the Scientific Corps of Royal Engineers very early in age when only sixteen and a half. His recruitment was without even an examination since he made a good record during the training period. He arrived in Madras in September 1821 as a young man of just eighteen and was attached to the office of the Chief Engineer of the Presidency. In 1822 he was sent as an Assistant to the Superintending Engineer of Tank Department in the Southern Division, Capt.Fullerton. His responsibility was to repair and maintain the tanks in Coimbatore, Madurai, Trichy, Tanjore and Tirunelveli districts.

He was made Lieutenant in 1824 and was in charge of the Military buildings in St. Thomas Mount. He was deputed to serve in the first Burmese War.

In 1826 he came back as Superintending Engineer, Central Division of Tank Department and was also in charge of Pamban Pass work. Later he was promoted as Captain and made in charge of Cauvery Irrigation and Pamban Pass work. In 1830 he constructed the scouring sluices in the Grand Anicut and had to leave for England on sick leave. He came back and resumed charge in 1832 when he planned the Upper and Lower Coleroon Anicuts on the Coleroon arm of the river Cauvery.

Colonel Baird Smith wrote during this period complimenting those who executed large irrigation works with originality, courage, loyalty and conviction.

"The permanent prosperity of Tanjore is without doubt to be attributed in large measure to that first bold step taken by Colonel Cotton in the construction of the Upper Coleroon dam under circumstances of great difficulty with restricted means against much opposition and with heavy personal responsibilities".

Captain Cotton gave ideas for the Madras Harbour to form a rubble mound breakwater parallel to the coast. He built the Madras - Red Hills railway line to carry the road materials to Madras and incidentally this was the first railway made in India. Soon after the completion of this railway length, his health broke down and he went to Tasmania on sick leave. There he started some experiments on a centrifugal steam engine when the boiler burst and injured him severely on the legs.

While on holiday in Australia he met and married Miss Elizabeth Lear month in Tasmania on the 29th October 1841. This noble lady always stood by her husband, bearing all the pains of living in inhospitable places with least convenience, as a source of inspiration to him to launch magnificent jobs with the firm belief and conviction that he was in God's hands and He would always show the way clear in the right time. She was a pious lady soft in heart and always pitied the poor, labouring hard to make a living.

On return from leave he was posted for a light job of building a Church at Walter. This gave him an opportunity to study the coast and the delta where he was destined to create his masterpiece in engineering skill. He made a number of groynes on Vizag Coast, which proved quite useful.

Godavari River was to be the scene of his most toilsome labour, his keenest anxieties and his grandest success.

This district was affected by famine quite frequently and Captain Cotton felt it to be odd to suffer in famine with a river carrying millions of cusecs as flood, year after year, passing by. He planned the Dowleshwaram Anicut across this mighty river. The river was 6 km wide at the Anicut site with three islands occupying more than a third of this length. Riverbed is of pure sand and the islands of thin alluvial deposits. Captain Cotton's experience in Cauvery works and his study of that important work of Grand Anicut founded on sand gave him the courage and conviction that similar works can be built across this river also though it is much larger in size with a maximum flood discharge of 1.5 million cusecs. Major Cotton sent his report on the 17th April 1845, which went upto the East India Company at London through the Board of Revenue and got sanctioned. This was a mammoth work organised by him and completed in record time. He was sincere and wholly dedicated to the work and all the time believed that it was God's mission given to him to execute this job. The Anicut work started in 1847 was completed in 1852 and drew great appreciation from the Governor in Council and the Court of Directors of East India Company in England.

He utilised his knowledge of the functioning of the Grand Anicut across Cauvery where he had the opportunity of even probing the manner in which it was founded in the sandy bed when he excavated on its side to introduce a battery of scouring vents. His design of the anicut consisted of two rows of circular wells six feet diameter in brick masonry sunk in sandy bed over which the body wall was built in random rubble masonry five feet thick in surki mortar with a broad crest of 4.57 m sloping down to the river bed the top surface alone finished with cut stone masonry for three feet thick in the crest portion and one foot thick in the glacis. A section of the anicut as built by Captain Cotton is shown in Drawing 7.1. Of course he laid a cyclopean stone apron for about 9 m with a retaining wall and an ordinary stone apron following downstream, the talus totaling to a length of about 76 m (250 ft).

The front row of wells were taken down to El. 5.26 m (17.25 ft) and finished with their top at El. 7.09 m (23.25 ft) while the rear row of wells were between El 4.88 m (16.00 ft) and El. 6.71 m (22.00 ft). The anicut crest was at El. 11.58 m (38.00 ft).

The anicut was constructed across the river with Dowleshwaram on the left bank and Vizzeswaram on the Right Bank spanning across the three intervening islands, which were stable and could be trusted. They are PichikaLanka, Bobber Lanka and Maddur. The anicut had to be built therefore in four bits - the Dowleshwaram branch, the Ralli Branch, the Maddur branch and the Vizzeswaram Branch. Of course the elevation of the sunken wells and the tail of the talus might have been varied. But it should be said to the credit of the builder Captain Cotton and all those colleagues of his, both English and Indian, that the straight alignment has been maintained over this great length and crest level of the body wall all through. The cost was £165000.The anicut was constructed between 1847 and 1852 and that is a great achievement considering the stupendous nature of the work, the mighty river that was being bunded and the technical know-how and the tools that were available at that point of time.

As envisaged by Captain Cotton who assiduously built a large system of irrigation cum navigation canals in the sprawling delta below the majestic anicut created to raise the water level to feed the canals, the area to be irrigated was 1,75,000 hectares (4,33,000 acres) initially. The anicut also served the purpose of the much awaited highway link across the wide river.

With the abundant water from Godavari flowing over the land through several of the irrigation cum navigation canals, the farmers were enthused to get more and more of lands reclaimed for expansion of irrigation and by 1887 the extent rose to 3,21,600 hectares (7,94,829 acres) nearly double over a span of 35 years. The socio economic conditions and the general standards of living of the rustic people of the delta rose dramatically and the Godavari districts were turning to be developed areas. This necessitated some improvements to the anicut to increase the head and facilitate larger drawals through the main canals, which was done by raising the crest of the anicut to 11.81 m (38.75 ft) and erecting 0.6 m (2'0") falling shutters. Soon this was also found to be inadequate and the 2'0" shutters were replaced by 0.9 m (3'0") shutters in 1936 with the pond level rising to 12.73 m (41.75 ft).

The ayacut to be served soon rose further to 404694 ha (10, 00,000 acres) with an irrigation intensity of 135%.

Cotton wrote to the Board of Revenue in 1851 after completing the anicut thus :

"Can we see this large and important work, calculated substantially to promote the real comfort of a million of people, thus brought to completion through so many difficulties and contingencies, without heartily acknowledging the goodness of God in thus prospering us and bringing the project so far to a successful issue notwithstanding the opposition it has experienced from quarters from which I had every right and every reason to hope for and from which I confidently expect most cordial and energetic support in carrying out a work of such unequalled magnitude in India, a work approved and ordered by the Home authorities and calculated to be in every way so vast a public benefit? May we not hope that its accomplishment, with the abundant effects which have already resulted from it to the district will lead to the adoption of such extensive works for the improvement of the country, and the promotion of the welfare of the people entrusted to our care, as will lead to an increasing appreciation of a Christian Government. There is nothing that the people more thoroughly appreciate after peace, than public works especially those that furnish them with water. And I cannot but trust that this is only the beginning of a series of works worthy of our nature, our knowledge, our religion and the extraordinary power God has been pleased to put into our hands. I say our religion because I am sure; it ought to lead us to do our utmost in every way to care for those who are thus committed to us".

The above would show that in his great endeavor he was not sailing smooth, he had to work against odds and even for this work, which had obvious benefits he had to struggle convincing the authorities who had the power on their hands but no vision. Explaining the need for Irrigation and Drainage he wrote.

"It will be well, perhaps to remark on some mistakes which are almost universal on this subject. The first is that, if a tract of land has plenty of rains, there is no necessity for irrigation. No quantity of rains will prevent a famine unless it is tolerably distributed. The fact is that water from irrigation is required in almost every part of India, even to prevent famine. But, further, there is never a season when at sometime or other additional water would not improve the crop. Again when we say irrigation we always mean the complete regulation of water, that is including draining; so there is never a season when there is not, at some moment, excess of rain which requires to be carried off by a system of drains. It is this REGULATION OF WATER that is needed and which so abundantly repays the cost of works. God gives us rain, but, as in everything else. He leaves something for us to do which, if we are too indolent to do, we must suffer for it".

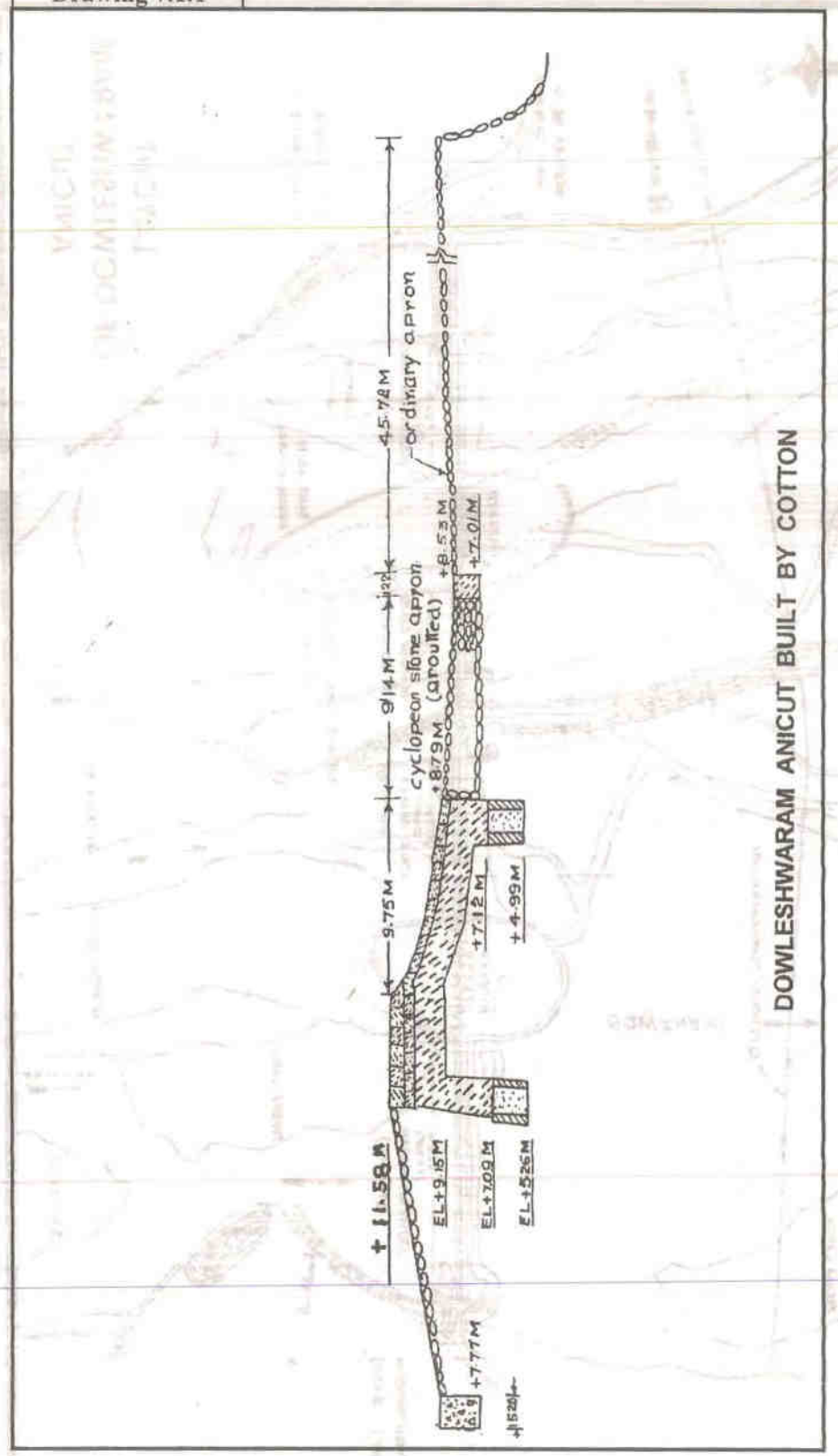
The successful completion of the Godavari Anicut at Dowleshwaram, his masterpiece, brought him to the pinnacle of his fame.

His services were acknowledged by the Madras Government in 1858 in the following remarkable words "If we have done our duty at least to this part of India and have founded a system which will be a source of strength and wealth and credit to us as a nation, it is due to one MASTER MIND, which with admirable industry and perseverance in spite of every discouragement, has worked out this great result; other able and devoted officers have got Colonel Cotton spirit and have rendered invaluable aid under his advice and direction, but for his first creation, we are indebted to him alone. Colonel Cotton's name will be venerated by millions yet to be born, when many, who now occupy a much larger place in the public view, will be forgotten. But although it concerns not to him, it would be for our own sake, a matter of regret if Colonel Cotton were not to receive due acknowledgment during his lifetime.

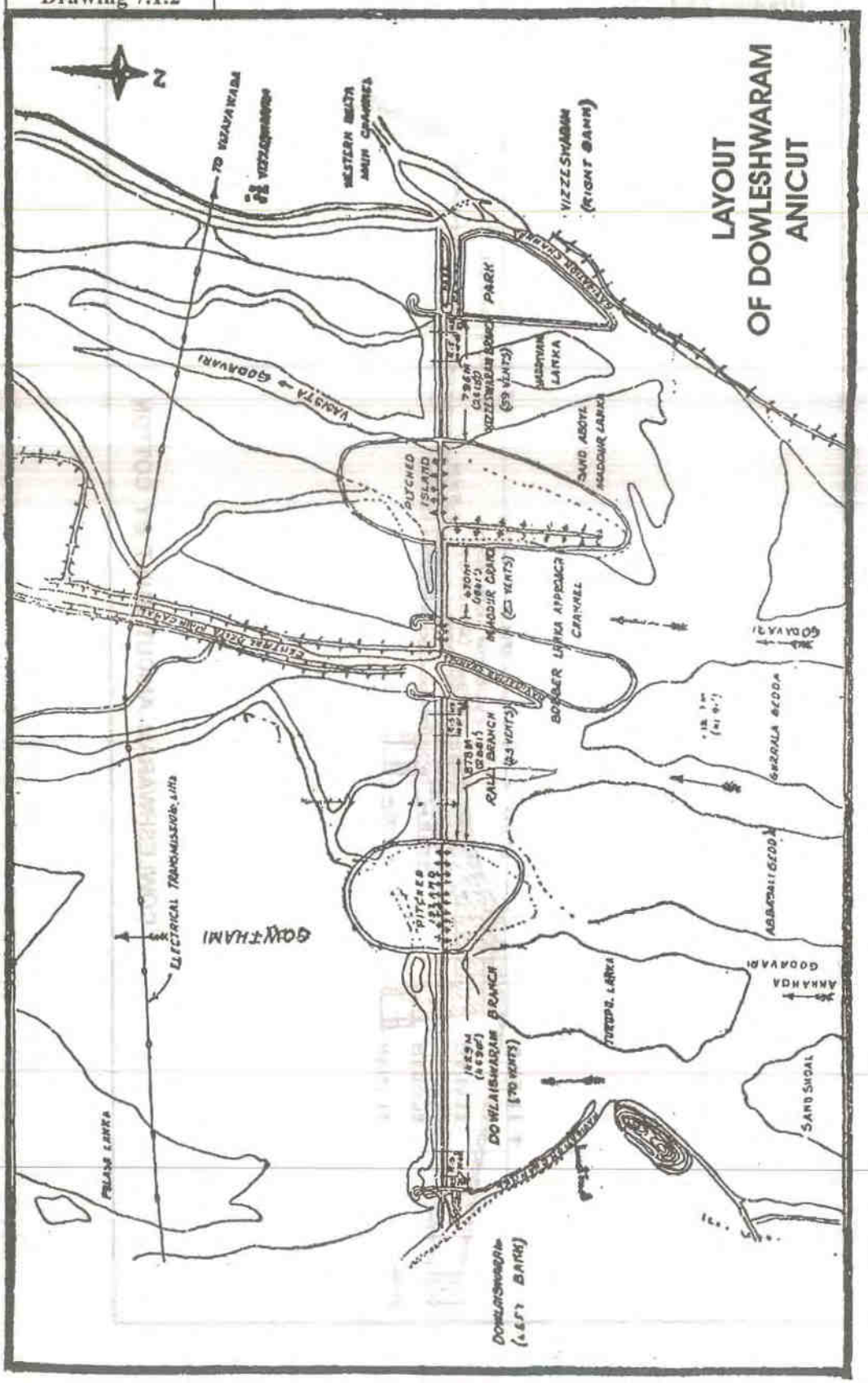
He was aptly called the most illustrious Irrigation Engineer and the Father of Irrigation! Even now, a statue of Sir Arthur Cotton stands at the entrance of the Godavari anicut at Rajahmundry, which is worshipped by the peasants of that area every day. He was knighted and entertained at a Public Banquet in London on his return from India in 1860.

Sir Arthur Cotton was a devout Christian. He avoided the card table, the dancing hall and the bar. The spiritual solace strengthened and comforted him until the very end of his earthly mission. He died on 14th July 1899 at the age of 96 years and proved the saying "An honest man is the noblest work of God".

Drawing 7.1.1


DOWLESHWARAM ANICUT BUILT BY COTTON
45.72 M
ordinary apron
cyclopean stone apron
+8.79M (aroulled)
+8.53 M
+7.01M
9.14 M
9.75M
+7.12 M
+4.99M
+11.58M
EL+9.15M
EL+7.09 M
EL+5.26M
+7.77M

Drawing 7.1.2


LAYOUT
OF DOWLESHWARAM
ANICUT
N
TO VIJAYAWADA
WESTERN DELTA MAIN CHANNEL
VIZZESWARAM (RIGHT BANK)
PARK
VADAPATA → GODAVARI
DUTCHED ISLAND
BORDER LANKA APPROACH CHANNEL
RAIL BRANCH
ELECTRICAL TRANSMISSION LINE
GOWTHAMI
PITCHED
DOWLAISWARAM BRANCH
PALAM LANKA
SAND SHOAL
GODAVARI

The Krishna Anicut at Vijayawada.

Necessity for proposing some irrigation schemes to protect the deltaic region of the River Krishna was felt from time to time for more than a century whenever famine descended on the area causing undue damage to the crops and untold misery to the farmers. They could see large flows in the river in the monsoon months, which was of course dwindling fast in later months; but had no wherewithal to provide irrigation to their lands when not supported by rainfall. One such severe famine experienced in 1832-33, set the people and the Government thinking of some proposals to use the river waters. Several suggestions came forth. But no one was prepared to venture on a scheme of constructing an anicut across the main river Krishna that sometimes in floods rose to 40 feet (12.19 m) above riverbed. But it was Sir Arthur Cotton's suggestion in 1844 when he was planning an anicut across Godavari that a similar anicut can be built across Krishna that infused confidence with the administration that the work could be attempted. A Committee of experts was appointed in 1848, which recommended that the work should be taken up. The rapid progress registered by Captain Cotton in his master piece of an anicut across even a bigger river Godavari was instrumental in establishing that such works are possible on Krishna. Captain Cotton himself was associated in the design for this anicut too. The Krishna Delta Irrigation Project was finally sanctioned in 1851.

Captain Orr, a competent contemporary of Captain Cotton was put in charge of the Anicut, which was built during the period 1852-55 at a cost of about Rs.2 crores.

The site chosen was near Bezawada about 100 km from the coast where the river flows crossing the Eastern Ghats with a narrow width of about 1.2 km. The anicut body wall 1021 m (3350 ft) long 4.27 m (14 feet) height was built with brick masonry over rows of 1.2 m (4 ft) dia brick masonry wells, sunk 3.35 m (11 feet) deep and flanked by long stone aprons both upstream and downstream. Scour vents, head regulators and locks were provided on either end to feed the canals irrigating the sprawling deltaic area. The head sluice on the Vijayawada side had 6 vents 6.1 m x 3.35 m (20"-0" x 11"-0") capable of discharging 300 cumecs (10,600 c/s) while the head sluice on the Seethanagaram side had 15 vents 1.8 m x 2.9 m (6"-0" x 9"-6") for a discharge of 188 cumecs (6640 c/s).

The ayacut proposed under the anicut scheme was acres 2.35 lakh hectares (5.8 lakh). The ayacut however progressively increased to encampus all the culturable area in the entire delta. To meet the increasing demand in the Delta, the anicut crest was raised by 0.9 m (3") in 1893. Soon it was found that this caused severe damage tc the downstream aprons and the raised portion had to be dismantled soon. In 1897, 0.6 m (2 feet) falling shutters were erected and in 1898 they were replaced by 0.9m (3 feet) automatic falling shutters. Since even then sufficient head could not be built to push enough supplies to the Delta, in 1923-25, 1.8m (6"-0") falling shutters were erected. There were 29 sets of 11 shutters each operated by the hydraulic system and plough.

By that time the ayacut increased to about 4.86 lakh ha. (12 lakh acres). This necessitated maintaining water levels 0.15m x 0.45m (0'-6" to 1'-6") even above these shutters, which resulted in inevitable damages downstream to the aprons. The bodywall also showed symptoms of stress and possible failure. The Engineers were seriously recommending the construction of a new barrage in the place of the anicut when part of the anicut gave way in 1952, which expedited the construction of a new Barrage presently named as the Prakasam Barrage commissioned in 1957.

The Kurnool Cuddappah Canal (KC Canal)

This legendary canal is perhaps the earliest attempt made for trans basin diversion by carrying some flows available in a perennial stream across the available low ridge, over to the adjacent river basin to irrigate some parts in the drought prone areas in that basin. It is not clear as to who would have conceived such a scheme in the first instance. But it is understood that Sir Arthur Cotton who was the best available irrigation expert at that time was consulted in this and he being a promoter of navigation cum irrigation canals seems to have jumped at this favoured idea and its early execution. The scheme however was taken on hand for execution by a company called "The Madras Irrigation and Canal Company" which was founded in 1858. The Company was authorised by an Act of Parliament to raise a capital of one million pounds. Five per cent interest on outlay was guaranteed by the Secretary of State, who reserved to himself the right to control the proceedings of the Company and to purchase the works after 25 years. In those years when Indian Administration was in the formative stages under the British, the Government was hesitant to invest on large development projects particularly the irrigation schemes which needed high investments, long gestation periods and delayed returns and hence encouraged private enterprises.

Tungabhadra is an important tributary of the river Krishna. Tunga and Bhadra rise as two different streams in the Western Ghats and join near a village called Kudali about 12 km from Shimoga. This tributary has substantial potential, which is now being nearly fully tapped. In 1860s it was almost virgin and carried substantial flows, which were proposed to be tapped from near Kurnool by building an anicut across.

It is said that the promoters first chose a site near Kurnool town and finding that it was not suitable and had doubtful foundation features, abandoned that site and moved upstream about 40 km to a place called Sunkesala where they could find a rocky bed for construction of the masonry weir. Here also the builders seem to have bungled both in design and construction mostly due to inexperience in building such irrigation structures. Drg.7.2 shows the cross section of the weir and its stability features. (This is adopted from the College of Engineering Manual on Irrigation written by Col.W.M.Ellis.)

The body wall was 8.23 m (27 ft) high as originally built with brick masonry in lime surki mortar with inadequate base width as could be seen from the Drawing 7.2. The construction was started in 1863 and completed in 1866. But this anicut breached in 1882 and thereafter the height of the weir was reduced by 0.9 m (3'-0") as seen in the Drg.. Even with that crest at +288.8 m (+944.8') the stability diagram shows how the resultant falls beyond the middle third ignoring even "uplift". The design allowed a bank of clay formed on the upstream face practically upto the crest level and perhaps this is helping in the reduction of hydraulic pressure on the body wall and subscribing for its stability. (Please see the Drg.).

The anicut is in two lengths across two arms of the river with an island in between; the northern part is 324.13 m (1064 ft) long and the southern 1004.01 m (3294 ft). Earthen bund is formed on the northern end for about 251.46 m (825 ft.) connecting the bodywall with the existing high ground. Necessary flood banks have also been provided on the river margin to contain the floods, which are very high. The flood discharge recorded on 31st October 1916 was 9122 cumecs (3, 22,000 c/s).

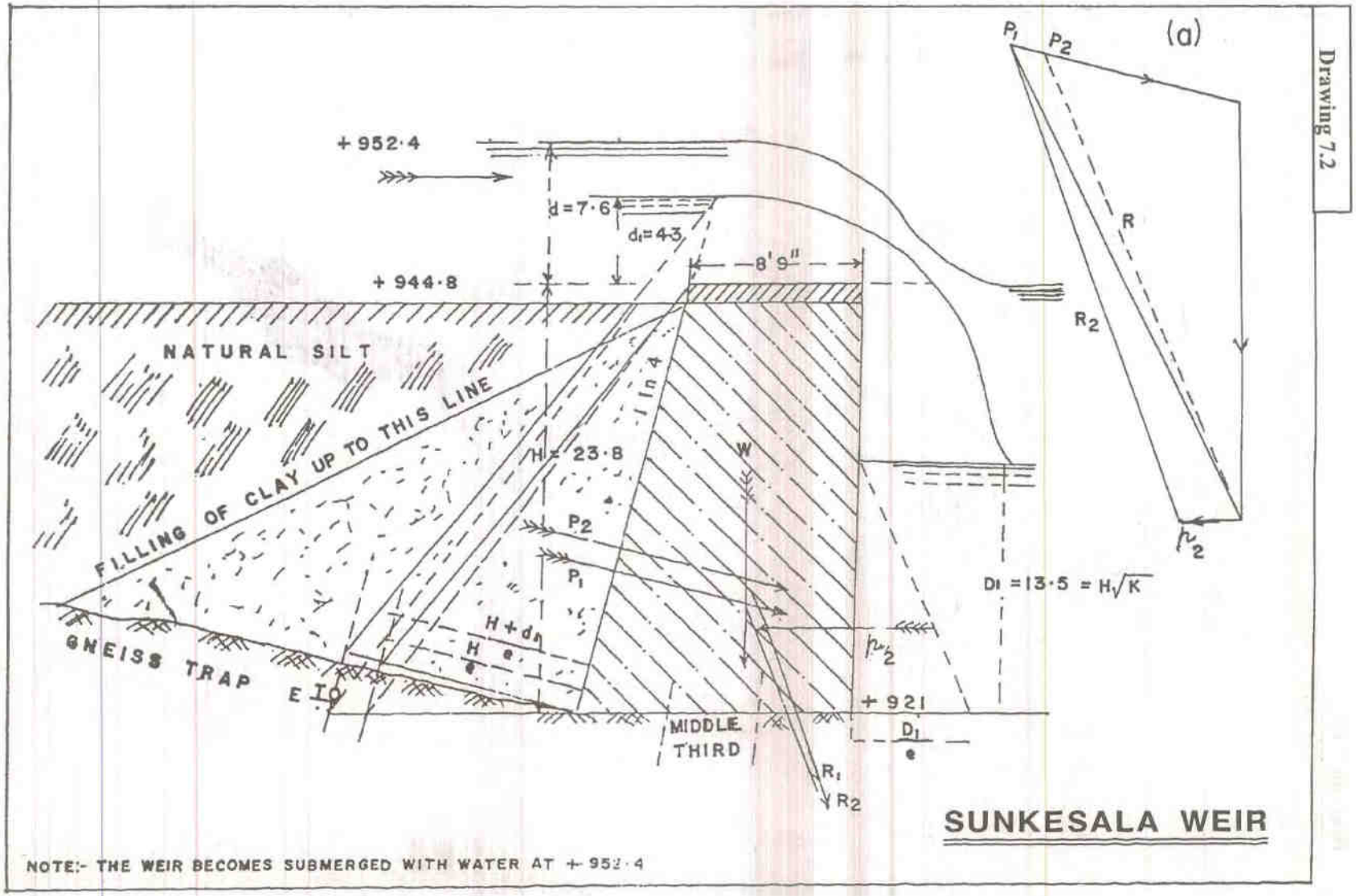
A battery of twelve vents 1.98 m x 1.52 m (6'-6" x 5'-0") with sill at +285 m (+934.61), 3.1 m (10.19 feet) below anicut crest provided with shutters in two tiers located at the right end of the southern part of the anicut serves as the scouring sluices. The Canal Head sluice at the right end has twelve vents 2.2 m x 2.1 m (7'-3" x 7') with sill at 285.9 m (+937.61), 0.9 m (3 feet) above the scouring sluice sill and 2.19 m (7.19') below the anicut crest level. The vents are provided with shutters in two tiers operated by screw gearings.

The Canal taking off at this anicut is designed to carry 85 cumecs (3000 c/s) at its head with bed width of 42.67 m (140 feet) and a Full Supply Depth of 2.13 m (7'-0") meant to irrigate an extent of 52724.4 ha (1,30,282 acres) in the Kurnool and Cuddappa districts. The total length of canal is 304 km (189 miles) and it runs through Kurnool, Nandikotkur, Nandyal, Sirvel and Koilkuntla taluks of the Kurnool district and through Jammalamadugu, Prodattur and Cuddappah taluks of Cuddappah district. The Canal execution took ten years 1861 to 1871. The Command area Map is enclosed as Drawing 7.3. The present prosperity of these areas is essentially due to this Canal conceived and executed more than thirteen decades ago and the hard work put in by those farmers who toiled hard to bring the dry undulating lands under plough to suit the wet land cultivation.

The transbasin diversion aspect of this unique scheme lies in that the command area is spread partly in the Krishna basin and partly in the Pennar basin. Pennar is a poor cousin of Krishna and even this small transport of water into its basin to benefit a small extent near the ridge is a boon to the people living in those areas.

The Canal runs on contour for the first 117 km (73 miles 23 chains) where it just crosses to the other side of the ridge into the Pennar valley and runs thereafter on the ridge upto its 150 km (93 mile 49 chains) where it crosses the Galeru valley. Thereafter upto its mile 188-km (117-43 chains) it runs on contour again, then picks up a ridge to reach the 233 km (145 miles -63 chains). Here the Canal picks up the flow from Kundu River a tributary of Pennar. Thereafter the canal runs on contour upto 274 km (171 miles 40 chains) picks up a ridge towards the Pennar River itself at its 289 km (180 miles 48 chains). The canal continues to 304 km (189 miles 79 chains) on the available ridge. The physiography of the country and the compulsion to cover areas in adjacent basins necessitated the alignment of this canal on contour and ridge alternately feeding the commandable areas some times on one side and some times on both. Hats off to the designer.

The Canal originally designed to serve as navigation cum irrigation canal soon lost its navigational use. Even irrigation use took quite some time to pick up because of the sparse population too poor to invest and also because of the black cotton soil. This accounts for the failure of the Company to make profits and the taking over the project by the Government even a little earlier than provided in their agreement.


Drawing 7.2
(a)
P1
P2
R
R2
+ 952·4
d = 7·6
d1 = 4·3
8'9"
+ 944·8
NATURAL SILT
FILLING OF CLAY UP TO THIS LINE
1 in 4
H = 23·8
W
P2
P1
H + d1
H
e
GNEISS TRAP
E I O
MIDDLE
THIRD
+ 921
D1
e
R1
R2
D1 = 13·5 = H√K
SUNKESALA WEIR
NOTE:- THE WEIR BECOMES SUBMERGED WITH WATER AT + 952·4

Drawing 7.3


INDEX MAP OF
KURNOOL CUDDAPAH CANAL
Sunkesula Anicut
KURNOOL
NANDIKOTKUR
Alagnur Balancing Reservoir
Gorukallu Balancing Reservoir
SANTAJUTUR ANICUT
Velugodu Reservoir
Regulator cum Bridge
BANAGANAPALLE
KOILKUNTLA
Owk Balancing Reservoir
KURNOOL CUDDAPAH CANAL
ALLAGADDA
RAJOLI ANICUT
ADINIMMAYAPALE ANICUT
CUDDAPAH
N
S
Reference
sugar cane
double wet
single wet
irrigated dry
river
LOCALISED AYACUT
District
KURNOOL
MAHABOOB NAGAR
CUDDAPAH
TOTAL

The British Government took over the Scheme in 1882. The Government at its expense had to close the breaches that occurred in 1882, decided to cut down the crest by 3'-0" in 1886 and spend money now and then on repairs and maintain. But all those got adequately repaid because of the abundant water supplies the river Tungabhadra could provide.

The actual area irrigated was only 39,570 ha (97,778 acres) for the period 1941-42 to 1950-51 against the designed ayacut of 52,746 ha (1,30,282 acres), which was due to the deteriorating condition of the canal.

Nellore and Sangam Anicut Systems

As had stated earlier the Pennar is the third large river system in Andhra Pradesh. This river entering the State in the Ananthapur District passes through Cuddappah District and enters the sea in the Nellore District while some of its tributaries drain parts of Kurnool district too.

As is true of all the east flowing rivers in the Peninsula, irrigation development was seen in the lower part of this basin close to the Delta through several of the open head channels taking off from the river to feed number of tanks spread over the eastern coastal strip.

The Pennar flow is not dependable. Served both by the southwest and the north-east monsoons its catchment brings heavy floods some times during the northeast monsoon but dries up soon. The open head channels like Duvvur channel, the Gandavaram channel, Panchedu channel, Kovur Channel and Vegur channel which served sizable ayacuts about 17,814 ha (44,000 acres) through a number of tanks were getting silted up and they could not draw adequate flows at the critical times when crops were to mature.

In very similar circumstances in the Palar basin to the south, in the then Madras Presidency, the Madras Government got a scheme sanctioned to construct a permanent masonry anicut now called the Palar Anicut, by the Hon.Court of Directors of the East India Company in November 1854 and completed the structure in March 1858 to stabilise the drawals in the existing open head channels of Kaveripauk, Mahendravadi, Sakkaramallur and Dusi Mamandur.

Likewise Captain D.C.Dutt investigated, selected a site near Nellore town for the construction of the Pucca anicut on this North Pennar and submitted an estimate for Rs.64,899/- in 1849 recommending the scheme promising an increase in revenue to a tune of Rs.20,000/-. The anicut now called the Nellore Anicut was constructed between 1853 and 1858 at a total cost of Rs.93, 000/-. The foundation of the body wall consisted of 0.9 m thick solid masonry resting over double row of wells of 0.9 m inside diameter and 1.80 m depth.

This anicut stabilised the large ayacut in the Delta to the south of the river Pennar through the Sarvepalli canal, the Krishnapatnam canal and the Jaffersahib canal. Krishnapatnam Canal runs midway between the other two.

The anicut first built for a length of 482 metres (1581 ft) suffered repeated breaches, which resulted in deep scours occurring on the left flank. Sir Arthur Cotton was consulted for his large experience in the Godavari and Krishna Anicuts and he after inspection suggested improved foundations on wells in the breached portions, increase in the length from 482 metres to 622 metres (1581 ft. to 2040 ft) and this renovation was completed in 1859 with a total outlay of Rs.1,12,500/-.

When improvements were contemplated to Sarvepalli Canal, in 1867, the sill level of the head sluice was lowered by 0.61 meters (2'-0") and an auxiliary head sluice of 6 vents of 1.067 x 2.743 m (3'6" x 9'0") was constructed. The extent of cultivation went on increasing slowly and difficulty was experienced in meeting the demand for water as more and more ayacut was brought under cultivation. In the year 1919, proposals were formulated to raise the crest level from +12.72 to +13.02m i.e. 0.305 metres (41.72' to 42.72') and also to pave the top surface with four rows of cut granite wheel tracts to take the increasing traffic in between the banks of the river, and they were sanctioned and executed. Subsequently in order to extend irrigation facilities under Idagali channel to bring 1619 ha (4,000 acres) of Padava lands under cultivation, the crest of the anicut was further raised to +13.11 metres (+43.01') and 0.61 metres (2'-0") falling shutters were installed in 1941.

The principal channels which conveyed supplies to the ayacut are the Jaffersaheb Canal and Sarvepalli Canal.

The Sarvepalli canal feeds Sarvepalli Reservoir besides irrigating direct ayacut. The total extent being irrigated by this canal is 18,219 ha (45,000 acres). The Jaffersaheb Canal irrigates an ayacut of 14,575 ha (36,000 acres) both direct and under tanks.

Hydraulic Particulars of Nellore Anicut. :

Length of the Anicut	621.79 m (2040')
Crest level of anicut	13. 109 m (+43.01')
Top of falling shutters	+13.719 m (45.0l')
Scouring sluice	+10.064 m (5 vents of 1.83 m x l.63 m [(+33.02') (5 vents of size 6'0" x 5'4")]
Head sluice	10.552m (9 vents of 1.83 m x 2.74 m) [+34.62' – (9 vents of 6'0" x 9'0")]
Auxiliary head sluice	+10.528m – (6 vents of (l.07 m x 2.74 m) [+34.54' – (6 vents of 3'-6x9'-0")]
Ayacut	32,793 ha (81,000 acs).

Sarvepalli Reservoir is the main terminal reservoir under Nellore anicut system. It receives its supplies from river Pennar from Nellore Anicut through Survapalli canal besides from its catchment of 8469 hectares (32.70 sq.miles). The reservoir has a capacity of 49 Mcum (1740 M.Cft.) water spread area being 1761 hectares (6.8 Sq.miles). Its earthen bund is 6821 metres long (4M.2F). Its FRL is at +8.449 m (27.72 ft) and TBL at + 10.278 m (33.72 ft.). Its surplus can discharge 147 cumecs (5200 cusecs).

Encouraged by the drawal facility and the growing prosperity of the southern part of the Pennar Delta after the advent of the Nellore Anicut, the then Executive Engineer Mr.R.Smith some time in 1867 investigated for the construction of another anicut to command the tanks to the north of the Delta. He selected a site about 35 km upstream of Nellore Anicut near a village called Sangam. Mr.R.Smith should have been a very enterprising engineer of the then Government as he was later committed to give his proposal for the building of the Periyar Dam in 1870 in the deep jungles of west flowing Periyar for transfer of waters through raising a dam across and crossing the ghats to the east through tunnel. He gave a novel proposal of raising an earth dam for 53.3 m (175 feet) by 'silting process' a new idea that had not been favoured by the then Chief Engineer who was for building a masonry dam and hence his proposal of 'silt dam' fell through.

Here also Mr. Smith's proposal of an anicut at Sangam did not come through till 1877 since the remunerative aspect could not be proved. When Sir Richard Jumple, the then Governor of Madras Presidency inspected the area, there was representation from the people and he ordered revival of Mr.R.Smith's proposal of the anicut at Sangam. The scheme was got sanctioned in 1881 and was named as 'Sangam Anicut' after the village where the headworks are situated. The structure was started in 1882 and completed in 1887. The structure is built over well foundations with 3 m deep wells built with brick in lime mortar. In 1937, 0.6 m (2 feet) falling shutters were fitted up over the Sangam Anicut with a view to draw increased supply, for by that time the ayacut to be served by this diversion structure went on increasing.

The Hydraulic particulars of Sangam Anicut as at present are as follows :

Crest level of Sangam anicut	+33.595 m (110.22')
Top of falling shutters	+34.205 m (112.22')
Length of Sangam anicut	1242.37 m (4076 feet)
Kanigiri Main Canal Head sluice	+31.154 m (21 vents 1.829 x 1.829 m)
Duvvur Canal Head sluice	+31.367 m – (5 vents of 1.829 x 2.134 m)
Nellore tank supply Channel	+3l.461 m (5 vents of 1.5 x 1.8 m)
Left under sluice	+30.532 m (14 vents of 1.829 x l.829 m)
Right under sluice	+30.852 m (2 vents of 1.524 x 2.438 m)
Length covered by shutters	1225 m (4019 feet)
No. of falling shutters	334 Nos of size 3.658 x 0.6 m (12'0" x 2-0)
Maximum flood discharge ever recorded was on 6.11.46	13,185 cumecs (4,65,448 cusecs) 3.l7 m (10.4') above crest of anicut

There are two main channels taking off from the right and left flanks of Sangam Anicut. The right side channel called the Nellore Tank supply channel feeds the Nellore Tank having an ayacut of 5,466 ha.(l3,500 acres) while the Kanigiri Main canal on the left feeds the large Kanigiri Reservoir which has an ayacut of 5,466 ha (l3,000 acres). The command area of this reservoir which was also created as part of the anicut project between

1882 and 1887 by enlarging an existing tank now spreads over the entire northen part of the Pennar Delta and has enriched the area. A third irrigation channel which also existed earlier called Duvvur canal takes off on the left flank and irrigates an ayacut of 1,619 ha (4000 acres). Two more canals called the Kanupur canal and the Kavali canal have been now taken up under the Sangam Anicut which will be discussed in the next chapter.

Some details on the Kanigiri Reservoir and the Nellore Tank which are the terminal storages linked to this diversion work deserve mention here.

Kanigiri Reservoir

Kanigiri Reservoir is the main terminal storage reservoir under Sangam Anicut system. It gets its supplies not only from the river Pennar but also from its own catchment area of 24,346 hectares (94 sq.miles). The length of bund is about 10,040 metres and the waterspread area is about 5,046 ha (12,464 acres). The storage depth of the Reservoir over the lowest sill of the southern channel head sluice is +6.538 metres (21.45 feet) (i.e., 98.67'-77.22'). The ayacut under the Reservoir is served mainly by two channels namely Southern Channel and Eastern Channel. The surplus waters of the Reservoir forms the Malidevi Drain which on its run, absorbs the field drainage and seepage and again supplies water for irrigation to the fields on either side of it.

The original capacity of the Reservoir was 181.8 Mcum (6.419 Mcft.). But due to silting of the Reservoir, the capacity is getting dwindled gradually and as per the surveys conducted in 1973, it is found to be 97.8 Mcum (3,454 Mcft.) only. The hydraulic particulars of the reservoir are as follows:

Catchment Area – Free	6216 hectares (24.00 sq.miles)
Intercepted	18120 hectares (70.00 sq.miles)
Combined	24346 hectares (94.00 sq.miles)
Depth of storage over sill of sluice	6,538 m (21.45')
Water-spread area	6,216 hectares (24 Sq.miles)
Length of bund	10, 000 m (6 M - 2F)
Original capacity of the reservoir	181.8 Mcum (6,419 Mcft.)
F.R.L.	+30.016 m (+98.47')
M.W.L	30.075 m (+98.67')
T.B.L.	+33.595 to 34.509 m (+110.22' to 113.22')
Capacity of the reservoir in 1910	181.1 Mcum (6,392 Mcft.)
Capacity of the reservoir in 1936	145.6 Mcum (5,138 Mcft.)
Capacity of the reservoir in 1946	135 Mcum (4,767 Mcft.)
Capacity of the reservoir in 1973	97.8 Mcum (3,454 Mcft.)
Surplusing capacity	597.3 cumecs (21,084 cusecs.)
a. Maldevi Low Escape:	
Radial shutters of 5 nos	9.144 m (30 ft.) each
Height of each shutter	2.59 m (8'6")
Sill level of the radial gates	27.484 m (90.17')
Maximum discharge	353 cumecs (12,460 cusecs)
b. Maldevi High Level Escape	
Sill level	+29.023 m (+95.22')
No.of vents	31 Each 3.048 m (10') wide
Height of screw gearing shutter	1.067 m (3'6")
Combined Discharge	123.7 cumecs (4,367 cusecs)
c. Pyderu Escape Channel	120.6 cumecs (4,257 cusecs)

This Pyderu Escape channel serves both as escape channel during high floods and also as an irrigation channel feeding an ayacut of 2,186 ha (5,400 acres). A pickup anicut across this channel was constructed at Talamanchi to feed Allur large tank and Allur Ramanna tank. Allur Ramanna tank supplies water to Bitragunta Locomotives in addition to the regular ayacut of 1,862 ha (4,600 acres).

Southern Channel

Sill level	+23.537 m (+77.22')
Number of vents	4 Nos
Size of vent	1.422 m x 1.829 m (4'8" x 6'0")
Ayacut	10121 ha (25,000 acres)
Length of the channel	40.63 km (25 miles 2 Furlog)

Eastern Channel

Sill level	+23.567M(77.32')
Number of vents	9 Nos
Size of vent	1.422 m x 1.829m (4'8" x 6'0")
Ayacut	25223 ha. (62,300 acres)
Length of the channel	30.57 km (19 miles)

Nellore Tank

The Nellore Tank is the terminal storage Reservoir on the right side of Pennar River under Sangam Anicut System. It receives its supplies through Nellore Tank Supply Channel taking off from Pennar at Sangam Anicut besides from its free basin of 22,675.5 hectares (10.33 sq.miles) and intercepted catchment of 2,375 hectares (9.17 sq.miles). Prior to the construction of Sangam Anicut, the ryots used to form Korambu across the river Pennar and take water to the tank. This tank is said to have been constructed by a Chieftain of Kakatiya empire named SAMMANTHA BHOJA around 1250. In 1901, a head sluice with screw gearing arrangements was constructed at Sangam Anicut on the right bank of Pennar and a channel excavated for a length of 10,460 metres (6½ Miles) connecting the head sluice with the old channel.

Hydraulic Particulars

Catchment Area – Free	2,675 hectares (10.33 Sq.miles)
Intercepted	2,375 hectares (9.17 Sq.miles)
Combined	5.050 hectares (19.50 Sq.miles)
Capacity	836 Mcft.
Water-spread area	1,424.5 hectares (5.5 Sq.miles)
FRL	+20.793 metres (+68.22 feet)
MWL	+21.463 metres (70.22 feet)
TBL	+22.622 metres (+74.22 feet)
Surplus capacity	85.6 cumecs (3,023 Cusecs)
Ayacut	4,858 ha (12,000 Acres)

After the advent of the Sangam Anicut both the Sangam and Nellore Anicuts are being operated in tandem to serve the entire area of the Pennar Delta. These anicuts with their canal systems and intermediate and terminal storages benefit more than 1,00,000 hectares (2,50,000 acres). Proposals are under way to modernise this Pennar Delta System for increased benefits and efficiency, which will be dealt with in the next chapter.

The Delta Systems

The State of Andhra Pradesh is endowed with three rich delta systems, the Godavari Delta System, the Krishna Delta System and the Pennar Delta System, which constitute the main rice bowl for the State and maintain a production even surplus to the State.

Deltas by nature are fertile and are considered to be the most favoured areas (MFAs) for rice cultivation. The land is flat or with mild grades and offer easy facilities for irrigated agriculture with adequate water and network of canal system. They are densely populated. All the same, as is true of all the eastern Deltas, they suffer from flooding and drainage problem particularly when the north-east monsoon lashes the coast with depressions and cyclonic storms causing large scale human misery and loss to crops and property.

The river profile shows a marked change as it enters the Delta. After descending from the hill slopes and running down fast in the plains, the river profile gets milder and milder in grade with the river approaching the confluence with the Bay, the velocity decreases markedly, the river throws down its own sediment and raises its bed and has a tendency to split and meander. The Delta widens and gradually grows unnoticeably. A number of islands appear in the river course.

The river Godavari called Aganda Godavari upstream of Dowleshwaram anicut gets split into Gowtami Godavari and Vasishta Godavari much as the Aganda Cauvery above the Upper Anicut has the first split and runs as Coleroon and Cauvery downstream creating the Srirangam Island. Of course thereafter the Cauvery splits into 36 minor rivers whereas here, the topography is such that the Vashista Godavari throws out one branch called Vynateyam Godavari near the Bay and the Gowthami Godavari throws out one or two branches like Coringa river, Pallamkuru drain very close to the Bay. The River Krishna however maintains its singular identity till very close to the Bay where it throws out a branch called Puligaddu and a few smaller arms much lower.

While the Canal systems in the Cauvery Delta are ancient and have been developed over centuries more as inundation canals, the canal systems in the Godavari and Krishna Deltas were designed and executed in the nineteenth century to serve as irrigation cum navigation canals. Sir Arthur Cotton the pioneer and the architect of the deltaic irrigation in these Godavari and Krishna Deltas was a great promoter of navigation in the irrigation canals. He firmly believed that with the poor communication facilities then existing in the rural areas in these Deltas, the only way to develop irrigation is to give transport access to the cultivated areas though the canal systems which will serve the area intensely with the main canals, branches, minors etc. This meant that the canal systems are to be designed with adequate bed widths and flow depths with necessary locks and other accessories, which he provided in his designs. For instance in Godavari Delta Canal system against 823 km of main canals, 783 km were made navigable. The branch canals and distributaries totaled to 3377 km of which quite a large length was usable by country boats and small craft. Similarly in the Krishna Deltaic canals also most of the main and branch canals which total upto 360 km (224 miles) were designed and executed as irrigation cum navigation canals.

These Deltaic canal systems were a boon to these areas of Godavari and Krishna Deltas where for millenniums the rivers were carrying large quantities of precious waters unutilised, to the sea while the farming in the areas endowed with good alluvial soils was risky and unpredictable with no assurance of irrigation supplies for the crop period. By the end of the last century these Deltas were fully developed and became the rich agricultural tracts in the State. The area irrigated as on 1951-52 was 4,96,834 ha (12,27,667 acres) in Krishna Delta and 5,12,928 ha (12,67,445 acres) in Godavari Delta (as per Administrative Reports of Madras P.W.D.)

However over a period of time the Navigation part of these deltaic canals fell into disuse. All the canals being earthen channels the movement of the navigation craft created wave action resulting in erosion of canal slopes and resultant silting up. Lack of maintenance led to a number of stretches becoming unusable for navigation. Also with the development of the agriculture and prosperity in the area, more and more roads were laid and also the rail systems. For local transport they relied more on their own bullock carts than country boats, which were proving to be more costly.

While the British engineers of the erstwhile Madras Presidency were thus executing a number of major and medium projects in the present Andhra Pradesh area, the Nizam of Hyderabad who had in his administration several renowned irrigation engineers was also making his own attempts to develop irrigation in his territory by building dams, anicuts and creating storages. A few of such irrigation schemes implemented during the period prior to Independence are briefly detailed here.

Muniyeru Project

This is an anicut scheme executed and commissioned in 1898-99 by the then Madras Government in Krishna basin in the Krishna District on one of the minor tributaries of Krishna, Muniyeru. The main anicut is 172.7 m (566.5 ft) in length with another 15.2 m (50 ft), on which under sluices of 4 vents 1.8 m x 1.5 m (6'-0" x 5'-0") are located. The paved byewash is in five stretches totalling to 425.2 m (1395 ft) capable of discharging a flood of more than 567 cum (20,000 c/s). The head sluice is located on the left flank with 4 vents (6-6" x 5'0") with a capacity of 13 cumecs (460 cusecs) from which the Muniyeru canal takes off to run on contour for 42.02 km (26.1 miles). The canal capacity at the head is 6.9 cumecs (245 c/s) capable of drawing upto 9.6 cumecs (338 c/s). The ayacut to be served is 4575 ha (11,300 acres) in which one tank with its ayacut of 433 ha (1070 acres) is merged. By and large this scheme has been successful with the entire area delineated, getting irrigated at least in one season. The main crop is paddy and groundnut is tried in small areas in Rabi season.

Ghanpur Anicut.

This anicut was built in 1905 on Manjira, a tributary of Godavari near Chinna Ghanpur village of Medak District in the erstwhile Nizam State. A large designed flood discharge of 11615 cumecs (4,l0,000 c/s) had to be provided for. The Canal taking off on the left is called Fateh nehar while that on the right is called Mahaboob nahar. An ayacut of 5787 ha (15000 acres) is benefited by this project.

Pocharam Lake Project.

A project was taken up in 1918 by the erstwhile Nizam, Hyderabad State to utilise the waters of the Alair stream which is a tributary of Manjira a tributary of Godavari by building a dam across with masonry about 9.15 m (30 ft) high and 640.08 m (2100 ft) long and creating a small storage of capacity 51.6 Mcum (1.82 TMC) to feed an ayacut of 4049 ha (10,000 acres) in the Medak district. 13 tanks with ayacut 793 ha (1959 acres) have also been absorbed in this command.

Fifteen vents 1.2 m x 1.8 m (4'-0" x 6'-0") function as scouring vents as well as vents to discharge the surpluses. The canal sluice has 4 vents 0.9 m x 0.9 m (3'-0" x 3'-0") capable of discharging 6.4 cumecs (227 cusecs). The canal runs on contour for 60 km (6 miles) and is unlined. The scheme is in operation since 1922.

Nizamsagar Project

This is a storage project created on Manjira, a tributary of Godavari at Atchampet in the erstwhile Nizam State of Hyderabad. This reservoir project was taken up in 1923 and completed in 1931 and has been in operation since then.

The headworks consists of a masonry dam 2287 m (7500 feet) long and 48.2 m (158 feet) high. Automatic gates for 16 vents 12.2 m x 4.7 m (40' x 15.5') on the left flank and 12 nos 12.2 m 4.7 m (40' x 15.5 ft.) on the right flank both capable of discharging a flood of 7705 cumecs (2,72,000 cusecs) form the surplus arrangements. The live storage is 725 Mcum (25.60 TMC) with an FRL at RL +427 m (+1401.00) and minimum draw down level of RL +415.8 m (+1364.00).

The scouring sluices are of 9 vents 2.4 m x 4.6 m (8'-0" x 15'-0") each and the canal Head sluice of 11 vents 2.4 m x 3.2 m (8'-0" x 10.5 ft.).

The main canal taking off on the right bank runs on contour for 154.56 km (96 miles) and is unlined with a capacity of 96.3 cumecs (3400 cusecs) at the head. The ayacut as designed is 96,761 ha (2,39,000 acres). But the actual irrigation has been only much lower about 54%. About 24494 ha (60,500 acres) served by 620 tanks have been merged in this ayacut. The main crop is paddy with a small area under sugarcane.

Palair Project

This reservoir project was taken up in 1923 by the erstwhile Nizam, Hyderabad State in the Krishna Valley in Khammam District.

A reservoir of 66.3 Mcum (2.34 TMC) was created by forming an earth dam 2530 m (8300 feet) long 20.6 m (67.5 feet) high with a masonry spillway 618 m (2,027 feet) long fitted with automatic falling gates 6 nos. of 15.2 m (50 feet) each capable of discharging a flood of 2742 cumecs (96,795 cusecs).

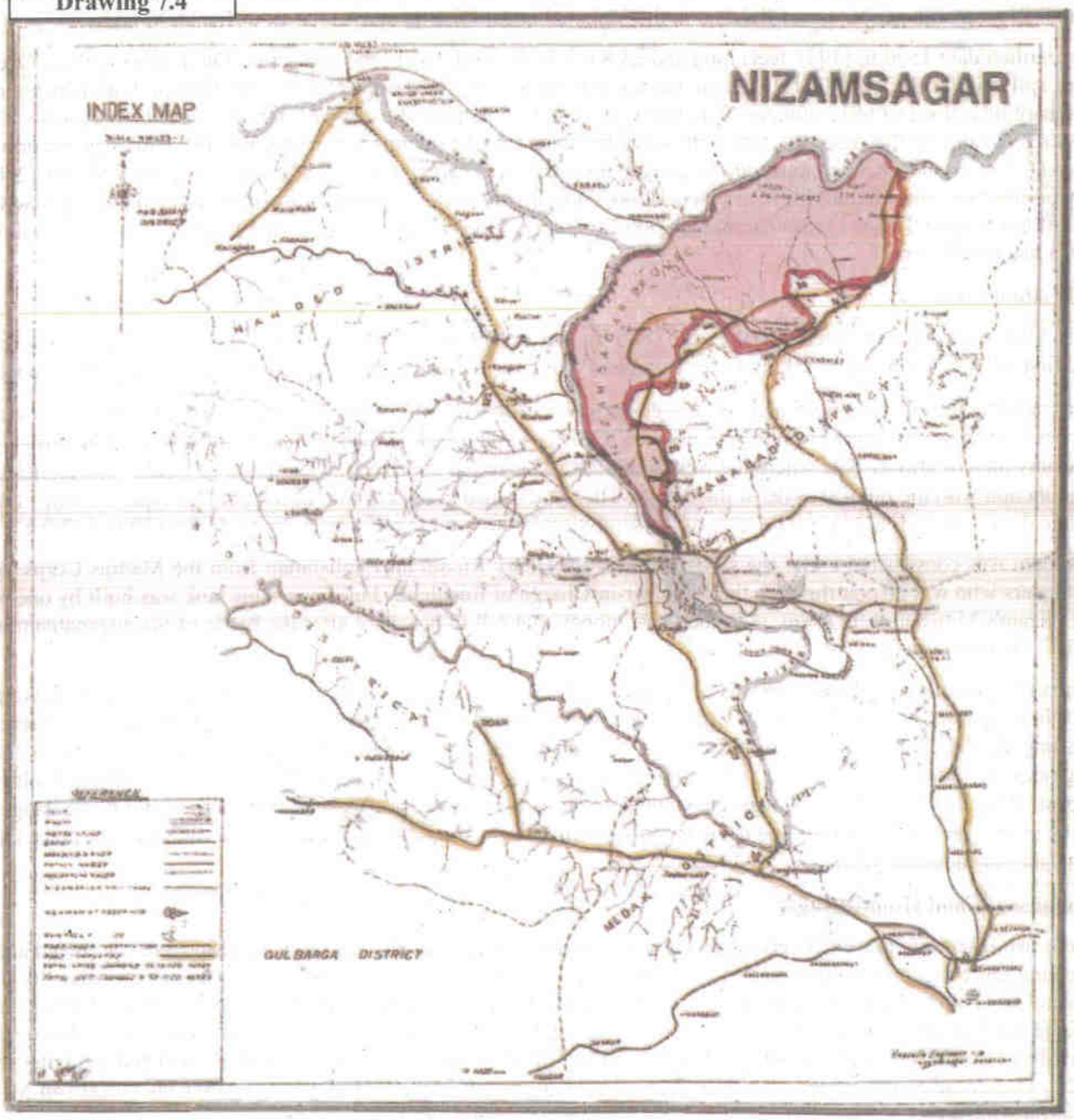
There are two head sluices with 4 vents 1.2 m x 1.8 m (4'-0" x 6'-0") each one on each flank from which a canal 23.35 km (14.5 miles) unlined is excavated on the left flank with a carrying capacity of 9 cumecs (320 cusecs) and the canal on the right flank lies abandoned.

The designed ayacut is 7975.7 ha (19,700 acres). The project was commissioned in 1928.5 tanks with 170 ha (420 acres) under irrigation have also been merged in the command. The average area actually irrigated is only around 6478 ha (16,000 acres) the main cropping being paddy.

Wyra Dam Project

This is another small reservoir project executed in Madhira Taluk of Khammam District in the erstwhile Nizam Hyderabad State in the year 1930 by building a composite dam 1768 m (5800 feet) long and 18.6 m (61 feet) high across Munair a small tributary of Krishna. The spillway is a weir 402 m (1320 feet) long capable of surplussing 1704 cumecs (60,152 cusecs). There are two head sluices. The one on the right flank has 3 vents 1.5 m x 1.8 m (5'-0"x 6'-0") with a capacity of 6 cumecs (210 cusecs) at the head and the other on the left flank has 2 vents 1.23 m x 1.5 m (4'-0" x 5'-0") with a capacity of 2.6 cumecs (90 cusecs) at the head. The right flank canal is 24 km (15 miles) long and the one on left flank is only 6.5 km (4 miles) long. Both run on contour and are unlined. This scheme started in 1923 was commissioned in 1930 and is designed to irrigate 6883 ha (17,400 acres) excluding the ayacut of 83 ha (206 acres) under one tank, which is fed from the system. Paddy is the main crop. On an average only about 4453 ha (11, 000 acres) are being served.

Drawing 7.4



Dindi Project

This is a small storage project started in 1940 and completed in 1943 by the erstwhile Nizam of Hyderabad on the Dindi River a minor tributary of Krishna in the Mahabubnagar District at a total cost of Rs.34.36 lakhs.

An earthen dam 1506 m (4941 feet) long and 23.8 m (78 ft), high has been built across Dindi river with an Ogee type spillway for 305 m (1000 ft) length and another high coefficient weir 518 m (1700 ft) long both capable of discharging a flood of 6912 cumecs (2,44,000 c/s). A special feature of earth dam is that it has been given a surki concrete facing on the reservoir side with wave breakers instead of rough stone revetment. This has cut down seepage losses and also economised the earth dam section. The capacity of the reservoir is 68.6 Mcum (2.42 TMC) live with the FRL at 395.7 m (+RL 1298). Originally it was proposed to irrigate 6073 ha (15,000 acre) kharif jowar and 6073 ha (15,000 acre) Rabi jowar. But by 1953-54 the entire area has been brought under paddy 6073 ha (15.000 acres).

Mir Alum tank

Mir Alum tank was constructed in the year 1806 by Navab Mir Alum, he then Prime Minister of Hyderabad as the first attempt to provide drinking water storage to that city. It is situated about 8 km to the west of Hyderabad.

It is perhaps the first multiple arched dam constructed in the world. It consists of 21 semicircular horizontal arches resting against piers or buttresses built on rocky bed and meant to resist the thrust of water unlike ordinary masonry dam of gravity type where the weight of masonry is relied upon to take the thrust of water. The arches in conjunction with the buttresses resist the thrust. This type is also known as the 'thrust buttress type' of dam. The whole dam is an arch in plan. The span of the semi-circular arches range from 21.3m to 44.8m (70 to 147 ft.).

The dam was constructed under the supervision of Mr.Henry Russel an Englishman from the Madras Corps. of Engineers who was also at the time the Engineer-in-Charge of Residency buildings. This tank was built by one of the Nizam's Ministers Mir Alam, with the Prize money that fell to his share after the battle of Srirangapatnam in 1779. This cost him Rs.0.68 million.

When the construction of the dam was completed and it began to store water, the masonry joints started leaking and lime from mortar began getting washed away with the leakage water. People were afraid that with further washing of the lime, the dam would give away under pressure of water. Mr.Alam therefore, wrote to the Engineer-in-charge about the fears, which the public expressed. The Engineer replied that when sufficient silt is deposited against the arches, the leakage would stop on its own accord and assured that there would be no danger to the bund. He also suggested that the deep portions in the rear should be filled with earth which would make the dam safe for thousand years.

Osmansagar and Himayatsagar

These two reservoirs presently serving as the water supply storages for the city of Hyderabad were conceived and executed more as flood control measures to tame Musi, a tributary of River Krishna on whose banks the city of Hyderabad is built and its tributary, Easi. A bit of history of the city of Hyderabad is to be traced to establish the linkage the two storages have to the city in the correct perspective. The reservoir constructed across Musi was named as Osmansagar and that on Easi was named as Himayatsagar. The first was built in1920 and the latter in 1927. Osmansagar was named after Mir Osman Alikhan Nizam VII and Himayatsagar after his eldest son Mir Himayat Alikhan.

Hyderabad the capital of the State of Andhra Pradesh is the fifth largest city in India with an ancient civilisation and Hindu-Islamic culture. The twin cities of Hyderabad and Secundarabad are separated by Hussainsagar an artificial lake constructed during the time of Ibrahim Quli Qutb Shah by Hussain Shah Wali, his son-in-law (around 1570). This lake is fed from the Balkapur stream which branches off from Musi about 50 km from Hyderabad. Four sluices on the Secunderabad side regulate the level of the water in this lake.

Hyderabad was founded on the bank of River Musi 8 km east of Golkonda in 1590-91 by Muhamed Quali Qutab Shah who was a unique personality. In the l6th century when the Golkonda population was expanding fast, many buildings sprang up along the banks of the River Musi. Golkonda was the capital of the Qutb Shahi rulers of Deccan under the Moghal Emperors of Shahjehanabad (old Delhi). It is said that the Sultan of Golkonda, Sultan Muhamad Qusli Qutb Shah, who was also a renowned poet, while laying the foundation of this historic city prayed thus to God Almighty. "Oh God, bestow unto this City peace and prosperity. Let millions of men and women of all castes, creeds and religions, make it their abode, like fishes in the ocean". Whether the prayers of

the founder have been fulfilled or not it is true that people from all parts of the country have settled here and have merged with the local culture giving the city a cosmopolitan flavor.

But this city of Hyderabad was ravaged by the frequent floods brought by Musi. This river seemingly lazy, meandering through the city with low flows confined between high banks as a narrow stream could rise into fits of violent behavior with the sudden fall of intense rains in the area and submerge and cause damages to the growing city. The first flood of which there is any record is said to have occurred in 1572 and this led to the construction of the 'Purana Pul' in 1578 the present "old bridge" still in use. The then king of Golkonda, Sultan Ibrahim Qutb Shah, and the one who ordered the creation of Hussainsagar built this bridge too. Purana Pul is an elegant bridge 183 m (600 feet) long, 10.7 m (35 feet) broad and 16.5 m (54 feet) above the riverbed and is a landmark in the midst of the old city of Hyderabad.

Local chronicles record the occurrence of eleven large floods since the founding of the city of Hyderabad of which the ones which occurred in 1631 and 1831 are remembered as the worst because of heavy damages incurred with several houses being swept away causing loss of life and property. The worst however came in 1908 on that fateful Sunday night, the 27th September 1908, with a cloud burst and breach of several tanks upstream resulting in a rise of as much as 11.6 m to 13.7 m (38 to 45 feet) above the bed level of the river in the city area by midday of Monday. It is recorded that the flood level rose by 4.9 m (16 feet) in less than 3½ hours and this caught the administration helpless and the people quite unprepared. Ten to fifteen thousand lives were lost and more than 80,000 were left homeless.

The Nizam's Government desired to find a permanent solution to this flood problem and prevent the recurrence of such a catastrophy. He ordered that the best engineer should be contacted at any cost and the best advice secured. The choice naturally fell on Sir Mokshagundam Visvesvaraya. He was touring Italy when a cable from His Exalted Highness, the Nizam reached him requesting him to accept an assignment with his Government for saving the city of Hyderabad from the devastating floods. He quickly finished his tour in Europe, America, Russia and Canada and joined in Hyderabad on April 15, 1909.

Soon he plunged into the work, gathered all available data of rainfall and the floods, and gathered a number of engineers, surveyors and subordinates to draw the plans for future. He was specially requested to

a. advise and assist in the reconstruction of Hyderabad city
b. to frame proposals for the future protection of the city from floods and
c. to prepare a complete scheme of drainage for the Hyderabad city.

After analyzing all the data he could gather, he came to the conclusion that the only way to prevent recurrence of the floods is to create two storages upstream of the city to impound the floodwaters and mitigate the floods entering the city. He proposed one on Musi at a distance of 14 km above the city and another across Easi at a distance of 10½ km from Hyderabad to hold 239 Mcum (8439 Mcft) and 338.5 Mcum (11,950 Mcft.) respectively. He drew the necessary plans and estimates for these two reservoir projects and submitted to the Nizam Government by October 1909. By November he also gave his own design and schemes for city improvement and city sewerage. Of course the Government took their own time to get convinced to put them into action. But Sir M.Visveswarayya soon left Hyderabad to join the Mysore service where he rose to become Dewan of Mysore. He was however now and then requested to visit and advise as the works proceeded till about 1930.

Mr.T.D.Mackenzie and Clement T.Mullings of the Madras P.W.D.were actually assisting the Nizam in executing these dams.

The salient features of these two reservoirs are

		OSMANSAGAR	HIMAYATSAGAR
Catchment	sq.km.	738	1307
Max. Flood discharge	Cumecs (c/s)	2975 (1,05,000)	4533 (1,60,000)
Year of completion		1920	1927
Type of Dam		Earth	Earth
Length	M (ft)	1920 (6300)	2256 (7400)
Max. height	M (ft)	36 (118)	33.8 (111)
Storage capacity	Mcum. (TMC)	124.6 (4.4)	117 (4.13)
Spill way length	M (ft)	91.5 (300 ft)	183 (600 ft)
No. of gates, vertical lift		15 Nos (4.5m x3 m)	17 Nos (4.57m x 6.1 m)
Design discharge capacity	Cumecs (c/s)	2975 (1,05,000)	4533 (1,60,000)

Manair Project

This medium irrigation project is across Manair in the Godavari basin near Nirmal village in Karim Nagar District. This is one of the medium irrigation projects investigated, planned and executed by the reputed engineer of the Hyderabad State Sir. Ali Nawaz Jung Bahadur. The work was started in 1944 and completed only in 1950 at a cost of Rs.1,13,95,000 to serve an ayacut of 6984 ha (17,250 acres) in the basin with 4858 ha (12,000 acres) in Abi and 911 ha (2250 acres) Tabi the rest being perennial crops. After sometime the entire ayacut got converted into wet paddy.

A composite dam 3201 m (10,500 feet) was constructed to form a reservoir of 85 Mcum (3 TMC). Maximum height of the dam is 30.5 ft (100 ft.). The maximum flood discharge of 5666 cumecs (2,00,000 cusecs) is meant to be taken care of by 889 m (2,917 ft.). Ogee spillway and another 2007 m (6583 ft) over flow weir.

The Yeluru Open Head Channel System.

Yeleru is a hill stream having its origin in the Yellavaram Taluk of the East Godavari District. This river runs barren in the head reaches until it reaches a village called Tirumali in the Peddapuram Taluk of this District. From then on as many as 225 open head channels take off from this river for the benefit of irrigating small extents in 61 villages en route mostly lying in the then Zamindaris and Estates. (Most of these channel heads have now been provided with controls). Pithapuram lying at the tail end was a reputed erstwhile zamin. The total area irrigated by these channels is around 18219 ha (45,000 acres).

Maintenance and regulation remained with the Estates and Zamins till their abolition and these minor channels were not brought under the purview of the Public Works Department. At best the Revenue Department was looking after these channel systems when any problem arose.

These channel systems continue to be the role model for the total involvement of the beneficiary, the farmers, in water regulation and maintenance to this day. This tradition of internal water distribution adopting an established mode and priority must have evolved long back when the erstwhile zamin and estates left the farmers to fend for themselves. As early as 1854 Kanchi Ramanna Panthulu has recorded in his diary how this system of water regulation has been traditionally followed. Water regulation was by turns and for some unknown reasons eighteen days have been taken to constitute one turn. The turn is reckoned from the beginning of the Fasli.

As is customary in all such irrigation canal systems, the turn starts from the tail end namely the villages in the Pithapuram taluk. They can divert Yeleru waters for six days and distribute among themselves internally. The next six days are allotted for the Government villages in Peddapuram Taluk and the last six days are the turn of the other Estate villages in Peddhapuram Taluk. There after the next eighteen day turn continues in the same cyclic order. In each of these six day turns the villagers of the running turn are eligible to open all the open head channels in their reach, cross bund the Yeleru river whenever necessary and divert the river waters for themselves. The open heads of the other channels which are not on that turn will be kept closed at the head. The luskars keep watch of this regulation and help the farmers.

For convenience in regulation as per their turns the Yeleru river length is divided into 12 segments starting from Tirumali village wherefrom irrigation starts. These 12 segments are as under:

Sl.No.	Name of segment	Length of river km	No. of Channels	No. of villages	Ayacut benefited Ha /(acres)
1.	Kirlampudi	8	8	16	4882 (12058)
2.	Ramavaram I	5	25	8	2607 (6439)
3.	Ramavaram II				
4.	Megaddhni	3	21	6	581 (1436)
5.	Dabba Calva	3	24	7	2063 (5096)
6.	Chadalada	3	19	8	1531 (3781)
7.	Virava I				
8.	Virava II	5	45	13	NA
9.	Hanumantha				
10.	Pittalabanda		Not Available		3649 (9014)
11.	Pavara				
12.	Pithapuram	8	85	7	2721 (6721)

Yeleru River and the irrigation systems above described create drainages and return flows and those drains again offer irrigation as secondary sources. Gorrikandi drain, Peddapuram yeru, Navara yeru are some of them which have their own ayacut and the internal regulation here again are through the traditional rights starting from the time the drainages set in. The ayacut served by these drainages is substantial.

Nagavali open Head Channels

Nagavali is a river flowing through the Srikakulam District the northen most in Andhra Pradesh. Vegavathi, Suvarnamukhi and Janghavalli are its important tributaries. The river confluence the sea near Kallapalli village.

A number of open head channels taking off from this river have been functioning since ancient times. A few important ones among them are as under:

Sl.No.	Name of channel		Ayacut Ha (acres)
1.	Sayamma	Right side channels	4713 (11,640)
2.	Seeninaidu	Left side channels	321 (793)
3.	Desai	Left side channels	409 (1010)
4.	Buya	Left side channels	325 (803)
5.	Nedampeta	Left side channels	81 (200)
6.	Mamidivalasa	Left side channels	81 (200)
7.	Lankam	Left side channels	263 (650)
8.	Labham	Left side channels	263 (650)
9.	Venkamma	Left side channels	469 (1159)
		Total	6925 (17105)

Most of these channels sustain double crop wet. In order to build up adequate head during months of lean flow 'korumboos' are formed across the river with temporary bunds leading the available flow to the channel heads.

Here again the maintenance and water regulation is carried on by the beneficiary villages adopting a traditional practice evolved long back.

Observations on the Development Process

In this Chapter an attempt has been made to briefly detail the several irrigation projects executed on the river systems in the present Andhra Pradesh territory during the British period. Before ending this chapter it may be worthwhile to record certain observations on the developments seen during this period in the following sectors related to irrigation.

a. The process of the technological developments in the planning and design of irrigation systems.
b. The performance of the traditional management process in the existing and newly developed systems &
c. The Indian Irrigation Commission and its comprehensive report on the status of Irrigation in the country at the beginning of this century.

a) As detailed in the previous chapters, the Vishala Andhra, the present Andhra Pradesh was formed in 1953 with the inclusion of the dominions of the Nizam of Hyderabad. Only that part of the Andhra Pradesh lying in the coastal districts and the Royalaseema area was under the direct British rule as part of the then Madras Presidency.

The major river systems cutting across the coastal districts were seen to be of such large dimensions and flow magnitudes that with the then technological knowhow no meaningful attempt could be made to harness those flows. No one could even conceive or risk building large hydraulic structures for storage or diversion until the veteran and the bold young man from the Royal Engineers Captain Cotton came into the scene. He could not only conceive such bold ventures like the Godavari and Krishna Anicut systems, but also execute them with his knowledge after duly convincing the then East India Company to boldly invest in those schemes promising more or less a personal guarantee for substantial returns on the capital invested. His main plea was that investment in irrigation and navigation would yield better return than even railway projects, which were also in the priority list then.

In the Royalaseema districts of course the sources were very limited, the area was drought prone and the only way to improve the irrigation prospects was through transbasin diversion. This was also tried with the blessings of Captain Cotton in executing the Kurnool Cuddappa Canal Project described earlier.

No storage structures could be thought of on these mighty rivers in their lower reaches under the British control with the help of the technological science then developed. Of course large tanks had been formed even centuries earlier by the natives throwing high earthen bunds across valleys. But the rivers had not been bunded across to create large reservoirs.

When Periyar dam was taken up for the benefit of Madurai and Ramanathapuram Districts in the present Tamil Nadu, the first such structure to be built in the region in 1895, they had to use lime surki mortar since cement had not yet appeared. When Mettur Dam was taken up on Cauvery in 1924 the first such structure attempted in the region as a long straight high masonry gravity dam, they could not dare providing for spilling the floods over the structure since hydraulic modelling and the science of energy dissipation had not developed enough to provide the key. They had to therefore with effort find a saddle to dispose of the floods and create the spill channel for quite some length to join the river downstream. Sound solid rock foundation had to be searched for and the sites chosen in all such cases since the techniques of building structures on permeable foundations had not been perfected as yet. Even for the design of the gravity structure they had to seek the help of the best academicians they could find in the world. It must be remembered that though the pure sciences like hydraulics had been developed enough, the applied sciences came to be adopted only in the twentieth century. Hydrology as a science was first presented only in 1936. In these circumstances neither the East India Company nor the British Government which took over the reign later could be blamed for not launching major projects on these river systems in the then Madras Presidency.

On the other hand there was commendable activity in launching irrigation structures in the Deccan Plateau on the same river system in their upstream reaches and on their tributaries with the munificence and understanding of the Nizams who ruled the State. The search for a Competent Engineer in Sir M.Visvesvaraya to handle the aftermath of flood havoc and the earnestness of the then Nizam to engage him at any cost and with any condition to find a permanent solution for the flood problem that affected the city of Hyderabad as detailed earlier, speaks of the spirit of activity in this sphere in the Nizam State. A large number of schemes listed in this chapter fall in the then Hyderabad State and this is because construction of storage structure on these rivers and streams in those locations in the plateau where they are originating has been feasible with the then developed status of technology.

Thus, we are able to see how before Independence, in all the major river systems a number of minor storages and diversion structures have sprung up in the tributaries and the main stream in their upper regions wherever such works could be located without undue risk with the technology then available; how for long stretches in the middle reaches these rivers flowed down, carrying large floods now and then, practically untapped; and how by the time these rivers mellowed down in their velocities and flowed with shallow depths over wide beds, large anicut systems with their wide spreading command areas in the rich deltas could be created thus making the tail end areas of these river systems probably the richest areas in the basin.

Of course in the coastal regions harvesting of the north-east monsoon was planned with a number of small and big tanks in the river valleys, most of which existed even before the advent of the British. The British took credit in bringing them to good shape, adding to their numbers and also connecting them to the canal system they created by giving them the dependable river source.

In the whole region, creation of large storages to hold large magnitude of flows carried by such river systems was the need and this had to necessarily wait until the technological developments could ensure safe investments of large sums of money and this became possible soon after Independence.

b) The traditional management of the existing irrigation systems, mostly tank systems survived even during the British period and in fact the Britishers rather would like to leave those traditions to continue undisturbed, for they involved the beneficiary fully and left very little to be done by the administration. These traditions and customs also got slowly built up even in the new command areas created during the British period. But the involvement of the beneficiary could not be fully ensured and committed as in the case of existing tank systems.

The example of the maintenance of the irrigation command under the Anantasagaram Tank in Nellore District can be cited. This tank was constructed by 'Royasam Kondamarshy' in 1519 to irrigate an ayacut of about 1600 ha (4000 ac). The storage capacity of the tank is only 14.2 Mcum (0.5 TMC). But lying in the coastal belt, this tank enjoys more than one filling. On top of it its surplus course served at least another 2429 ha (6000 acres) through 12 anicuts built across it. There is a good part of return flow in this surplus drain, which ensures reuse of water over and again. The entire tank system with all these diversions from the drains with the attendant distribution network is totally managed by the farmers themselves adopting a traditional custom laid down long back.

The role of the Government in the maintenance of minor irrigation sources like the tanks can only be supportive rather than proprietory. Historically even when the Rulers formed tanks they were handed over to the beneficiary for their upkeep, operation and maintenance. The saying 'That Government is the best Government which rules least' applies totally to irrigation tank maintenance.

A minor irrigation tank is the lifeline of the village and the village life is closely interwoven with the tanks. The receipt of fresh inflows into the tank will be a cause for celebration in the village. During some important festivals the villages congregate on the tank bund to perform certain religious rites. Usually, some fruit bearing and tamarind trees etc. are grown on the tank bund and rear margin and the whole villagers are entitled to the usufruct of these trees. The tank provides water to the village cattle during the dry months. The water of tank will also provide food by way of fish. The tank will also be a centre for birds and other fauna. The babul trees grown in the foreshore lands will supply food to the sheep and goats during the summer months. When the tanks dry up the silt accumulated in the tank bed is utilised by the villagers as manure in their fields. Thus, the tanks help maintain ecological balance and improve environment. This is in sharp contrast to the major reservoirs, which are believed to destroy ecology and environment. The last but not the least importantce of minor irrigation tanks is the replenishment of groundwater, which is another important source of drinking water as well as irrigation. The farmers in the village have therefore a clear committed stake in the upkeep of the tank and hence their interest in the management.

During the pre-independence days whenever the tank used to receive fresh floodwater, the villagers used to gather on the tank bund, particularly "Dashbandis" and "Service Inamdars" of the village. If the floodwaters were more, they used to remove the obstruction in "Kalinguladala" and to protect the bund from any danger. If any damage was noticed the villagers used to contribute labour collectively and repair it. In those days it was the collective responsibility of the ayacutdars to maintain the tank. In Rayalaseema, the ayacutdars used to elect Pedda (President) and Chinna (Secretary) and they were required to contribute labour for the maintenance on acreage basis. If any one fails to contribute labour, fines were used to be imposed by the "Pedda". The ayacutdars irrespective of their status used to submit to the authority of Pedda. In Anantapur area "Gonchi system", a type of collective farming, is still existing in certain areas. In this, lands of all the families are managed collectively. Maintenance of tanks was carried out by the beneficiaries only.

Our villagers exhibit a rare sense of democratic spirit, collectivism, consensus, respect of collective authority in the management of irrigation systems. They are managing the irrigation tanks following the set procedures without hitch.

c) The beginning of the twentieth century was marked by an important event in the history of irrigation in India, namely the appointment of the Indian Irrigation Commission, under the presidency of Col.Sir Coling Scott Moncrief, KCSI, KCMG, with four other Members, among whom Diwan Bahadur P.Rajaratna Mudaliar CIE, Member of the Legislative Council of Madras was the only Indian Mr.W.J.Gordon, M.Inst.C.E. Superintending Engineer, P.W.D. United Provinces of Agra and Oudh was the Secretary. This first Irrigation Commission of 1901-03 was appointed in the shadow of two famines, which had highlighted the need to extend irrigation as a protection against future famines. The wide spread suffering caused by successive famines in the closing decades of the 19th century led to setting up of a series of famine Commissions. The first Commission appointed in 1878 made several suggestions on the basis of which the famine codes were promulgated from 1883 onwards. The second famine Commission was set up after the drought of 1896-97. It recommended,that "Among the measures that may be adopted for giving India direct protection from drought, the first place must unquestionably be assigned to the work of irrigation". In the terms of reference to the First Irrigation Commission, the Government of India fully endorsed this view. The various famine codes had dealt with the methods and the administrative machinery to be used both before and during a famine to avoid extreme distress. According to the codes, the nerve of the system for dealing with the conditions created by droughts and famines was the opening of famine relief works, to provide employment to large numbers of unemployed people. Prominent among such works was the digging of new tanks and the repair of existing tanks. Only after the appointment of the First Irrigation Commission, more ambitious construction programmes were taken in hand as famine relief works.

This first Irrigation Commission according to a Resolution of 13th September, 1901 of the Governor-General-in-Council, was required inter alia –

i. To ascertain the utility of irrigation under local conditions of Agriculture, whether in generally increasing the produce of the land or in securing it from the effects of failure of rainfall.

ii. To report upon the extent to which irrigation has been provided by works constructed by the State and the results- Productive, Protective and Financial - which have been attained.
iii. To determine the scope which exists for further extension of State irrigation works with particular regard to such proposals for new works as may be laid before the Commission by local officers.
iv. To consider the extent to which local capacities for irrigation have already been utilised by private individuals.
v. To consider the character and utility of the works on which relief labour has been employed during the last famine; to make recommendations wherever possible, either for the completion or definite abandonment of such works as have not been completed; to examine the existing programme of relief works and to suggest the arrangements permanently required for reviewing and maintaining them in the most efficient manner as to ensure the application of relief labour as far as may be possible to works which will have a real protective value. The emphasis was more on assessing the extent and reliability of the protection that will be afforded by such works than to the merits of the schemes regarded as financial investments

The Commission started its work on the 28th of October 1901, toured the country extensively visiting and discussing with both the Provincial States and also the Native States. The Commission submitted their report in April 1903.

The Hon. Sir F.A.Nichelson, KCIE, ICS, Senior Member of the Board of Revenue fed the Commission with all necessary information when they toured the Madras Province. Col.A.W.Smart, R.E., acting Chief Engineer for Irrigation, an Executive Engineer from Krishna Delta and a few others gave evidence. The Commission recorded information on all aspects of irrigation in the Madras Province in about 100 pages of their Report. They detailed the Existing State Irrigation works. They commended the functioning of the Godavari and Krishna Canal Systems and also the Cauvery and Coleroon works. They took note of the functioning of the Kurnool Cuddappah Canal, the Periyar Project and also the Sangam anicut systems in Nellore District. They recommended improving the Godavari and Krishna Delta Systems. They suggested vigorous actions to complete the projects taken up as famine works. They particularly emphasised on the maintenance of the tanks through Kudimaramath.

While in Hyderabad State Mr.A.J.Dunlop CIE, Revenue Secretary, Hyderabad gave evidence before the Commission besides the Chief Engineer for Irrigation, His Highness the Nizam's PWD Minister Mr.P.Roseore Allen MICE. They gave necessary information on the irrigation under the schemes in Telangana and other areas then under the Nizam, the area benefited, the revenue realised and so on. The Commission brought to notice the poor status of tanks in the region and emphasised their restoration and upkeep through adequate financing. The Commission also took notice of the several new schemes being implemented particularly in Telangana area and wanted them to be expedited.

The Commission declared that "There were obvious limits to the permanent changes which the State may reasonably be expected to meet for the purpose of increasing the produce and profits of cultivation in particular tracts." Accordingly, it laid down a set of criteria for judging the feasibility of proposals for irrigation works subject, of course, to the all important reservation that there could be no limit to expenditure where human life and safety were involved. The Commission took into consideration seven factors such as the estimated total cost of famine relief works in a tract for the preceding 25 years, the population of the tract, the per capita area which should be protected by irrigation and the area already protected. After weighing these factors it concluded that Government should be prepared to face expenditure equal to three times the future annual cost of famine relief and remissions of revenue for the sake of preventing famine in future. According to the Commission, protection works could be sanctioned without hesitation when the capital cost was not likely to exceed three times the net revenue, or whenever a net return of three percent on the actual outlay could be anticipated. The Commission recommended definite lines of policy regarding the selection, financing and maintenance of irrigation works, dealt in detail with practically every scheme under consideration at that time.

The conclusions recorded by the Commission reads "our general conclusion is that there is a wide but not unlimited field in which the Engineers and Civil Officers can work together for the protection of the country from famine; partly by the construction of new State irrigation works, and partly by encouraging and stimulating the extension of irrigation by means of private works. Both methods will involve heavy expenditure on the part of the State upon which there will be no direct return, although it may be justified by the value of protection afforded. We have endeavored to indicate not only all the possibilities, but also the limitations to extensions of irrigation. It has been incumbent on us to consider the latter, but it is the former on which we prefer to dwell, and to which we invite the more earnest consideration. It is more important to realize what irrigation can do, than

what it cannot. The whole of India can never be protected from famine by irrigation alone, but irrigation can do much to restrict the area and to mitigate the intensity of famine. We cannot but repeat, in respect of the measures that we propose, the wise warning of the last Famine Commission that their enduring success will depend no less on their effect in evolving a spirit of self-help and thrift among the people than on their efficiency in securing the crops from drought. Nevertheless, we hope that, if they are vigorously and systematically carried to completion, they will at least give all the protection from drought that irrigation is capable of affording; and that the additional security thereby conferred on the agricultural classes of India may tend to develop amongst them that prudence and practice of thrift without which irrigation itself will be of little permanent or lasting value."

As a result of the Commission's recommendations, a large number of new works were undertaken. One of the functions of the Indian Irrigation Commission was to report on the desirability of the extension of irrigation as a means of protection against famine. The Commission recommended a number of protection projects, some of which were not undertaken nevertheless, due to World War-I and consequent paucity of funds. The emphasis remains on the remunerativeness or productiveness of irrigation projects rather than the security they could afford to insecure and precarious areas. As a result of the labours of the Indian Irrigation Commission, several large projects were taken in hand and, in spite of World War-I were successfully completed.

The most important projects, undertaken prior to introduction of the Mantagu-Chemsford Reforms in 1921, included the triple canal project, the Lower Jhelum Canal and the upper Swat Canal, all in west Punjab (now in Pakistan), the Tribeni Canal Project in Bihar; the Godavari Canals, the Pravana Canals and the Nira Right Bank canal in Maharashtra; the Sarada Canals and the Weinganga canals in Uttar Pradesh and the Mahanadi canals in Madhya Pradesh.

Before the introduction of the Mantagu-Chemsford Reforms in 1921, irrigation works were virtually under the control of the Central Government. No major irrigation works could be undertaken without the sanction of the Secretary of State of India in London who was naturally advised by the Governor-General of India on the necessity of such projects. The Secretary of State's sanction was necessary before a project could be classified as productive. The Government of India and the Provincial Governments were, however, given powers to sanction minor or unproductive works the cost of which was met from revenues and did not exceed Rs.10 lakhs. Such works were known as "Imperial" or "Provincial" accordingly as they were financed by the Central Government or by the Provincial Governments. Prior to 1921 the loans raised by the Government of India for financing irrigation projects were treated as advances to the Provincial Governments at certain pre-determined rates of interest, which varied from time to time, depending upon the average rate of interest on loans raised in the open market.

After 1921, the provincial Governments were authorised to raise loans for financing irrigation projects themselves on their own credits. The rate of interest at which the specific loan was raised varied from 3 percent to as much as 6 percent. Actually, however, a figure of about 4 percent came to be generally accepted as the minimum annual yield from an irrigation project for it to be considered as "Productive". It may, however, be mentioned that although Provincial Governments were authorised to raise loans at their own credit after 1921, no irrigation projects costing more than Rs.50 lakhs could be undertaken without the administrative approval of the Secretary of State for India upto 1st April, 1937, when "Provincial Autonomy" was introduced in India. The Government of India Act (1935) made a radical change in the administration of irrigation projects. The Act brought "irrigation" within the jurisdiction and control of the local Provincial Governments, subject to certain contingencies. According to the Act, irrigation was to assume a federal character only when there were any inter-state disputes. Thus the All India perspective of irrigation projects was lost. This change led to an increase in tempo of construction of new irrigation projects not only in what was known as British India but also in Princely States like Hyderabad under the Nizam.

CHAPTER 8

IRRIGATION DEVELOPMENT AFTER INDEPENDENCE – MAJOR IRRIGATION PROJECTS

After India became independent on the 15th August, 1947 she set herself vigorously to tackle the enormous problems, which demanded immediate attention. The greatest and the most urgent of these problems was the eradication of the curse of appalling poverty of India's millions with all its attendant ills. It was recognised that this objective could only be achieved by means of a planned social and economic advance so as to build up a technologically modern society and a vibrant social order. As early as in 1921 the Indian National Congress even in the midst of their pre-occupation with the political struggle for independence had adopted a comprehensive economic programme and later an agriculture programme in 1936 which resulted in the setting up of a National Planning Committee in 1938. This Committee did a considerable amount of work and considered nearly all aspects of national planning.

This country has been fortunate in having a great visionary in Shri Pundit Jawaharlal Nehru, our first Prime Minister, who with his burning desire to develop this country fast economically and lift up the masses from abject poverty plunged into action immediately after independence. He was gifted with scientific temper and went about his task with proper planning. The first step in this direction was the constitution of the Union Planning Commission in 1956 with men of repute and expertise in the different fields of development and commit them to formulate Five Year Plans for implementation. He presided over the Commission and guided them to give the first priority for Irrigation and Power. He was clear that the former was absolutely necessary to provide food for the people and the latter to provide energy to industrialise and provide employment for the people. To ensure that there is necessary support and scientific input for implementing various development schemes he established several research institutes all over the country under the Council of Scientific and Industrial Research.

The Planning Commission recognised the great importance of exploitation of the irrigation potential of the country, especially in the context of the country's partition into two independent Nations, India and Pakistan. When the above is viewed in the context of the rapidly increasing population of India, the urgency of expanding the area under irrigation became amply clear. It is under these circumstances during the period of the first few Five Year Plans, great strides have been made towards a rapid and planned expansion of irrigation and power potential in the country, keeping in view the objective of large exploitation of water resources and an integrated, basinwise development.

In Andhra Pradesh, however, planning and execution of irrigation projects during the Plan periods had a slow start until the political firmament could be firmed up. The Andhra State got separated from the erstwhile Madras State on the 1st October 1953 and the present Vishala Andhra, Andhra Pradesh was born on the 1st March 1956 along with the States Reorganisation programme conceded by the Union Government.

It cannot be said that irrigation engineers have been lying low awaiting political aspirations to be sorted out with so much of water potential available before them. There were serious and concerted efforts to plan and harness the large flows carried by the rivers Krishna and Godavari. Earlier to the separation, the Madras Irrigation Engineers undertook large scale investigation in the field and formulated designs, drawings and estimates for three major projects, two on Krishna and one on Godavari which deserve mention here. The Krishna Pennar Project had to be drastically modified to give place for the Nagarjunasagar Project and the Telugu Ganga Project while the Tungabhadra Project on the tributary of Krishna got implemented and largely improved thereafter. The Ramapadasagar Project on Godavari of course had to be abandoned on technical grounds.

One significant event that requires to be mentioned is the setting up of the Second Irrigation Commission by the Government of India in the Ministry of Irrigation and Power by a Resolution No.DW 11-28 (52/67) dated the 1st April 1969. The first Irrigation Commission of 1901 and its Report of 1903 has been referred to in a previous chapter. This Commission after an elaborate exercise of discussions, questionnaires and visits to the States, gave their Report in 1972 in four volumes.

This Commission was chaired by Shri Ajit Prasad Jain, Member of Parliament and had one Vice Chairman, four Members and a Member Secretary. Late Sri K.V.Ekambaram, retired Chief Engineer (Irrigation), Government of Tamil Nadu served as one of the Members. This Commission was set up to go into the question of irrigation development in the country in a comprehensive manner.

The terms of reference of the Commission were as follows:

(1) To review the development of irrigation in India since 1903, when the last Irrigation Commission submitted its recommendations, and report on the contribution made by irrigation to increasing the productivity of land, and in providing insurance against the vagaries of rainfall.

(2) To examine in detail the irrigation facilities available in chronically drought affected and food deficit area. and suggest essential and minimum irrigation works to be undertaken promptly in such areas.

(3) To draw up a broad outline of development of irrigation of all types, for achieving self-sufficiency in cereals, and for maximising the production of other crops, and to make a broad assessment of the funds required for the purpose.

(4) To examine the adequacy of water supply in major irrigation projects.

(5) To examine the administrative and organisational set-up for the planning, execution and operation of Irrigation works, particularly with a view to the speedy completion of projects, and reduction of their gestation period.

(6) To suggest criteria for the sanctioning of irrigation projects and

(7) To examine any other matter incidental or related to the development of irrigation in the country, and make suitable recommendations.

After reviewing the progress in Irrigation in the country after partition, the Commission set out certain policies and considerations for further development of irrigation for a balanced fast progress in the standard of living and ensuring food security for the large population. The Commission has reaffirmed that the Irrigation projects are to be so planned that the "farmer is assured of getting designed supply in 75% of the years". The Commission has stressed the need for economising on water use in Irrigation through adoption of scientific principles. While expressing concern on the gap between the utilisation and the creation of the Irrigation potential, the Commission has recorded special commendation on the efforts taken by Andhra Pradesh to hasten the ayacut development under the Nagarjunasagar by constituting several four member teams consisting of representatives of the Revenue, Agriculture, Irrigation and Co-operation departments with the Block Development Officers as the Convenors and suggested similar approach in other large new projects in other States to tour the command area and give their suggestions. They recommended proper pre-irrigation surveys, and localisation, execution of on-farm development works, land development through consolidation wherever possible and research and farmer training. While dealing with the deficiencies in the existing irrigation systems both physical and managerial, they demonstrated the large support storages offer for sustained irrigation through the crop period. From the Statistics (1967-68) produced in their Report it is seen that in respect of staple food, rice, Andhra Pradesh and Tamil Nadu topped the list among the States with 92.8% and 92.9% respectively of the area of irrigated rice bearing to the total area under rice. But the yield per hectare remained low with 1369 kg/hectare in Andhra Pradesh and 1974 kg/hectare in Tamil Nadu at that point of time; the area under rice being 3395 lakh hectares and 2686 lakh hectares in these States respectively.

The Commission refers to the ultimate Irrigation potential as assessed by the Union Planning Commission in 1963 as under, comparing with the achievement as in 1966-67.

Million hectares

States	Ultimate Irrigation Potential				Achievement
	Major and Medium projects	Minor Projects		Total	As in 1966-67
		Surface water	Ground water		
Andhra Pradesh	6.5	2.0	1.8	10.3	3.9
Tamil Nadu	1.5	0.8	1.3	3.6	3.4

It may be seen that Andhra Pradesh has a long way to go to use their large natural water resources and it is towards this goal, number of major and medium projects are being contemplated in many of the river basins.

The Commission has recommended certain administrative and organisational changes to facilitate faster irrigation development in the country. The Commission also recommended the establishment of National Water Resources Council chaired by the Hon'ble Prime Minister as a policy making apex body with adequate technical support. This Council has since been constituted in 1982 and has also adopted a National Water Policy in September, 1987 which has now been revised based on the experience gained and technological developments seen since then. The revised Policy has also been adopted on the 1st of April, 2002 in the 5th meeting of the National Water Resources Council.

The Commission has recommended all time collection and maintenance of correct flow data in all our river systems and also planning for computerisation of all irrigation and agricultural statistics by the States.

The Commission has recorded their valued recommendations for the development of Irrigation, State by State and river basin wise in separate volumes, which has served as guidelines for future planning. They have also referred to certain deficiencies and problems they came across and suggested solutions. Thus the Report of the Irrigation Commission 1972 has brought in valuable input for the development of irrigation since independence.

THE KRISHNA PENNAR PROJECT (1951 SCHEME)

Since the days of Sir Arthur Cotton in the middle of the 19th century many schemes for the integrated development of the water resources of the River Krishna and its major tributory Tungabhadra and the adjacent river Pennar to the south have been proposed and considered. Mr.Arogiaswamy Mudaliar was a pioneer among the Indian Engineers who conceived large water resources projects in the erstwhile Madras Presidency and undertook preliminary investigation for a number of major irrigation schemes. He had also put forward a specific proposal to build a dam on Krishna near Sangameswaram and divert the water through a large canal to Pennar and further south beyond Madras upto the famous temple town of Chidambaram. Later Col.Ellis, the engineer who designed the Mettur dam had also seconded the proposal saying that linking Krishna and Pennar rivers cutting through the low Mittakandla ridge had immense potential of irrigation expansion.

On the recommendation of the then Chief Engineer (Irrigation) Shri A.R.Venkatacharya, the Madras Government sanctioned the investigation of the project in 1947, which commenced on the 15th December 1947. A few alternatives were studied and the Krishna Pennar Project (1951 Scheme) was finally proposed. This envisaged the building of two large masonry gravity dams one on River Krishna 39.6 m (130 feet) high to form a reservoir of capacity of 7903 Mcum (279 TMC) at Siddeswaram and the other on Pennar 48.8 m (160 feet) high to create another reservoir of capacity 78.8 Mcum (276 TMC) at Someswaram with a 189 km (118 mile) Krishna Pennar Canal of 1275 cumecs (45,000 cusecs) capacity linking the two reservoirs. Irrigation contemplated was for 0.85 mha (2.1 million acres) of 1st crop and 0.61 mha (1.5 millions) of 2nd crop under these reservoirs. Power generation proposed was 250 MW. One of the canals proposed was the 320 km (204 miles) Madras Canal taking off from Someswaram reservoir and this was to ensure drinking water supply to the Chennai city besides irrigation en route. The total cost of the full scheme which gave the option of two stage development was estimated at Rs.208 crores at that time with about 3.8% return. Food production of 2.6 million tonnes of rice and 0.13 million tonnes of millets was anticipated and more than all, it was said that the costly food imports could be averted.

With the separation of Andhra, from the then Madras State in 1953 this mega project had to be shelved and redrafted, resulting in the present Srisailam and Nagarjunasagar projects on Krishna. However it is to be noted that theTelugu Ganga Project now completed (1998) to carry 425 Mcum (15 TMC) of water of Krishna from Srisailam reservoir to meet the drinking water needs of Chennai city with en-route irrigation for 2 lakh ha (5 lakhs acres), more or less followed the alignment of the canals contemplated in the Krishna Pennar Project of 1951.

THE RAMAPADA SAGAR PROJECT ON GODAVARI

The River Godavari is a mighty one with a large flood discharge baffling any Engineer who attempts to bund it. Sir Arthur Cotton could build the Dowleshwaram anicut against all odds as described earlier but no proposal to hold the waters in a reservoir could be evolved for a long time thereafter.

The Madras engineers toyed with the idea of creating a very large reservoir with a high dam built at Polavaram with the waterspread extending to about 100 km upstream upto Bhadrachalam where the famous temple of Sri Rama worshipped and sung by Sri. Bhaktha Ramados lies. Hence they named the proposed reservoir as Ramapada Sagar.

Preliminary investigations revealed that the river bed at the proposed dam site is sandy with no trace of rock for 81 m (200 feet) and more and there was no hope of building masonry or concrete dam across this wide sandy river. Prospects of forming earthen dam were seriously considered and the large size earth dam being built in other countries like USA and Europe were studied

In any case the strategy for diversion of river flows during construction would pose a formidable problem in this mighty river with a normal flood of about (half a million cusecs) and possible maximum flood of 0.56 lakh cumecs (2 million cusecs). Hence as early as 1944, Dr.K.L.Rao who was an Assistant Engineer at the time in the then Public Works Department of Madras State (the first Doctorate holder in the Department) and who rose to be an illustrious Minister for Irrigation and Power in the country in the Ministry of Shri Pundit Jawaharlal Nehru, and later of Srimathi Indira Gandhi, was deputed to tour the United States of America for about six months, study the dam construction techniques adopted in that country by various agencies and come out with a viable suggestion for forming coffer dams for the proposed Polavaram Dam across Godavari. He made extensive studies on cofferdams and dams under construction at various sites in USA and submitted an elaborate report to the Chief Engineer on the 13th December 1944 from London by mail. He was held up in that country due to the Second World War.

He had worked out a preliminary design for the cofferdam for the Polavaram Project in that report. After explaining the uniqueness of the problem on hand in that we are to deal with a flood magnitude in Godavari much larger than the flood, the American Engineers had to deal with in any of their projects and with no rock in sight in the river bed even below 81 m (200 feet), Dr.K.L.Rao proceeds to suggest that even assuming that the river flows can be diverted through the left arm of the river while the work is taken up in the right arm, the left arm may have to be widened and strengthened to carry even the normal floods and various methods to tackle the heavy seepage that will pass through the coffer dam to be created on the right arm have to be devised since the coffer dam in

this case cannot be taken to rock and the over burden is just permeable sand. He had studied the problem of seepage and gathered information from theoretical and laboratory sources too.

Finally he suggested that the cofferdam across the right arm could be attempted in three stages. Adequate distance is to be maintained between the cofferdam and the dam excavation pit to get the seepage reduced and also afford facilities to pump out heavy seepage. In the first stage the sheet piles are to be driven to about 15.2 m (50 feet) with a clay blanket in front to reduce the seepage and then cofferdam embankment formed. In the second phase, after excavating in the rear of the formed cofferdam the sheet piles in the next inner row is to be taken to 30.5 m (-100 feet) and in the next phase to 48.8 m (-160 feet). The cofferdam would consist of gravel filled cribs, in cells, which would withstand the pressures better.

Dr.Terzaghi, the father of the modern science of Soil Mechanics, who was evolving his theories on the characteristics of soil and its properties as a construction material for raising high embankments was also requested to visit the site and give his advice, which he did.

Even after planning such elaborate exercises, the designs of the earth dam and other appurtenances and the plan of execution of this high dam in Godavari bed could not be finalised for long.

Though the benefits from such a mega project would be enormous the technical and economical viability had to be carefully examined by Indian Engineers before launching further investigations.

Dr.K.L.Rao in his enthusiasm to get this mega project implemented went to the extent of drafting, Detailed Specifications, Schedules and Drawings for the Ramapaada Sagar Dam and Power Plant designing each and every appurtenant work in detail. M/s. INTERNATIONAL ENGINEERING COMPANY INCORPORATED, DENVOR, COLORADO, USA was commissioned to get these Specifications, Schedules and Drawings checked and approved and the entire report as finally approved by Dr J.L.Savage was printed in September 1947 for the Public Works Department, Government of Madras. This report also carries as an Appendix a very detailed Report on Design of coffer dam and on excavation conditions at the site of the proposed Ramapada Sagar Dam across the Godavari River, Polavaram drafted by Dr .Karl Terzaghi himself as a consulting engineer.

Though this book of specifications and drawings containing 90 printed pages of detailed specification and schedules and 109 detailed printed drawings prepared with great effort and high cost could not be utilised since the project did not come up, this became a treasure of knowledge from which material could be drawn by the Department while major irrigation projects in other basins in Madras State were taken up for preparing specifications, schedules and drawings.

At this stage the Andhra State got separated in 1953 from the Madras State and they had to wait until the Visala Andhra Pradesh could come into existence with the accession of Hyderabad State and the inclusion of Telangana area. The Andhra Pradesh had to consolidate its position, come into the main stream along with other States, exercise its priorities and undertake the irrigation projects sanctioned through the Five-Year Plans. In that process the Krishna Pennar Project and the Ramapaada Sagar project fell through. The Khosla Committee which went through the alternatives in harnessing the water resources in the Krishna basin in the State advised the execution of the Nagarjunasagar project in preference to the Krishna Pennar Project (1951) investigated and kept ready by the erstwhile Madras State in view of the varied interests that had developed since partition. The Ramapada Sagar stands deferred and instead a barrage across Godavari at Polavaram is under consideration for reasons of the complexities in founding a high dam at the location.

This part of the information is detailed in this text to serve as a background to comprehend the planning and design of major projects, in Andhra Pradesh through the FIVE YEAR PLANS. The major irrigation projects completed and ongoing are detailed and discussed below individually.

THE NAGARJUNASAGAR PROJECT

The Nagarjunsagar Project is the major irrigation project built across river Krishna about 145 km from Hyderabad having the largest command area in Andhra Pradesh and is also by far one of the largest projects in the country. The maximum height of the Nagarjunsagar masonry dam above the deepest foundation is 124.66 m (409 ft). The volume of the masonry dam structure is 5.61 million cubic metres (199 Mcft.) This dam is the highest and largest rubble masonry dam in the world built by the largest manual labour ever engaged on the construction of any dam in the world, the maximum labour engaged being of the order of 60,000 men, women, and children, skilled and unskilled put together, at a time.

The reservoir formed has a waterspread area of 285 sq.km (110 sq.miles) and a gross capacity of 1.20 million hectare meters (9.7 M acre feet) and is the largest man-made lake in the country, the capacity of even the Gobindsagar formed by the Bhakra dam being only 986,400 hectare meters (8.0 M acre feet).

Nagarjunasagar is so named after the great Buddhist Savent, Acharya Nagarjuna who lived and preached the Mahayana form of Buddhism on the banks of the River Krishna at this place centuries ago. It is located in the Nalgonda district 2.5 km downstream of Nandikonda village

The masonry dam 1450 m (4756 ft) in length is flanked by earthen dams on either side for a total length of 3413 m (11,200 ft) with a maximum height of 25.9 m (85 ft). The spillway 471 m (1545 ft) in length carries crest shutters 26 in number of size 13.72 m x 13.41 m (45 ft x 44 ft) to cater to a routed flood of 45,310 cumecs (16.0 lakh cusecs).

The Project started in December 1955 was inaugurated by the first Prime Minister of India, Shri Jawaharlal Nehru. Laying the foundation stone for this mammoth project on the 18th December 1955, Shri Jawaharlal Nehru addressed a large gathering of people at the dam site. His speech delivered in Hindi extracted from the CBIP publication "Modern Temples of India, April, 1999 - a commemoration volume of Jawaharlal Nehru Birth Centenary" is appended because of its heritage value (Appendix-I). Most part of the dam and the canals for Phase I was completed by March 1967 and water let into the canal system for irrigation in August 1967 by Srimati Indira Gandhi.

The dam with all the spillway shutters was completed in all respects by March 1974 and by August 1978, an irrigation potential of 5.06 lakh hectares (12.49 lakh acres) was created against 8.30 lakh hectares contemplated in Phase I of the Project. By June 1997 the irrigation potential created rose to 8.09 lakh hectares (19.93 lakh acres) almost reaching the Phase I target.

The foundation rock is of granite and quartzite with a few bands of shale and could be treated through consolidation and high pressure grouting. A few fault zones and doterite dyke areas were specially treated.

Eight penstock pipes 4.88 m (16 ft) diameter are embedded in the dam at the left flank. One number conventional with 110 MW capacity and 7 nos reversible with 100 MW each capacity totalling 810 MW form the power units under this dam. Besides this there are canal powerhouses of 3 nos of 30 MW each in the right canal Power House and two units of 30 MW each in the left flank canal Power House. Thus the total power potential in the project is 960 MW.

The project initially estimated to cost Rs.91.12 crores (1960) underwent several revisions and the latest reassessed cost is Rs.950.00 crores. The salient features of the project are given at Annexure-III.

Several challenging tasks had to be performed during construction, all with the indigenous know-how by the engineers of Andhra Pradesh. Of course a panel of experts in dam building in the country drafted to guide during the execution stage was well utilised. River diversion itself posed a problem in this perennial river and to a large extent solved by going in for a diversion cum irrigation tunnel 8.2 m (20 ft) dia of horse shoe shape bored through the hill on the left flank.

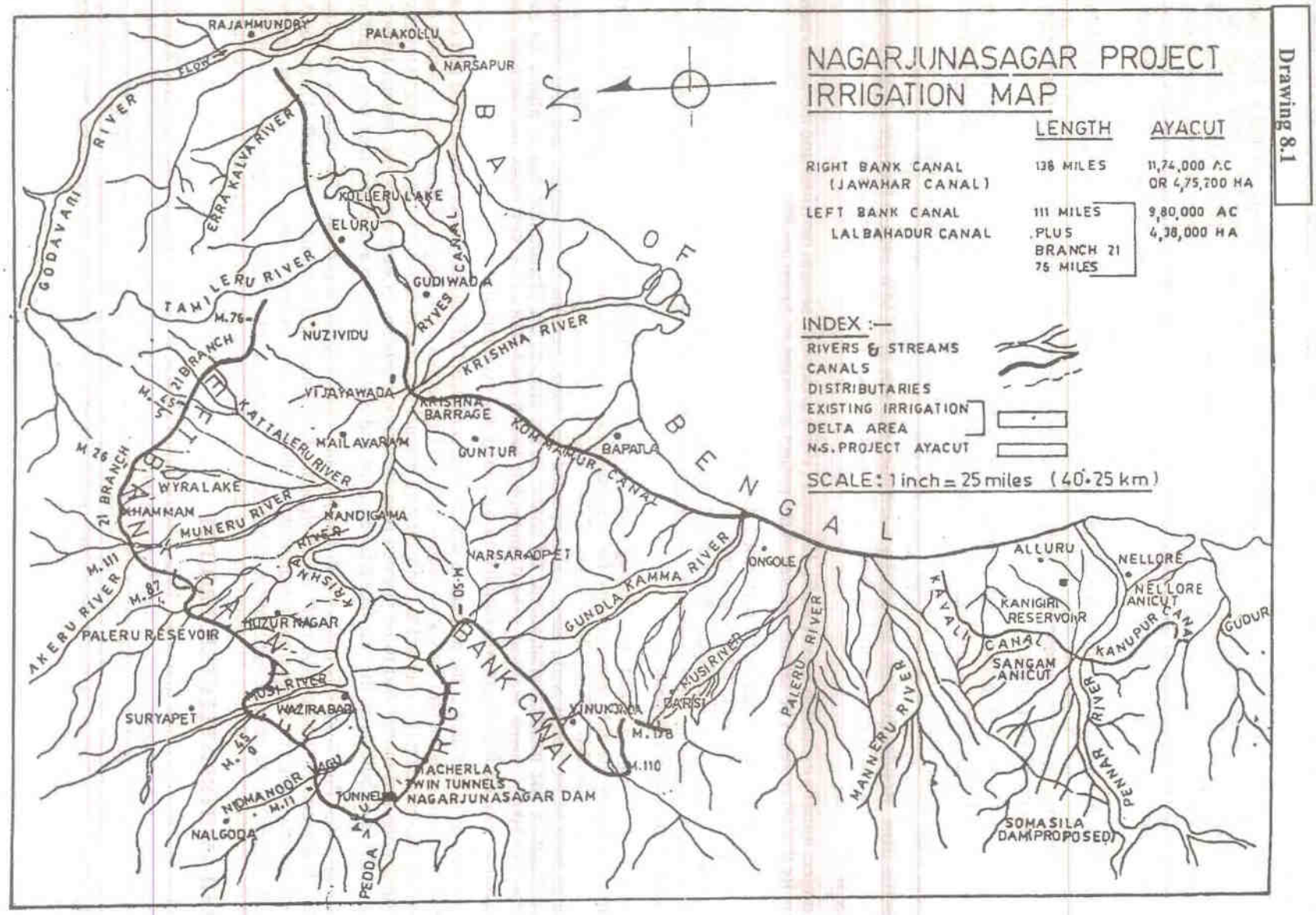
The entire work was executed only through job work system employing minor and petty contractors, the Department taking the full responsibility for the execution of details and quality. Turnkey jobs with major contractors were avoided. This is how, many of the major irrigation projects in the first few Plans periods were executed even in the Tamil Nadu State. This ensured fast work, keeping to the targets and also avoided time taking litigation and irksome arbitrations. Of course in the process the Department had to plan a lot more of facilities like labour camps, medical, school, and public health needs and so on. Still there was resultant economy in execution. The R&R problem was handled satisfactorily and economically.

The uniqueness in this dam is the manner in which large contingent of manual labour was utilised particularly to carry materials of construction for such a high structure. Upto about 32 m height of dam wherein almost half the volume of masonry dam lies was tackled only through manual labour and above this the use of mano tower cranes for lifting stone and mortar had to be planned over steel trestle bridges to supplement the manual labour. The timber scaffolding built in on the rear face criss crossing and moving on ramp as the dam rose was a sight to see.

The benefits that flow from this project both tangible and intangible are enormous. The districts benefitted are Guntur, Prakasam, Nellore on the right and Nalgonda, Khammam and Krishna on the left. There has been a tremendous economic and social transformation in the districts served by this project. Agriculture prospered with assured irrigation and several agro-based industries have sprung up. Roads, transport and communication facilities, warehousing, all got a big boost and this arid tract got transformed into a flush green prosperous tract.

SRISAILAM HYDRO ELECTRIC PROJECT

The Srisailam Project is the first major hydroelectric project taken up for construction on the river Krishna, the second biggest in Andhra Pradesh. A dam has been built across the river where it is crossing the Nallamalai range of hills of the eastern ghats in a deep gorge about 3 km from the ancient famous Saivaite temple Srisailam, one of the twelve Jyothilingams, the abode of Lord Mallikarjuna and Goddess Bhramaramba in the Kurnool District. Another favourable feature of this hydroelectric project is that it is centrally located in the State facilitating economic transmission of power to various load centres.


NAGARJUNASAGAR PROJECT
IRRIGATION MAP
LENGTH
AYACUT
RIGHT BANK CANAL (JAWAHAR CANAL) 138 MILES 11,74,000 AC OR 4,75,700 HA
LEFT BANK CANAL LALBAHADUR CANAL 111 MILES PLUS BRANCH 21 75 MILES 9,80,000 AC 4,38,000 HA
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RIVERS & STREAMS
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SCALE: 1 inch = 25 miles (40·25 km)
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ONGOLE
ALLURU
NELLORE
KAVALI CANAL
KANIGIRI RESERVOIR
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M.110
RIGHT BANK CANAL
LEFT BANK CANAL

Speech of Hon'ble Prime Minister of India, Shri Jawaharlal Nehru

नागार्जुन सागर परियोजना का शिलान्यास

18 दिसम्बर, 1955

प्यारे बहनों और भाइयों,

अभी इस कृष्ण नदी के उस पार मैं था और वहां मैंने एक शुभ काम किया, शिलान्यास किया। एक बुलियादी पत्थर वहां लगाया। जिसके सिलसिले में अब यह डैम यहां पर बनेगा। जो मैंने वहां कहा शायद यहां आपने सुना हो, वहां खड़े होकर और इस जगह को देखकर मेरे मन में अनेक विचार आये। तरह–तरह के ख्यालात् आये, पुराने और नये। मुझे याद आया कि यह जगह एक हमारे। इतिहास में भारत की बड़ी प्रसिद्ध जगह थी। और प्रसिद्ध भारत में ही नहीं, लेकिन दूर-दूर के देशों में और वहां से लोग आते थे यहां जो श्री पर्वत नाम था फिर विजयपुरी उसका नाम हुआ। उस नगर में, यहां लोगों से मिलने, पढ़ने और भारत की विद्याओं को भारत में जो एक धर्म था, बौद्ध, उसको सीखने को, समझने को। तो यह एक भारत की संस्कृति और एशिया की संस्कृति का एक बड़ा केन्द्र था यहां । तो आज जो हम जमा हुए हैं यहां इस बड़े काम का आरम्भ करने, तो कुछ हमें अपने इस पुराने इतिहास को याद करना है। जब हमारा देश सारे एशिया में प्रसिद्ध था, जब यहां की रोशनी दूर–दूर जाती थी, और जब यहां का संदेश भी लोग सुनने दूर–दूर से आते थे। हमारा देश उस समय और देशों पर हमला नहीं करता था, लड़ाई नहीं लड़ता था। हमारा संदेश प्रेम का था, शान्ति का था। और इसी तरह से भारत की संस्कृति फैली। अब फिर एक बड़ा समय आया है कि हमारा देश तरक्की करे और उन्नति करे, आगे

बढ़े, तो हमें इस पुरानी याद को फिर से ताज़ा करना है, कि हम ठीक रास्ते पर चलें, प्रेम के, शान्ति के, आपस में सहयोग के और उस महापुरूष का ध्यान करें, गौतम बुद्ध का, जिनका नाम हमारे देश से निकलकर दुनिया के कोने–कोने में फैला। उस प्राचीन समय में पुराने जमाने में दो हजार वर्ष हुए कितने लोग चीन से और अन्य देशों से, जापान से, जो इस समय इडोनेशिया देश कहलाता है, और बर्मा और लंका, वहां से लोग हमारे देश में आते थे और हमारे कितने लोग वहां जाते थे, इस तरह से, हमारा व्यवहार और देशों से था। फिर समय आया है, आप देखते हैं कि हमारे पड़ौसी देशों से फिर हमारा मिलना जुलना आरम्भ हुआ है, शुरू हुआ है। बड़े बड़े लोग वहां से आते हैं हमारे देश में, और हमारे लोग भी वहां जाते हैं। तो फिर से वे पुराने संबंध को जो हमने ताजा किया है आजकल की दुनिया में,

हमारा संदेश प्रेम का था, शान्ति का था। और इसी तरह से भारत की संस्कृति फैली। अब फिर एक बड़ा आया है कि हमारा देश तरक्की करे और उन्नति करे, आगे बढ़े, तो हमें इस पुरानी याद को फिर ताजा करना है ...

तो उसमें दोनों बात है। एक तो पुरानी कहानी हमें याद आती है और एक आजकल का समय याद आता है, और आजकल के प्रश्न हमारे और उनके हैं। फिर से दुनियां में, संसार में शान्ति की चर्चा बड़े जोर से है और फिर से हमारे देश में विशेषकर खासकर शान्ति का संदेश दिया जाता है। हमारी सारी नीति वैदेशिक नीति, और देशों की, वो शान्ति पर है और हम अपने देश में भी चाहते हैं कि

हमारे सारे काम शान्ति से, प्रेम से ओर सहयोग से हों। हमारा देश बहुत बड़ा है, भारत देश, और उस समय भी आप देखें आज नहीं हजारों बरस से, एक हिस्से का दूसरे हिस्से से। उत्तर में जो विचार होते थे, वो यहां आते थे, यहां के बड़े बड़े पुरूष, महापुरूष और उत्तर पर नजर डालें तो भारत का उत्तर भाग, दक्षिण और पूरब और पश्चिम हजारों बरस से उनके विचार एक थे मिलते जुलते थे, एक दूसरे पर असर डालते थे। तो उस प्राचीन समय से भारत की एकता का चिन्ह चाहे अलग अलग राज भी हो गये, अलग अलग हुकुमतें हुई, लेकिन भारत का दिल एक था, भारत का मन और दिमाग एक ही है, हजारों बरस से। आप देखें, यहां अभी मैं इस कृष्णा नदी के उस पार था, जो आजकल आंध्र प्रदेश कहलाता है। आंध्र प्रदेश। नदी के इस पार आया तो वो आजकल हैदराबाद प्रदेश कहलाता है। लेकिन इसमें कौन सा फर्क हुआ है? उधर भी हमारा परिवार और इधर भी हमारा आपका परिवार। एक नदी तो हमें अलग नहीं कर सकती और इस समय जो बड़ा कार्य हम शुरू कर रहे हैं वो नागार्जुन सागर का दोनों तरफ का है, दोनों को मिलना है, दोनों का कार्य है। इस तरह से इस काम को हम एक दूसरे के सहयोग से कर सकते हैं। अलग–अलग करें तो काम ठीक नहीं होगा इसी तरह से भारत भर में जो बड़े बड़े कार्य हो रहे हैं वो सब एक दूसरे के सहयोग से हों, क्योंकि सारा भारत आपका है। आपका खाली ये जिला और हैदराबाद प्रदेश नहीं, या आंध्र प्रदेश नहीं, आपका तो सारा भारत है। आपका और मेरा। हम अपनी बड़ी जायदाद को, बड़ी विरासत को कम क्यों करें। थोड़ा कन्याकुमारी तक, उधर दक्षिण और उत्तर सब मेरा है। और हम आपके हैं और आप हमारे हैं। हम एक बड़ा सपरिवार हैं इस देश में तो फिर थोड़ी देर के लिए हम अपने अलग–अलग प्रदेशों को भूल जायें। मैं उत्तर प्रदेश का रहने वाला हूं या आप इधर के, दक्षिण में रहने वाले, और हम सोचें

कि हम सब इस महान देश भारतवर्ष के रहने वाले हैं। दुनियां में हमारा आदर होता है, इसलिए कि हम भारतीय हैं, इसलिए नहीं कि मैं उत्तर प्रदेश से आया, और आप हैदाराबादया आंध्र से आये। भारत का नाम है। और जो भारत का नागरिक है, उसका इसलिए आदर है कि वो भारत इसलिए आदर है कि वो भारत से आता है। तो हमेशा आप इस बात को याद रखें कि हम भारतीय हैं, हम हिन्दुस्तानी हैं और हम सब, हमारा यह बड़ा परिवार है भारत भर का और हमें मिल जुलकर रहना है। इस परिवार में अनेक प्रदेश हैं, अनेक धर्म मजहब हैं, अनेक जातियां हैं, लेकिन सब लोगों को मिलकर यहां रहना है, तब भारत की उन्नति होगी, तरक्की होगी। आप याद रखें कि जो चीज हमको मिलाती है, जोड़ती है, वह हमारी शक्ति बढ़ाती है और हमें उससे लाभ होता है। जो चीज हमको अलग करती है, हममें आपस में दीवारें खड़ी कर देती है, वो अच्छी नहीं होती, वो बुरी होती है। इसलिए ये जो जातिभेद और भेद हैं इनका समय अब नहीं रहा। हमें इस देश में मिलकर रहना है, और ऊंच नीच को भी नहीं रखना है अब इसलिए कि देश भर की सब जनता को बराबर का मौका मिले उन्नति का, तरक्की का, और आगे बढ़ने का।

हम और आप यहां जो आज जमा हैं, यह एक पवित्र स्थान है, क्योंकि यहां हमारे बुजुर्गो ने हजारों बरस हुए बड़े–बड़े विचार किये, बड़े बड़े कार्य किये और उनके विचार दुनिया में फैले। यहां एक बड़ी विद्यापीठ थी, उनके आचार्य नागार्जुन अध्यक्ष थे। उनका नाम अब तक प्रसिद्ध है और उनका नाम भारत में ही नहीं, चीन और तिब्बत में और जापान में, इन देशों में प्रसिद्ध है। चाहे आप और हम कुछ भूल भी गये हों लेकिन और देशों में अब तक उनका नाम प्रसिद्ध है, इतने महापुरूष वो थे। तो हम एक पवित्र स्थान पर हैं और यहां एक नगर था जिसका उस समय नाम विजयपुरी था। यहां के उस समय के जो बड़े राजा लोग थे उन्होंने बनाया था। वो नाम भी, एक सुन्दर नाम है। और जो काम हम आज कर रहे हैं वो भी एक विजय का काम है, जनता की विजय जनता की भलाई, उनके दुख दूर हों, इससे बड़ी विजय क्या हो सकती है।

मैं आशा करता हूं कि फिर से यहां एक नगर बसेगा, इस बड़े सागर के आसपास जो सागर बनने वाला है और शायद उचित हो, मुनासिब हो अगर उस नगर का नाम भी आप विजयपुरी रखें। आज विजयपुरी मैंने आपसे कहा। किस बात के ऊपर विजय? पहले राजा महाराजा लोग एक दूसरे से लड़ाई लड़ा करते थे, लेकिन आप जानते हैं कि हमारा ध्येय यह है कि हम कोई लड़ाई न लड़ें, शान्ति से चलें। लेकिन एक लड़ाई हम लड़ेंगे। किसी देश से नहीं किसी कौम से नहीं, किसी पुरूष से नहीं, लेकिन एक महायुद्ध हम लड़ना चाहते हैं, हमारे देश की दरिद्रता से और गरीबी से। तो ये वो यहां विजयपुरी हो वो एक विजय की निशानी हो कि इस लड़ाई में देश की दरिद्रता से हम लड़ें। उसको दबायें, उसको हरायें और उसको इस देश से निकाल दें।

याद आता है मुझे कि इस नागार्जुन सागर का यहां एक ऐसे डेम बनाने का पहले शायद विचार किया था नवाब अली नबाज जंग ने। कुछ बरस हुए सोलह सत्रह बरस हुए जब एक कमीशन बना था, प्लानिंग कमेटी बनी थी, उस प्लानिंग कमेटी में नवाब अली नबाज़ जंग का और मेरा साथ हुआ था। और उनसे अक्सर मिलना होता था, और मैंने देखा था कि कैसे ऊंचे दर्जे के इंजीनियर हैं वो, और उनसे बहुत सहायता मिली थी हमें। तो इस तरह के बड़े–बड़े विचार उनके थे। तो वह जो उनका विचार बरसों का था वो पूरा हो रहा है। अब तो ये खुशी की बात है। ये कार्य हम शुरू कर रहे हैं बड़ी खुशी का है, लेकिन उसमें एक बात है जिससे मुझे कुछ चिन्ता होती है और वह यह है कि जो उस पुरानी विजयपुरी और पुरानी विद्यापीठ के जो जमीन के नीचे गड़े हैं या ऊपर निकल आये हैं, टूटी–फूटी इमारतें वो अब यह सागर बनेगा तो सागर के नीचे छिप जायेंगी। फिर हम वहां नहीं पहुंच सकेंगे। इसलिए यह आवश्यक हो गया है कि इस सागर के बनने से पहले इसमें बड़े जोर से खूब जांच हो, खुदाई हो और जो–जो यहां चीज मिले उस समय की, वो निकाल कर हम बाहर ले आयें, उसको बाहर रखें ताकि उस समय की यादगारें सब हमारे पास रहें और कोई भी नहीं जाए।

तो यह महान कार्य आज शुरू हुआ। जो अब यह आप लोगों पर है, आप जो यहां जमा हैं और यहां के इधर–उधर के रहने वाले, नदी के उस पार और इस पार में काम मजबूती से, अच्छाई से चलेगा। और हम और आप सब मिलकर शुद्ध दिल से और परिश्रम से और एक दूसरे के सहयोग से इस काम को बढ़ायेंगे। और निश्चित समय पर यह काम पूरा हो और सारे यहां के और दूर–दूर के इलाकों में इसका पानी जाकर वहां के ह मारे लाखों भाई किसान रहते हैं, उनको फायदा पहुंचाएं, उनका लाभ हो। उनकी भलाई हो, और इसमें से, इस पानी के वेग से हम बिजली पैदा करें, बिजली की शक्ति, उस शक्ति से भी आपका लाभ हो, काम हो, बढ़े और आपके दुःख दूर हों। तो इस काम में जो–जो लगें आप सब जो इंजीनियर लोग हैं, जिनके ऊपर इस कार्य का बोझा पड़ेगा और जो कितने और लोग उसमें काम करेंगे, उनको हम सब अपनी शुभकामनाएं भेजें और अपना आर्शीवाद।

मेरे साथ आप सब कहिए

जयहिन्द जयहिन्द जयहिन्द

The Project was inaugurated by the then Prime Minister of India Shri Jawaharlal Nehru on 24.7.1963 when Sir Neelam Sanjeeva Reddy, who later became the President of India, was the State Chief Minister. This is one of the components of major development works taken up in Krishna basin in lieu of the earlier designed Krishna Pennar Project on the recommendation of the Khosla Committee including the giant irrigation project lower down, the Nagarjunasagar. These two projects are so located that the water spread of the Nagarjunasagar about 100 km downstream at its FRL almost touches the toe of the Srisailam dam.

Though cleared by the Union Planning Commission as early as 26.3.1964, and sanctioned by the Government of Andhra Pradesh on 29.8.1964, this mega project had to languish for want of adequate funds for long when the Government of Saudi Arabia came up with a massive loan assistance of $ 100 million in 1976 after which the tempo got built up.

First sanctioned for Rs.3847.50 lakhs its cost had to be revised from time to time and its ultimate cost has gone above Rs.23725.00 lakhs.

Essentially first conceived, designed and planned as a Hydro Electric Project just upstream of the Nagarjunasagar project, this storage has also been brought to multipurpose use with canals being taken from both the flanks.

The location of the dam site has been carefully chosen to secure the highest head available for power generation. At about 200 km downstream of the confluence of Tungabhadra the river flows near Srisailam in deep pool of about 100 m depth known as Patala Ganga. Thereafter the riverbed rises gradually to about 12 m within a distance of 1 km and in short distance thereafter the riverbed drops again into a deep pool of about 30 m depth. The dam is built on this natural ridge in the riverbed with a rocky base to a height of 143.25 m above the lowest point of the foundation. The dam is a straight gravity dam in stone masonry and concrete just fitting in the narrow gorge with a length of 512 m of which 266 m is of spillway of the ogee type with 12 number of radial crest gates 18.2 m x 16.76 m to discharge a flood of 37,400 m^3/sec. Though an arch dam could fit in this narrow gorge as an ideal type of dam, it could not be preferred for the reason that the abutments were not sound to take the thrust.

The reservoir formed has a gross capacity of 8722 Mm^3 (308.02 TMC) with the effective storage as 7080 Mm^3 (250 TMC)

The power plants are located in both the flanks to operate with a hydraulic head of 91.4 m.

The one on the right flank has an installed capacity of 440 MW (4 of 110 MW) in the first phase and another 330 MW (3 of 110 MW) in the final phase, served by Francis vertical turbines. On the left flank reversible turbines of 7 units of 110 MW each totaling to 770 MW with 180 MW being firm power and 590 MW of secondary have been installed. The turbines, generators and other control equipment were all designed, fabricated and supplied by BHEL Haridwar.

The following further facilities got added on to this hydroelectric project making it one of multipurpose character.

a. An irrigation canal on the right bank to irrigate about 80,000 hectares in the drought affected districts of Kurnool and Cuddapah.

b. Another canal on the right bank which has been christened as the Telugu Ganga Project to cater to Chennai water supply by drawing 425 Mcum (15 TMC) of water from Srisailam reservoir and irrigate 1.11 lakh ha (2.75 lakh acres) en route.

c. An irrigation canal on the left side to irrigate about 80,000 hectares in the drought affected districts of Mahaboobnagar in Telangana.

An unique part of this project is the location of the spill way section and a skijump bucket for the energy dissipation. Extensive hydraulic model studies had to be conducted on this both in the Andhra Pradesh Engineering Research Laboratry at Himaayat Sagar, Hyderabad and the Central Water and Power Research Station at Khadakwasala, Pune.

The ski jump bucket is of radius 19.20 m (63 ft) with an invert level at El. 188.96 m (+ 620 ft) i.e., 64.02 m below the spillway crest with a lip angle of 45 °.

The geological formation at dam site though massive consisted of jointed quartzite with intercalation of fractured and disintegrated shales.

This type of formation necessitated extensive foundation treatment with consolidation grouting and special treatment of weak zones besides incorporating special features like provision of slight curvature in the lay out of the dam, introducing RCC grillage blocks at the toe of the non overflow section etc. more to meet the low value of sheer friction factor obtained through extensive load tests from samples in a number of locations. The formation

was however found to possess adequate bearing strength and hence the problem of settlement due to the presence of shales was not considered as much of consequence. The typical sections of non-overflow and overflow blocks of the dam are in Drawings 8.2.1 and 8.2.2.

The treatment of the foundation where a number of large size, cavities with soft material alround were found extending for long lengths proved to be a challenge for the construction engineers who solved those unusual problems indigenously and innovatively by providing several shafts and drifts and making suitable provision for the drainage collected. Care was also taken to provide for close and continuous monitoring of the behaviour of the dam through extensive instrumentation with thermometers, stress and strain meters, no-strain meters, joint meters, rock compression displacement meters, pore pressure cells, uplift pressure pipes, plumb lines etc.

River diversion during construction also caused formidable problems because of the narrow and deep gorge in which the dam is built. The flood season in the river is from June to October and this restricted the working season when riverbed had to be tackled from November to May. Even in this period it was found after an elaborate study of hydraulic data that it would be necessary to provide for a flow of 850 cumecs (30,000 c/s) though diversion arrangements.

After several alternative proposals for this diversion were considered, a circular tunnel of 9.14 m (30 ft.) diametre was mined through the left abutment to carry 566 cumecs (20000 c/s) and a diversion channel to carry 283 cumecs (10000 c/s) was executed on the right side with two semi-permanent concrete coffer dams built under water in the gorge one upstream and one downstream to isolate the foundation area. The building of these cofferdams posed its own problems with a great depth of water standing on the deep bed level even under the minimum water levels of summer flow in the river and the bouldery nature of the river bed at the site.

The Power House complexes had their own share of complications to be met being located on the flanks away from the gorge. The water conductor system for the right bank power house consists of an approach channel, an intake structure, a 15 m dia 740 m long lined power tunnel, a 28 m surge shaft, 7 number of 6 m dia and 115 m long penstock tunnels taking off from the surge shaft and a tail race channel with necessary gates and regulating valves.

The Left Bank Power Station is presently under construction. This involves excavation of approach tunnels, tunnels for the water conductor system, provision of gates etc. and underground caverns for the Power House and transformer and switchgears. Unlike the Right Bank Power House, which is only a semi under ground power station, the Left Bank Power House will be a totally underground power station with a long tailrace tunnel.

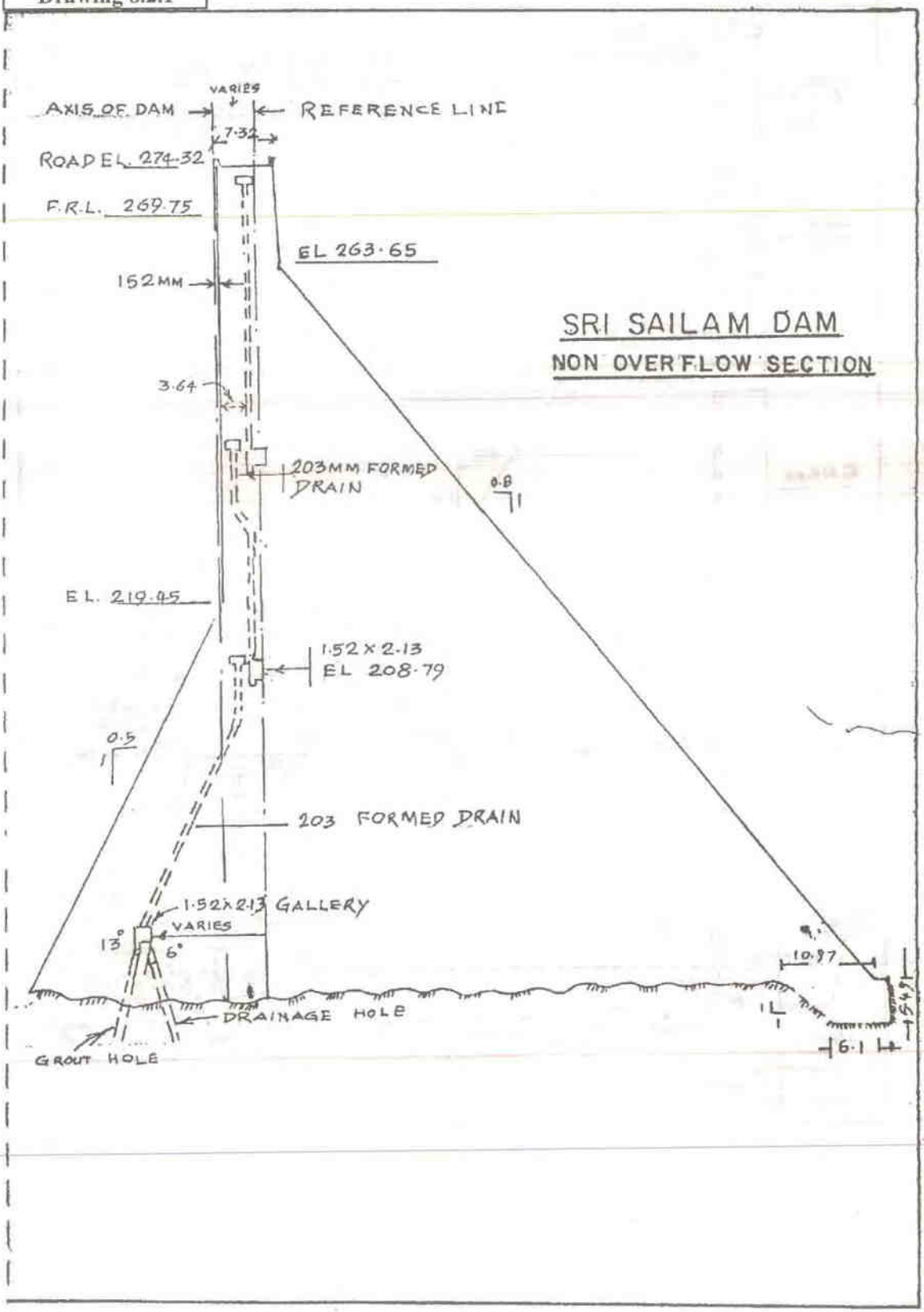
The Right Bank Power House started generating Power from the year 1982 and the seven units got commissioned one after the other on the following dates

Unit 1	30.08.82	Unit 5	31.03.86
Unit 2	14.12.82	Unit 6	30.10.86
Unit 3	19.11.83	Unit 7	15.03.87
Unit 4	27.08.84		

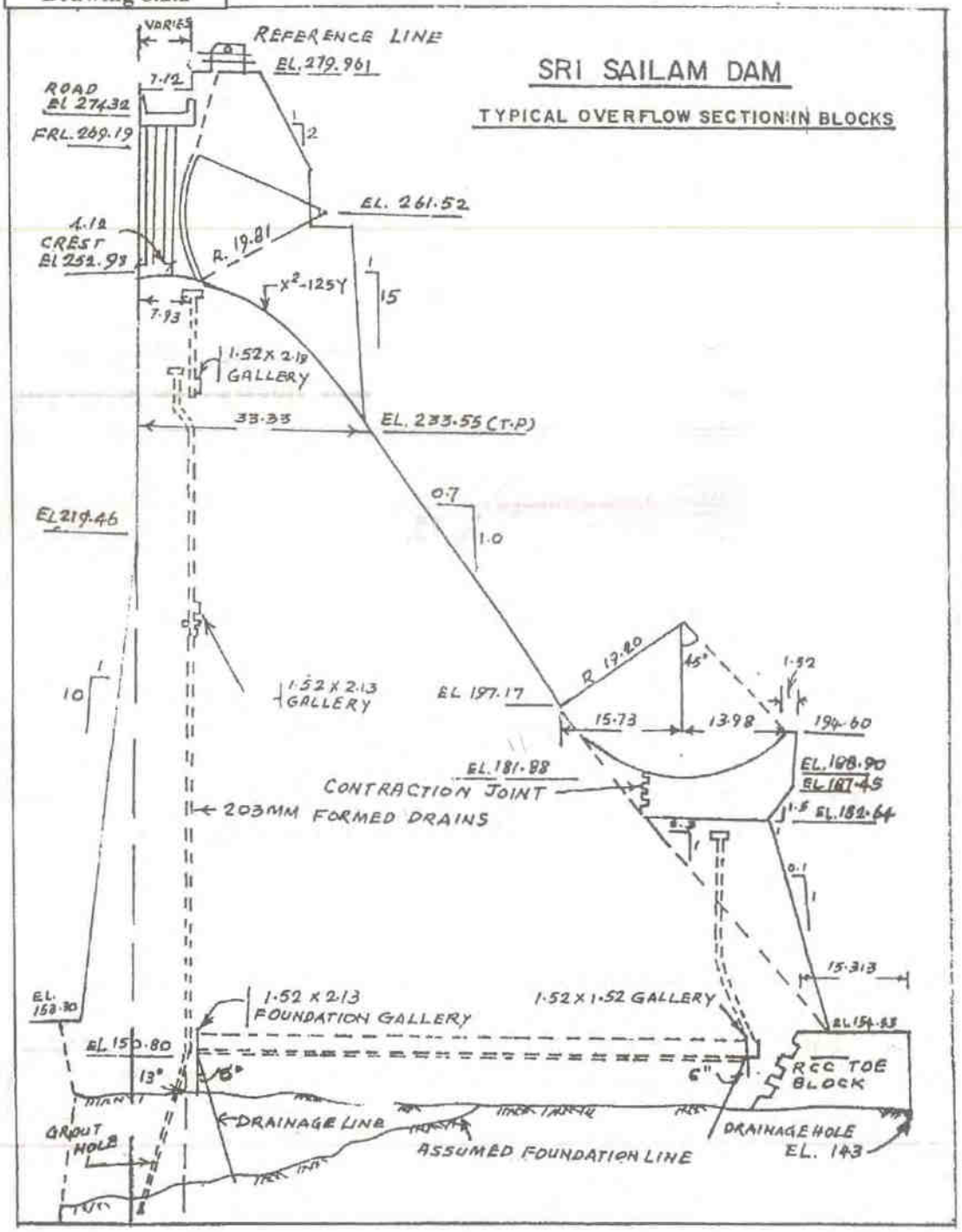
This project had also ushered in modern methods of construction in the State through the use of large size construction plant and machinery all indigenously made and operated. Blow knox plants one on each flank were installed with weigh batching and one cubic yard mixers and arrangements made for transportation of mortar by conveyors to a place near the dam. For the concreting in the main dam with a placement temperature of 60° F and the maximum size of aggregates as 150 mm, an aggregate crushing plant of 300 TPH capacity was installed which gave aggregate of 150 mm to 5 mm (6 inches to 3/16 inch) in the required proportions to meet the mix design for various types of concrete. An aggregate cooling plant was also installed to maintain the placement temperature. Cableways supplied by M/s. Usha Breco Ropeways, Calcutta were also erected with a fixed head master tower on the right flank hill and a moving tail car on the left flank. All operations were done electrically and controlled from a single operation cabin on the right flank. Concrete from the batching plant and mixes could be transported to the exact work spot in 4.6 cum (6 cubic yard) buckets and placed through the help of these cableways operated from the cabin with directions being given in telephone system.

Synchronising the capacities and the deliveries of the machinery could be cited as having played an important role in maintaining the desired output and progress in concreting the dam, block after block, particularly in the deep depths. The batching plant had a capacity of 139 cum (180 cubic yards) per hour with 4 mixers each of 2.3 cum (3 cubic yards) capacity 3 working at a time with one as standby. The cableways, the aggregate crushing and cooling plants were planned to match the capacity of the batching plant and this enabled an output of 700 units of 2.8 cum (100 cubic foot) per day without any difficulty.

Drawing 8.2.1


VARIES
AXIS OF DAM
REFERENCE LINE
7.32
ROAD EL. 274.32
F.R.L. 269.75
EL 263.65
152MM
SRI SAILAM DAM
NON OVER FLOW SECTION
3.64
203MM FORMED DRAIN
0.8
1
EL. 219.45
1.52 X 2.13
EL 208.79
0.5
1
203 FORMED DRAIN
1.52x2.13 GALLERY
VARIES
13°
6°
10.97
1
1
DRAINAGE HOLE
GROUT HOLE
6.1

Drawing 8.2.2


SRI SAILAM DAM
TYPICAL OVERFLOW SECTION IN BLOCKS
VARIES
REFERENCE LINE
EL. 279.961
7.12
ROAD
EL 274.32
FRL. 269.19
EL. 261.52
4.12
CREST
EL 252.93
R. 19.81
$X^2 = 125Y$
7.93
1.52 X 2.13
GALLERY
33.33
EL. 233.55 (T.P)
EL 219.46
0.7
1.0
10
1.52 X 2.13
GALLERY
EL 197.17
R 17.40
45°
1.52
15.73
13.98
194.60
EL. 181.88
CONTRACTION JOINT
EL. 168.90
EL 167.45
EL. 182.64
203MM FORMED DRAINS
0.1
15.313
EL.
153.30
1.52 X 2.13
FOUNDATION GALLERY
1.52 X 1.52 GALLERY
EL 154.53
EL. 150.80
13°
8°
6"
RCC TOE
BLOCK
GROUT
HOLE
DRAINAGE LINE
ASSUMED FOUNDATION LINE
DRAINAGE HOLE
EL. 143

Due to the formation of the Srisailam Reservoir, 117 villages, 52 in Kurnool district on the right and 65 villages in Mahaboob Nagar district on the left were affected necessitating an extensive Rehabilitation and Resettlement Programme (R&R) which was satisfactorily completed including the measures required for environmental issues. More than 21,000 families got displaced. More than Rs.240 crores were spent towards compensation for lands and houses alone part of which was through the intervention by the courts and part through the settlement by the LOK ADALAT.

The project in its entirety excepting for the Left Flank Power Station was completed by 1984 and has since been functioning satisfactorily, bringing substantial benefits to the State by augmenting the much needed power to the grid and other incidental benefits. The salient features of the project at given at Annexure-IV.

Dr.K.L.Rao, an eminent Engineer of India, was closely associated with the design and the construction of the dam from the initial stage whose inspiring guidance motivated the Engineers at site to tackle all major problems which the building of this dam had posed, with confidence. Engineers at all levels worked round the clock for several days as a team to solve all the problems posed during the construction of this prestigious project all by local expertise without any foreign assistance and built this monumental structure, the Srisailam dam.

THE PRAKASAM BARRAGE

The New Barrage on Krishna near Vijayawada constructed to take over the functions of the old Krishna Anicut designed by Sir Arthur Cotton and constructed by Captain ORE in the years 1852-55 at a cost of Rs.2 crores was aptly named after Sri Tanguturi Prakasam Garu, the then Chief Minister of Andhra, rather the first Chief Minister of Andhra State soon after its separation from Madras State in 1953. He laid the foundation stone for the Barrage on 13.2.1954.

The Krishna Barrage Project had to be sanctioned in an emergency even though there was financial crunch for the new State of Andhra as the old Krishna anicut was showing signs of distress and even breached in certain lengths.

As was the case in the Godavari Delta, the Krishna Delta was fast developing with the construction of the Krishna Anicut and the assurance of irrigation for cropping in the anticipated ultimate ayacut planned for the Anicut viz. 2.36 lakh ha (5.84 lakh acres), which was quickly exceeded. To meet the need for additional diversions and the head to be created, the crest of the anicut was raised by 0.9 m (3 ft) to increase the pond level in 1893. But this naturally caused several damages to the apron as could be expected and so this was quickly corrected by dismantling the raised crest and installing 0.6 m (2 ft) falling shutters instead, in 1897. The pond level created was inadequate for the growing ayacut and the 0.6 m (2 ft) shutters had to be replaced by 0.9 m (3 ft) falling shutters in 1898, a year later. By 1923-25, further improvements to the anicut became inevitable and the six feet falling shutters were erected over the body wall whose operation was difficult and risky and some damages to the apron could not be avoided. Water levels had to be manipulated and maintained above the top of the shutters to obtain necessary head for supply to the growing ayacut, which has now reached 4.86 lakh ha (12 lakh acres). It was becoming increasingly clear that unless the pond level is maintained at 2.44 m (8'0") above the anicut crest the command could not be fully served.

The obvious choice therefore was to go in for a Barrage with 3.66 m (12 feet) lift shutters. This not only helped pushing in adequate discharges into the canals but also facilitated fast transplantation process thereby saving the crops from the damages of the ensuing monsoon. A road bridge was also combined in the structure, which thus became an impotent link for N.H.5 to cross the river and meet the need for the developing traffic at the same time economising on the cost.

The Barrage has 70 spans each of 12.2 m (40'0") fitted with 12.2 m x 3.66 m (40' x 12') lift gates. There are 14 scour vents 8 on the Sithanagaram side and 6 on the Vijayawada side each with vent size 5.18 x 3.66 m (17'0" x 12'0"). The R.C. Road bridge is 7.32 m (24'0") wide between kerbs with 1.5 m (5'0") side walks on either side.

The gates are operated by hoists located on the Hoist Bridge 5.18 m (17 ft) above the road level. It is a matter for pride, that the entire structure, the embedded parts, the regulator shutters and other shutters, the hoists, the hoist bridge, the required controls, gears were all locally manufactured in the Sithanagaram workshops for the required precision. The erection was also completed by the departmental staff in record time. The last gate of the regulator was lowered in position on 11.7.60 the last span of the hoist bridge was installed in position on 14.8.60 with the last hoist erected on 10.11.60. 1700 tons of steel was used in the gates and hoists and another 750 tons for the hoist bridge.

The Barrage structure has been built on three rows of cut off wells of size 2.13 m x 3.81 m (7'0" x 12'6") with the front rows sunk 4.88 m (16'0") deep and others 6.10 m (20') deep. The solid apron and the talus have been provided as per design. The barrage has been designed to discharge a flood of 33,700 cumecs (11.9 lakh cusecs).

The Barrage structure is built at 31.85 m (104'5") upstream of the old anicut and whatever remained of the old anicut structure has been left in place to serve as additional talus.

The Head sluice on the Viajaywada side has 6 vents 6.1 m x 3.35 m (20'0" x 11'0") designed to discharge 300 cumecs (10,600 cusecs) while that on the Sithanagaram side has 15 vents 1.8 m x 2.9 m (6'0" x 9'6") designed to

discharge 188 cumecs (6,640 cusecs). The ayacut which was around 4.45 lakh ha (11 lakhs acres) has now stablised at 5.06 lakh ha (12.5 lakhs acres) in the districts of Krishna, Guntur, West Godavari and Prakasam. The cost of the barrage was about Rs.3.00 crores. The salient features of the project are given at Annexsure-V.

THE TUNGABHADRA PROJECT

The Tungabhadra Project, a multipurpose River Valley Project, was constructed as a Joint venture of the then Madras and Hyderabad States for providing irrigation facilities to 3.5 lakhs hectares in Raichur and Bellary Districts of Karnataka State and 1.46 lakhs hectares in Kurnool, Cuddapah and Anantapur Districts of Andhra Pradesh. The Project was taken up in 1945 and completed in 1953 at a cost of Rs.130.76 crores. Water was first released during the year 1953. Besides Irrigation, facilities for generating power to the extent of 99 MW were installed.

This project was getting into shape as India was marching towards Independence and formation of Andhra Pradesh as a separate State was in the anvil. This being the first major project in the region on a major tributary of the River Krishna with a large scope for development of its waters resources, it was contemplated and executed in stages. Starting in the first stage with the low level canal of 251 km on the right bank and another low level canal of 227 km on the left bank to provide irrigation both in the Karnataka and the Andhra Pradesh, excavation of High Level Canals both on the right and the left banks was taken up that again in two stages. The first stage of the High Level Canal was completed in 1968 and soon after the second stage was taken up.

The Tungabhadra Board Constitution

The Tungabhadra Board was constituted by the President of India under Section 66 (4) of Andhra State Act (30 of 1953) and reconstituted on 10.3.1955. The Tungabhadra Board is headed by Chairman nominated by the Government of India, with Members from both Karnataka and Andhra Pradesh and a Member (Finance) from Government of India. A full time Secretary is stationed at Tungabhadra Dam for efficient performance of the Board's functions. The Tungabhadra Board is in charge of the maintenance and operation of Tungabhadra Reservoir, Dam and Canals common to both the States of Karnataka and Andhra Pradesh on the Right Side of Tungabhadra River.

Water regulation:

The Tungabhadra Board was established for the completion and maintenance of the Project. The Board is responsible for distribution of water between the two States as per the terms stipulated in the Krishna Water Disputes Tribunal Award. In terms of the Award, the water available for utilisation in a water year in the Tungabhadra Dam shall be so utilised that the demands of water for the following projects to the extent mentioned below may be met:

	Mcum (TMC)
i) Tungabhadra Right Bank Low Level Canal State of Karnataka 538 Mcum (19.00 TMC) State of Andhra Pradesh 680 Mcum (24.00 TMC)	1218 Mcum (43.00)
ii) Tungabhadra Right Bank High Level Canal – Stages I & II State of Karnataka 496 Mcum (17.50 TMC) State of Andhra Pradesh 920 Mcum (32.50 TMC)	1416 Mcum (50.00)
iii) Tungabhadra Left Bank Low Level and High Level Canals (Karnataka only)	2635 Mcum (93.00)
iv) Raya and Basavanna Channels of the State of Karnataka only	198 Mcum (7.00)
v) Assistance by way of regulated discharge to Vijayanagar channels other than Rays and Basavanna channels of the State of Karnataka	56 Mcum (2.00)
vi) Assistance by way of regulated discharge to the Rajolibanda Diversion Scheme for use by the States of Karnataka and Andhra Pradesh Karnataka 14 Mcum (0.49 TMC) Andhra Pradesh 184 Mcum (6.51 TMC)	198 Mcum (7.00)
vii) Assistance by way of regulated discharge to the Kurnool-Cuddapah Canal of the State of Andhra Pradesh only.	283 Mcum (10.00)
Total	6006 Mcum (212.00)
Reservoir evaporation	510 Mcum (18.00)
Total	**6616 Mcum (230.00)**

If in any water year, water available for utilisation in the Tungabhadra Dam is less than the total quantity of water required for all the projects as mentioned above, the deficiency shall be shared by all the Projects proportionately. The proportions shall be worked out after excluding the evaporation losses.

The Working Tables for the utilisation of the water in the Tungabhadra Dam are prepared by the Tungabhadra Board so as to enable the States of Karnataka and Andhra Pradesh to utilise the water available for utilisation in the Tungabhadra Dam in the manner indicated above.

The Tungabhadra Board is in charge of operation and maintenance of the Canal System of Right Bank Low Level Canal upto km. 250.580 including 11 Common Distributaries to a length of about 90 km. and Right Bank High Level Canal upto 105.430 km. The operation and maintenance of Left Bank Canal, Left Bank High Level Canal including their Head Regulators and the Raya Basavanna Channels (except Head regulator of Raya Basavanna Channel) is entirely under the control of Irrigation Department of Government of Karnataka.

Water is released into different canal systems of Right Bank Low Level Canal and Right Bank High Level Canal and into the river for assistance to Vijayanagar Channel System, Rajolibanda Diversion Scheme and Kurnool-Cuddapah Canal as requisitioned by the Irrigation Departments of both the States. The drawal of water into the different canal systems and assistance by way of River releases to K.C.Canal, Rajolibanda Diversion Scheme and Vijayanagara Channel system is monitored by the Tungabhadra Board.

The equitable distribution of water as per the Award of Krishna Water Disputes Tribunal amongst both the States of Karnataka and Andhra Pradesh is thus ensured.

The Right Bank Low Level Canal with a designed capacity of 51 cumecs (1800 cusecs) at head provides irrigation for an area of 37,503 ha. (92,674 acres) in Bellary District of Karnataka State and 63,522 ha (1,56,963 acres) in Kurnool District of Andhra Pradesh.

The Right Bank High Level Canal with a designed capacity of 113 cumecs (4000 cusecs) at head provides irrigation for an area of 80,908 ha (199924 acres) in Bellary District of Karnataka and 76,397 ha. (1,88,777 acres) in Andhra Pradesh.

The Tungabhadra Board releases water on Right side through 96 Nos. off-take points on Power Canal and Right Bank and Low Level Canal and 24 off-take points on Right Bank High Level Canal upto Board limit. The regulation of water in the Distributaries beyond the off-take points and utilisation for the ayacut is the responsibility of the Irrigation Department of the respective States.

Hydro electric scheme

The Hydro Electric Scheme under Tungabhadra Project consists of three Power Houses (1) At the foot of the Dam on the Right side with an installed capacity of 36 M.W (2) At the foot of the Dam on the Left Side with an installed capacity of 27 M.W. and (3) Near Hampi at K.M.22/0 of Power Canal with an installed capacity of 36 M.W. The Tungabhadra Board operates and maintains the Powerhouses on the Right Side of Tungabhadra River (i.e.) one at Dam Site and the other near Hampi. The Powerhouse on the Left Side is under the control of Karnataka Electricity Board. The Electricity generated by the Right Side Powerhouses is shared between the States of Karnataka and Andhra Pradesh in the ratio of 20:80.

A copy of the constitution of the Tungabhadra Board is enclosed as Annexure-VI for information.

The cropping pattern originally envisaged was Hinguri, September to February, which was the practice earlier which took into consideration the monsoon rainfall, residuary moisture and the cooler climate of the winter months. But very soon the cropping pattern underwent a change with part of the command area served in Kharif paddy and the rest Rabi irrigation dry crop. This necessitated the canal to be kept running for nearly 11 months in a year with all the attendant problems. Command Area Development took quite some time.

To manage this interstate project efficiently and effectively, a Board was constituted by a special Act quite thoughtfully even as the project was taking shape and benefits were about to flow. The salient features of the project are given at Annexure VII.

RAJOLIBANDA DIVERSION SCHEME

This is a scheme executed jointly with the State of Karnataka, then Mysore to extend the benefit of irrigation for 37596 ha (92,900 acres), 2388 ha (5900 acres) in the Raichur district of Karnataka and 35208 ha (87,000 acres) in Mahabubnagar district of Andhra Pradesh.

An anicut 820 m (2690 ft) long and 9.4 m (31 ft.) high has been constructed on Tungabhadra, tributary of Krishna at a place called Rajolibanda. The flood discharge provided for is 21246 cumecs (7,50,000 cusecs). 3 vents 1.8 m x 2.1 m (6'0" x 7'0") have been provided for scour and 5 vents 1.8 m x 2.1 m (6'0" x 7'0") provided in the head sluice to feed a contour canal on the left bank running for 143 km (89 miles) the first 43 km (27 miles) lying in the Karnataka State. The main canal is lined and has a carrying capacity of 24.1 cumecs (850 cusecs) at the head and 21.8 cumecs (771 cusecs) at the Karnataka - Andhra border. This project started in 1944 came into partial operation by 1958 and completed around 1963.

The canal presently serves both the Kharif and also Rabi season and hence runs for nearly 11 months in a year. Tungabhadra of course gives dependable supplies still. Supplementation of 198 Mm^3 (7 TMC) is assured from the Tungabhadra reservoir and hence the command area gets well served and has developed well except for small areas in the tail ends.

GODAVARI BARRAGE PROJECT - THE COTTON BARRAGE

The Godavari Anicut at Dowleshwaram constructed between the years 1847 and 1852 by Sir Arthur Cotton was his masterpiece. This structure stood the test of times and originally planned for serving an ayacut of 1,61,874 ha (4,00,000 acres) continued to serve even as the delta ayacut increased fast to 4,04,686 ha (10,00,000 acres) an increase of 2 ½ times. This had to be facilitated by increasing the crest level and thus the pond level in stages, as detailed in the previous chapter.

As this majestic structure across the mighty river Godavari, crossed a century of its life and had to meet the demands of increasing ayacut, the engineers of Andhra Pradesh were getting concerned

about its safety and knew that any mishap would mean a great disaster throwing out of gear the irrigation prospects of the large deltaic tract with more than 4.05 lakh ha (10,00,000 acres) of flourishing paddy and sugarcane with 135% irrigation intensity. Managing the delta irrigation even with the increased pond level was becoming difficult and a need was felt for further raising the pond level which of course was just not possible with the old structure.

The hydraulic model studies conducted at the Irrigation Research Station at Poondi, Tamil Nadu after the raising of the pond level with falling shutters revealed that the downstream floor levels were inadequate for the formation of the hydraulic jump and shooting flow was occurring. Scours beneath the anicut flow were suspected and this was established through the electrical resistivity tests conducted in the year 1961. Cavities formed were actually seen by breaking open the floor in a few suspected spots. The existing gradient was suspected to have risen to as steep as 1 in 3.5 in places.

The very high flood of 1963 caused extensive scours in the apron of the Ralli part of the anicut and certain damages were noticed which had to be repaired on an emergency basis with an additional row of sheet piling etc. There was a lurking fear that any time the structure may collapse.

The Government of India constituted an expert Committee headed by Sri A.C.Mitra which went into the whole issue and categorically ruled out any further hotch / potch repairs to the structure and recommended the construction of a new barrage to replace the 120 years old anicut structure on the verge of collapse.

The new barrage was planned just 40 metres (131 feet) upstream of the existing anicut retaining the old structure in its place as it is, as an extension of the rear talus of the barrage.

The catchment area of the river Godavari at Dowleshwaram is 3,14,685 sq.km. The maximum flood discharge recorded was 85233 cumecs (30,10,000 cusecs) in the year 1953. The new barrage was designed for a 200 year return flood calculated as 91,400 cumecs (32,52,669 cusecs). While the maximum flood level as observed was 17.610 m, the designed maximum flood level was maintained as 19.570 m upstream and 19.200 m downstream.

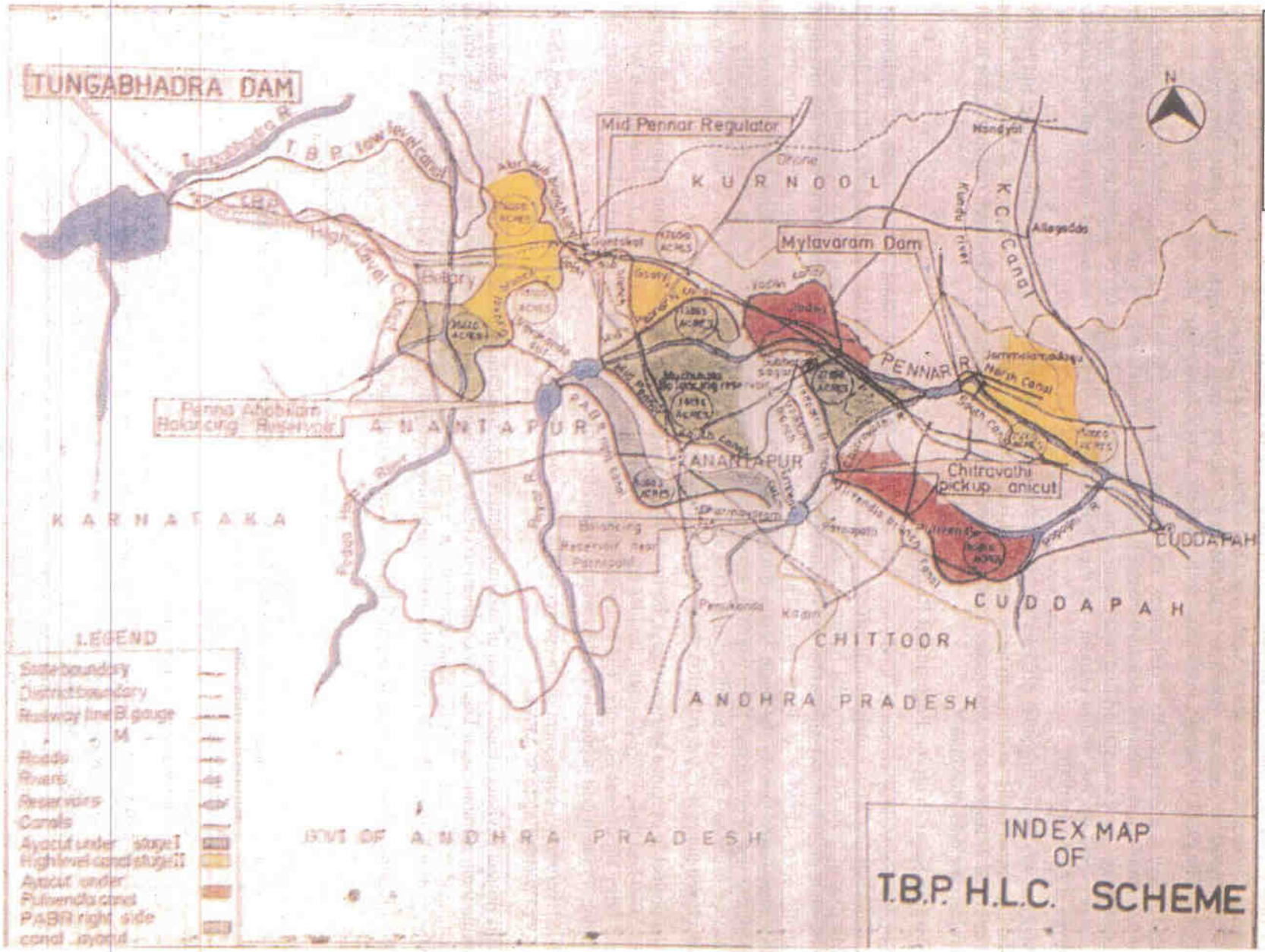
The barrage is designed as a glacis type structure on RCC raft 1.37 m thick over elastic foundation with necessary pile cut off. A cross section of the Barrage is in Map 8.2

The barrage is built to close the four arms of the river on the lines the old anicut was built, with 175 number of bays with vents 16.29 m on x 3.35 m operated by vertical lift crest gates each weighing 27 tonnes over the body wall with crest level at + 10.670 m.

	Length in metres	No. of bays
Dowleshwaram arm	1440.05	70
Ralli arm	884.45	43
Maddur arm	469.66	23
Vizzeswaram arm	804.90	39
Total	**3599.06**	**175**

The operating mechanism for the crest gates has alternative provisions for electronic remote control with individual hoisting equipment with hoist motors, which can also be hand operated.

Necessary embankments have been raised in between these arms in the lankas totalling to 2238 m. Total length of the barrage thus comes to 5.837 km. The barrage carries a road 6.70 m clear with 0.762 m wide foot paths on either side and acts as a highway crossing on the mighty river for surface communication.


TUNGABHADRA DAM
T.B.P. low level canal
T.B.P. High level Canal
Mid Pennar Regulator
KURNOOL
Mylavaram Dam
K.C. Canal
PENNAR R.
Penna Ahobilam Balancing Reservoir
ANANTAPUR
KARNATAKA
Chitravathi pick up anicut
CUDDAPAH
CHITTOOR
ANDHRA PRADESH
LEGEND
State boundary
District boundary
Railway line B.gauge
M
Roads
Rivers
Reservoirs
Canals
Ayacut under stage I
High level canal stage II
Ayacut under Pulivendla canal
PABR right side canal ayacut
GVT OF ANDHRA PRADESH
INDEX MAP OF
T.B.P. H.L.C. SCHEME

Drawing 8.3

The Head sluice for the Eastern Delta has 4 vents 12.19 m x 3.89 m designed to discharge 170 cumecs (6000 cusecs) to serve an ayacut of 1,11,696 ha (2,76,000 acres). The head sluice for the central delta has 3 vents 12.19m x 3.89 m designed to discharge 120.6 cumecs (4260 cusecs) to serve an ayacut of 82,564 ha (2,04,016 acres). The head sluice for the Western Delta has 5 vents of 12.19 m x 3.89 m designed to discharge 257 cumecs (9075 cusecs) to serve an ayacut of 2,10,083 ha (5,19,116 acres). The total ayacut under the project is thus 4,09,407 ha (9,99,132 acres). In all these arms necessary scour sluices have also been provided.

The project cost exceeded Rs.70.00 crores. Rs.5.00 crores were contributed by the ayacutdars as betterment levy and Rs.36.00 crores obtained as loan from the World Bank with the rest being invested by the State Government. The Barrage work was started first in the Ralli arm in 1969 and the Project was dedicated to the Nation on the 29th October 1982 by Smt. Indira Gandhi, the then Prime Minister of India. The salient features of the project are given at Annexure-VIII.

Many of the major irrigation projects in Andhra Pradesh by the sheer largeness and magnitude and high cost though started earlier continue in more than one Five Year Plan and are to be considered as 'on going' some by extensions in stages and some in their command area not getting developed fully. Such ongoing major irrigation projects are presented below.

Srirama Sagar Project – Pochampad Project

Srirama Sagar Project across Godavari river in Pachampad village, about 200km north of Hyderabad in Nizamabad district is a major multipurpose project formally launched on the 26th July 1963 with the first Prime Minister of India Sri Jawarharlal Nehru inaugurating. This project was chosen as the best among a few varied proposals made and investigated for use of Godavari waters for the past four decades and more, the investigation having been started as early as 1942. This project became possible after the accord reached in sharing the Godavari waters among the basin States through which Andhra Pradesh would utilise all the balance waters available upto Pochampad Dam which is assessed to be 5553 Mcum (196 TMC) at 75% dependability in any manner it chooses for its beneficial use. This should be considered as a boon to the Telengana Region which developed not only in the irrigation sector but also through agro based industries.

The project is executed in two stages, the first stage being planned to extend irrigation facilities to an ayacut of 3,92,000 hectares (9,68,240 acres), besides ensuring drinking water to urban areas like Karimnagar and Warrangal and other rural areas en route. The National Thermal Power Project at Ramagundam which is a lifeline in the Andhra Pradesh grid is being served its water demand from the project.

The Hydropower component of this project is the dam power house in the right non-overflow section with 4 units of 9 MW (totaling to 36 MW)

This project envisages construction of two more dams on the tributaries of Godavari joining the river downstream of the main Srirama Sagar Dam on Godavari to create additional storages to augment the supply for the irrigation command envisaged. Thus Kaddam dam built on a small tributary joining the Godavari on its left and the Lower Manair dam built on Manair joining the river much lower down form an integral part of this project.

The irrigation in the first stage was provided by the canals listed below

		Ayacut in hectares
a	The Kakatiya canal running for 284 km taking off from Sri Rama Sagar dam on the right flank to serve ayacut in Nizamabad 4,463 Karim Nagar 2,17,137 And Warangal 1,47,400 Total	3,69,000
b	The Saraswathi canal taking off from the left flank of Sri Ram Sagar dam and running for 47 km to be linked to the Kaddam reservoir to serve the ayacut in Adilabad district	14,151
c	The Lakshmi canal just a small one taking off at a higher level on the right flank from the Sri Rama Sagar dam itself to serve areas in Nizamabad district	8,849
	Total in I stage	3,92,000

In the second stage, formally inaugurated by the Hon'ble Chief Minister, Andhra Pradesh Sri Nara Chandra Babu Naidu on 06.03.1996, an addition of 2,37,550 ha is contemplated the addition being mainly under the Kakatiya Canal by extending it from km 284 to km 347 to serve 1,78,066 ha which came into operation in August 1997 and under Kaddam canal through its eastern arm extending from existing km 77 to km 144 as Sarawathi canal extension to benefit another 59,490 hectares. The ayacut under Kaddam canal gets stabilised incidentally. The additional ayacut under stage II is therefore 2,37,556 ha. The districts benefited by these extensions under stage II are Warangal, Khammam, Nalgonda under Kakatiya canal and Adilabad under Saraswathi canal.

Thus as many as six out of 10 districts of Telengana Region get the benefits from this project. The total water utilisation is assessed as 4117.6 Mcum (145.35 TMC) under stage I and another 109.3 Mcum (38.58 TMC) under stage II.

The Srirama Sagar dam on Godavari is essentially an earthen dam with a masonry spillway. A length of 13640 metres is in earth and 958 m in masonry on the left flank. The maximum height of the dam is only 42.67 m (140 ft). The spillway housed in the masonry portion is of ogee profile with slotted roller ski jump bucket in 42 bays with radial gates 42 Nos. (15.24 m x 10.05 m) to discharge a flood of 45,300 cumecs (16 lakh cusecs) corresponding to a 1000 year design flood as per frequency analysis.

There are six river sluices 2.44 m x 3.66 m (8' x 12'), which also served as diversion sluices during construction. The Head sluice of the Kakatiya canal is of 4 vents 2.44 m x 3.66 m (8'x 12'). The Head sluice of the Saraswathi canal on the left is of 2 vents 2.44m x 3.66m (8'x12').

The reservoir has a gross storage capacity of 3712 Mm^3 (131.09 TMC) and a water spread of 453 sq. km at its FRL + 332.54 m.

The Kaddam dam on Kaddam tributary, in Peddur village of Adilabad district was started in 1949 itself and completed in 1965 and later integrated with the Sri Ram Sagar Project with the Saraswathi canal tributary discharging into its reservoir and the Sri Rama Sagar canal stage II being extended from the tail of the Kaddam canal to serve an additional 59,490 hectares.

The Kaddam dam is also mainly an earth dam with a masonry spillway. The maximum height of the dam is 103 ft. (31.4 m) and the total dam length is 2285 m (7495 ft.).

The controlled spillway is of length 189 m (620 ft) with 9 vertical lift gates (18.3 m x 6.1 m) capable of discharging 12323 cumes (4,35,000 cusecs). The gross storage capacity is 215.8 M. cum (7.621 TMC) with water spread area of 24.7 sq. km at its FRL + 213.3 m.

The Kaddam dam on its own serves an ayacut of 91,903 ha (2,27,000 acres) besides facilitating an extension of benefits to 59,490 hectares through the linkage with the Sri Ram Sagar Project.

On Manair, the other tributary of river Godavari tapped for the Sri Ram Sagar project there is already a medium irrigation project called Upper Manair Project completed in 1950 irrigating 5868 ha in the Karimnagar District.

Under the Srirama Sagar Stage I a balancing reservoir has been formed on Manair lower down with a gross capacity of 192.6 Mcum (6.80 TMC) and a water spread area of 60.94 sq. km (23.8 sq.m) at the FRL at +280.416 m by constructing the Lower Manair dam. It is a composite dam on Manair 40.5 m (133 ft) high with 10,100 m of earth dam and a masonry length of 641 m of which 363 m is an uncontrolled spillway. The Kakatiya canal from Srirama Sagar dam infalls into the Lower Manair reservoir at its 146th km and takes off from the same to continue its full length of 284 km in the first stage and further down to feed an extended ayacut of 17,806 ha under stage II.

The Srirama Sagar Stage I first sanctioned for Rs.40.10 crores in 1964 has undergone many revisions since then, to Rs.240.0 crores in 1976-77, Rs. 318.00 crores in 1978-79, Rs.870.00 crores in 1984-85 and now running upto Rs. 2550.00 crores in 1997-98 with the stage II added on and the work is still continuing with the projected date of completion as 2003. The escalation in cost is justified by the increase in the scope of the project including lining the canal system of the Kakatiya canal right upto 28.3 lit/sec (1 cusec) discharge. Of course the time over run had its own toll in cost over run. Land acquisition of about 64,202 ha and large commitments in Rehabilitation and Resettlement added to the cost. A World Bank Loan of Rs.951.00 crores (US$ 240.24 Million) was also secured with their attendant disadvantage of high cost packages insisted on by the Bank. The total cost of the project as in 1993-94 was put at Rs.2,243 crores.

The project also had a problem in the implementation of the cropping pattern envisaged. Originally the ayacut was localised as one third irrigation wet in Kharif and two thirds as irrigated dry in Rabi. The irrigation wet was confined to the ayacut of 62,000 ha under the Kakatiya canal above Lower Manair reservoir and farmers were told that the supply will be only on the basis of irrigation dry; but they are free to use their ground waters and go in for any crop of their choice. This resulted in an unorganised and confused cropping pattern developing in the project

area and also a large gap occurring between the irrigation potential said to have been created and the actual potential utilised.

The salient features of this project are given in Annexure-IX.

Singur Project

A dam has been constructed across Manjeera, a tributary of Godavari to provide drinking water 113 Mcum (4 TMC) to the twin cities of Hyderabad and Secunderabad and to provide irrigation facilities to an extent of 16000 ha in the Medak District in addition to stabilisation of existing ayacut under Nizamsagar reservoir. Two units of 7.5 MW capacity (15 MW) powerhouse are also installed. The estimated cost is Rs.79.80 crores and is anticipated to go upto Rs.180 crores.

The dam consists of a masonry spillway 327 m long with a maximum flood discharge of 23,116 cumecs (8,16,000 c/s) provided with 17 radial shutters and an earth dam on the flanks on either side totaling to 7.11 km, 3.903 km on left and 3.12 km on the right flank works were mostly completed by 1989 and the benefits started flowing from 1996. Salient features of the project are given at Annexure-X.

Priyadarshini Jurala Project

For providing irrigation facilities to the drought affected areas in the Mahboobnagar district, a barrage of 40 m height has been built across the river Krishna near Revalapally village and upstream of Srisailam reservoir to serve an ayacut of 26103 ha under the left main canal and 15257 ha under the right main canal, the total being 41360 ha. and an utilisation of 505 Mcum (17.84 TMC). There is also hydropower generation of 221.40 MW through this project. The FRL of the reservoir is + 318.516 m. The gated spillway has 62 vents with radial gates of size 12 m x 8.516 m fixed on the crest. The earthen bund on the flanks run for 3.208 km.

The left main canal is 90 km long with a designed discharge of 0.96 cumecs (33.94 c/s) at the head and the right main canal 50 km long with a designed discharge of 0.59 cumecs (20.80 c/s) at the head. Salient features of the project are given at Annexure-XI.

The canals are unlined and the irrigation intensity is 115%.

The project cost is Rs.545.82 crores. The project was commenced in 1981 and waters were let out for irrigation on 05.08.1996. The right main canal is named as Nalasomanadri canal and the left N.T. Rama Rao Canal.

Vamsadhara Project – Stage I

On the basis of an Interstate Agreement reached between Andhra Pradesh and Orissa to share the dependable yield of Vamsadhara river at Gottu assessed as 3258 Mcum (115 TMC) at 50:50 ratios on 30th September 1962, this project was taken up.

In Stage I, a barrage is constructed on the river at Gottu village to utilise 541 Mcum (19.09 TMC) and to utilise another 890 Mcum (31.41 TMC), a barrage is proposed at Neradi village about 48 km upstream of Gottu Barrage in Stage II. 198 Mcum (7 TMC) is proposed to be utilised to supplement the left main canal ayacut of Stage I, thus making a total utilisation of 1629 Mcum (57.50 TMC).

The Gottu Barrage provides irrigation facilities to 364 villages in 12 Mandals of Srikakulam district. In Stage I, existing ayacut under open head channels and tanks to an extent of 39863 ha is stabilised and an additional ayacut of 20127 ha is planned making a total of 59990 ha.

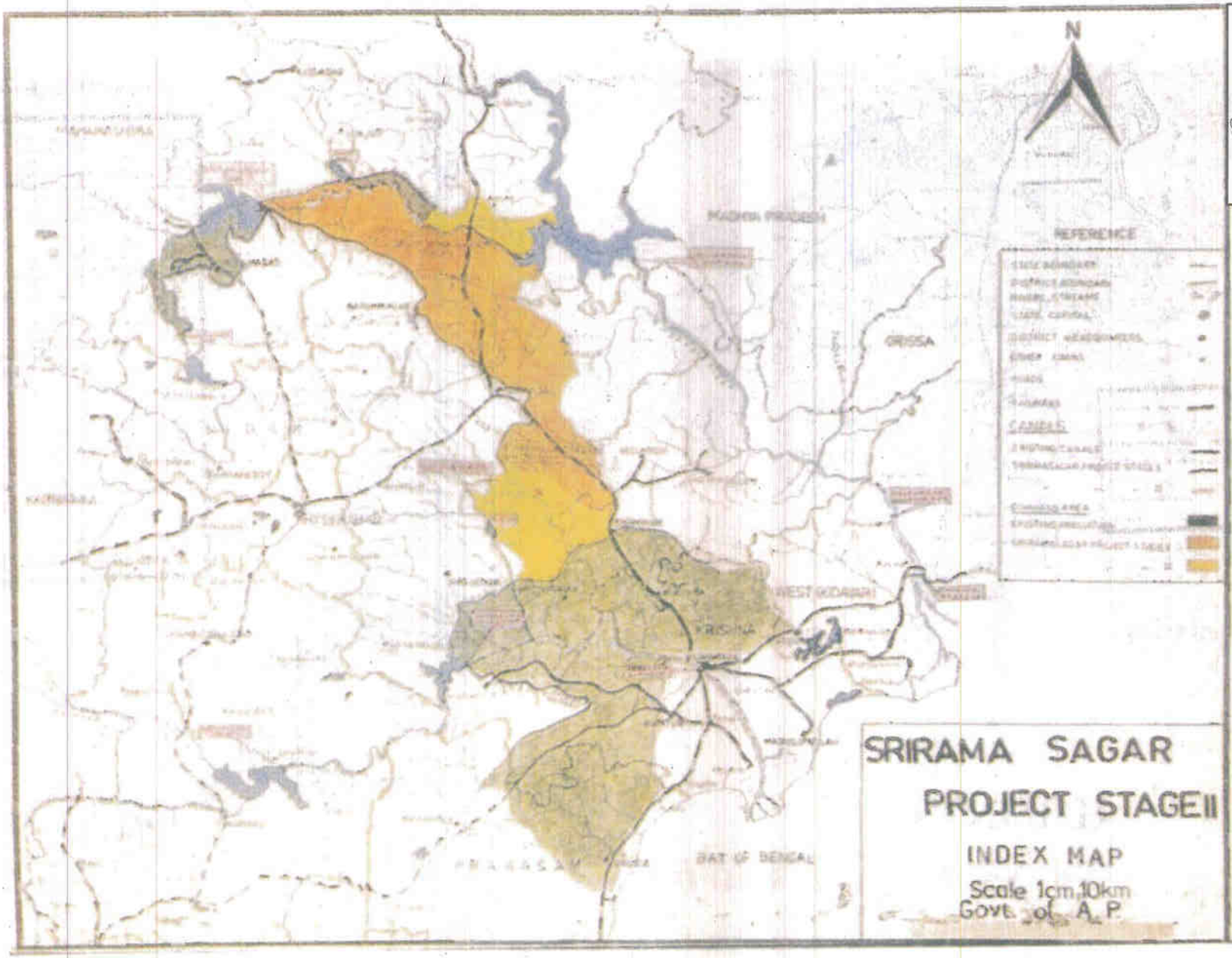
The Gottu Barrage is 476 m long and the irrigation canal takes off on the left bank and runs for 104.24 km. The head designed discharge is 70.20 cumecs (2480 cusecs). The design duty is 55 inclusive of all losses.

Stage I costs Rs.109 crores as revised in 1998. It was commenced in April 1970 and the first release for irrigation was on 29.09.1977.

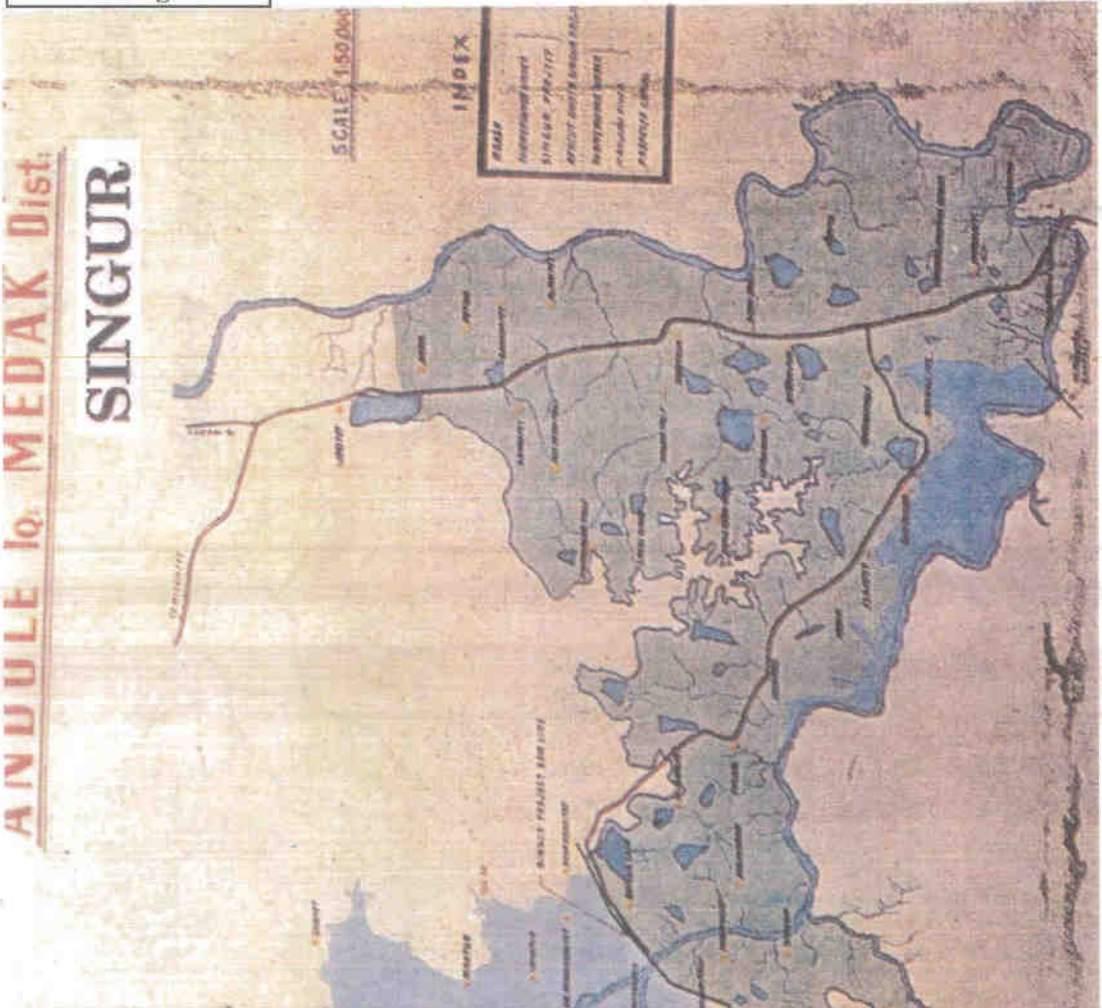
Vamsadhara – Stage II

This project is yet to take off for want of concurrence from the Orissa Government. Though in effect Andhra Pradesh use of waters will be within the limits agreed to in 1962, the Orissa Government has raised certain technical objections with regard to the location of the barrage, its design discharge, submersion problems, etc. and forest and environmental clearances are pending. As such investment clearance has not yet been given by the Planning Commission.

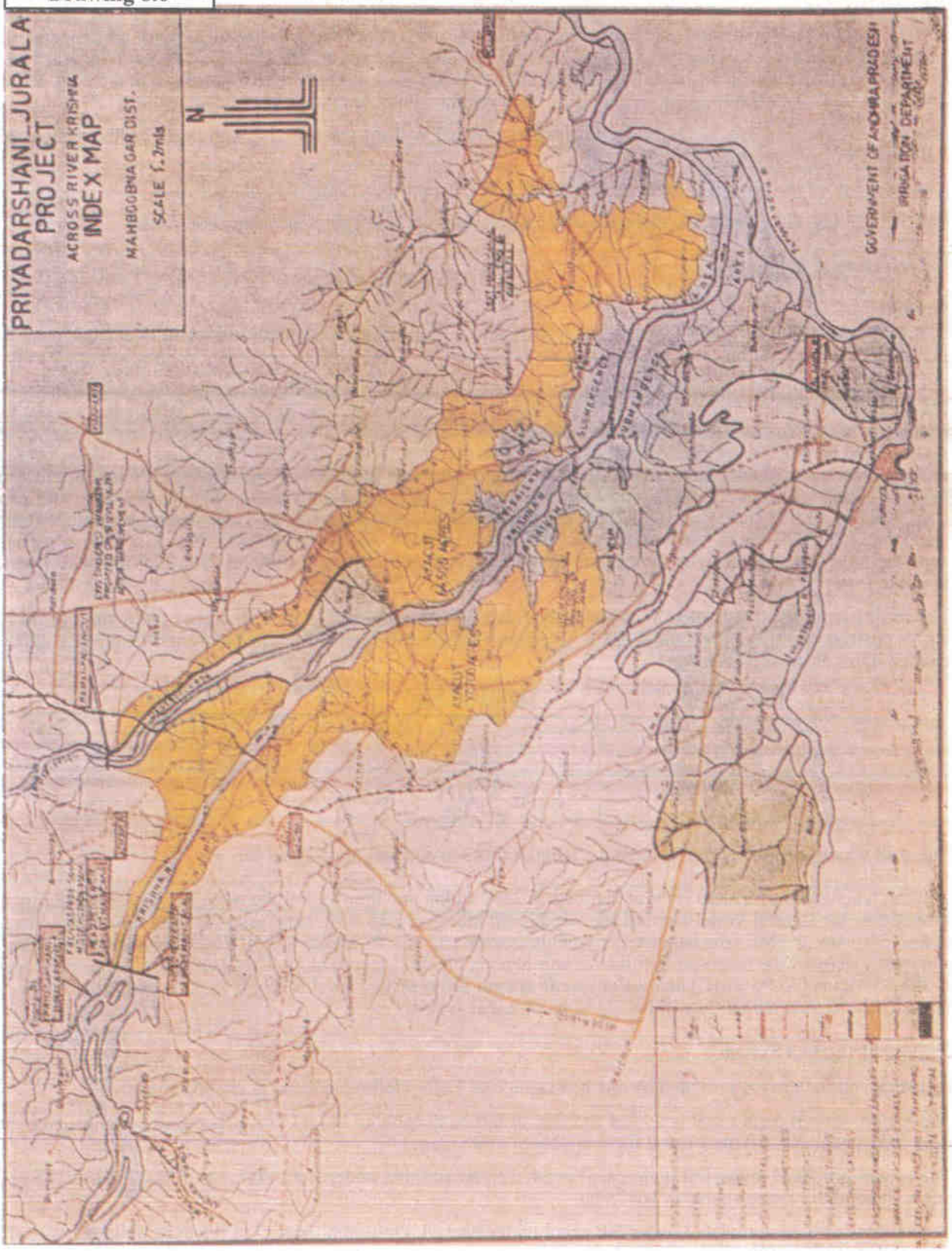
Drawing 8.4


N
REFERENCE
ORISSA
KRISHNA
BAY OF BENGAL
SRIRAMA SAGAR
PROJECT STAGE II
INDEX MAP
Scale 1cm.10km
Govt. of A.P.

Drawing 8.5



Drawing 8.6


PRIYADARSHANI JURALA PROJECT
ACROSS RIVER KRISHNA
INDEX MAP
MAHBOOBNAGAR DIST.
SCALE 1.2 mls
N
GOVERNMENT OF ANDHRA PRADESH
IRRIGATION DEPARTMENT

As proposed a barrage across Vamsadhara will be constructed at Neradi 48 km upstream of Gottu barrage and a flood flow canal of 227 cumecs will take off on right flank and run for 32 km where it will infall into the Hiramandalam reservoir to be formed under this project. This en route reservoir will be of 260 Mcum (9.179 TMC) capacity and will send out two canals one at the high level and another at a lower contour practically running upto the coast serving the area between the canal and the river on the right flank of Vamsadhara. The total area to be benefited is 43414 ha all in Srikakulam district, 8094 ha under the 31.8 km flood flow canal, 33293 ha under the 58.82 km right main canal and 2027 ha under the 30 km long high level canal.

Besides, the existing ayacut under the open head channel five on the left side and three on the right totalling 22,101 ha will get stabilized.

The total cost of the project is estimated at Rs. 275.74 crores as per 1986-87 revision.

Salient features of the Projects, Vamsadhara – Stage I & Stage II are given at Annexure - XII

Yeleru Reservoir Project

General

The Yeleru reservoir has been constructed across Yeleru river near Yeleswaram village in East Godavari district in Andhra Pradesh just north of Godavari estuary.

The scheme comprised construction of dams in 5 gaps and spillway in gap III for a gross storage of 682.70 Mcum (24.10 TMC) with left main canal system providing 0.332 Mcum per day (73 million gallons per day) of water supply to Visakhapatnam steel plant and stabilization of 27362 ha under existing Yeleru open head channel system. The benefits under phase I will cease to exist after completion of Polavaram project by taking over them under its left main canal system and phase II of Yeleru reservoir project will come into existence for creation of new irrigation potential of 58280 ha covered under its left and right canals. The phase II of the project contemplates extension of Yeleru left main canal from km 113.43 to km 160.00 for providing irrigation facility to an extent of 54320 ha in the upland areas of East Godavari and Visakapatnam districts. It also envisages construction of a canal on right bank of the river for irrigating an extent of 4050 ha. However this report pertains to phase I only.

The project envisages construction of an earthen dam 950 m long and 43 m high across the main river in gap I with a positive cut-off to arrest the seepage. The other gaps II, IV, V and VI in the adjacent hills are also closed by earthen dams as detailed below:

Gap number	Length of dam	Height of dam
I	950 m	42.97 m
II	167 m	28.40 m
IV	540 m	20.30 m
V	190 m	19.37 m
VI	540 m	21.45 m

The spill way is located in gap III having a length of 147 m and height of 11.50 m.

The catchment area of Yeleru river at dam site is 2232 sq.km and the yield of the river at 75% dependability is assessed by the Central Water Commission as 438.90 Mcum (15.30 TMC) and after meeting the upper utilisation of 84.95 Mcum (3 TMC) the balance net yield is assessed as 353.95 Mcum (12.50 TMC). However the gross storage capacity of the reservoir at full reservoir level is 682.40 Mcum (24.10 TMC) and the live storage capacity is 508.23 Mcum (17.95 TMC) and water spread area at full reservoir level is 59.36 sq. km. With 98.50% of intensity the annual irrigation will be 27362 ha by canal system.

Proposed Irrigation System

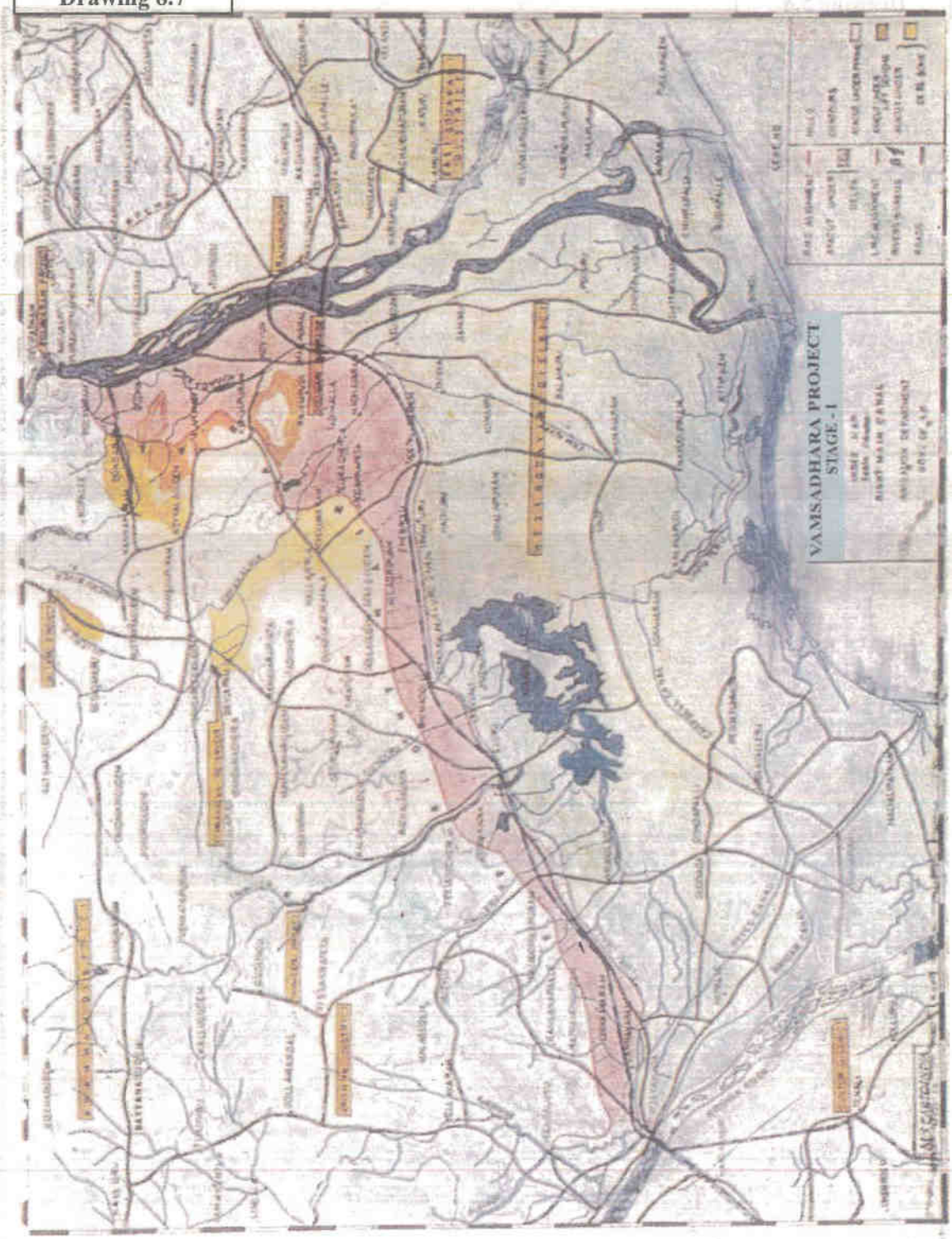
Irrigation stabilization is provided by one head sluice of Yeleru left main canal at ch. 455 m gap IV.

The length of right bank canal is 24 km and that of left bank canal is 113.43 km. In the area commanded by both right bank canal and left bank canal there are about 190 villages.

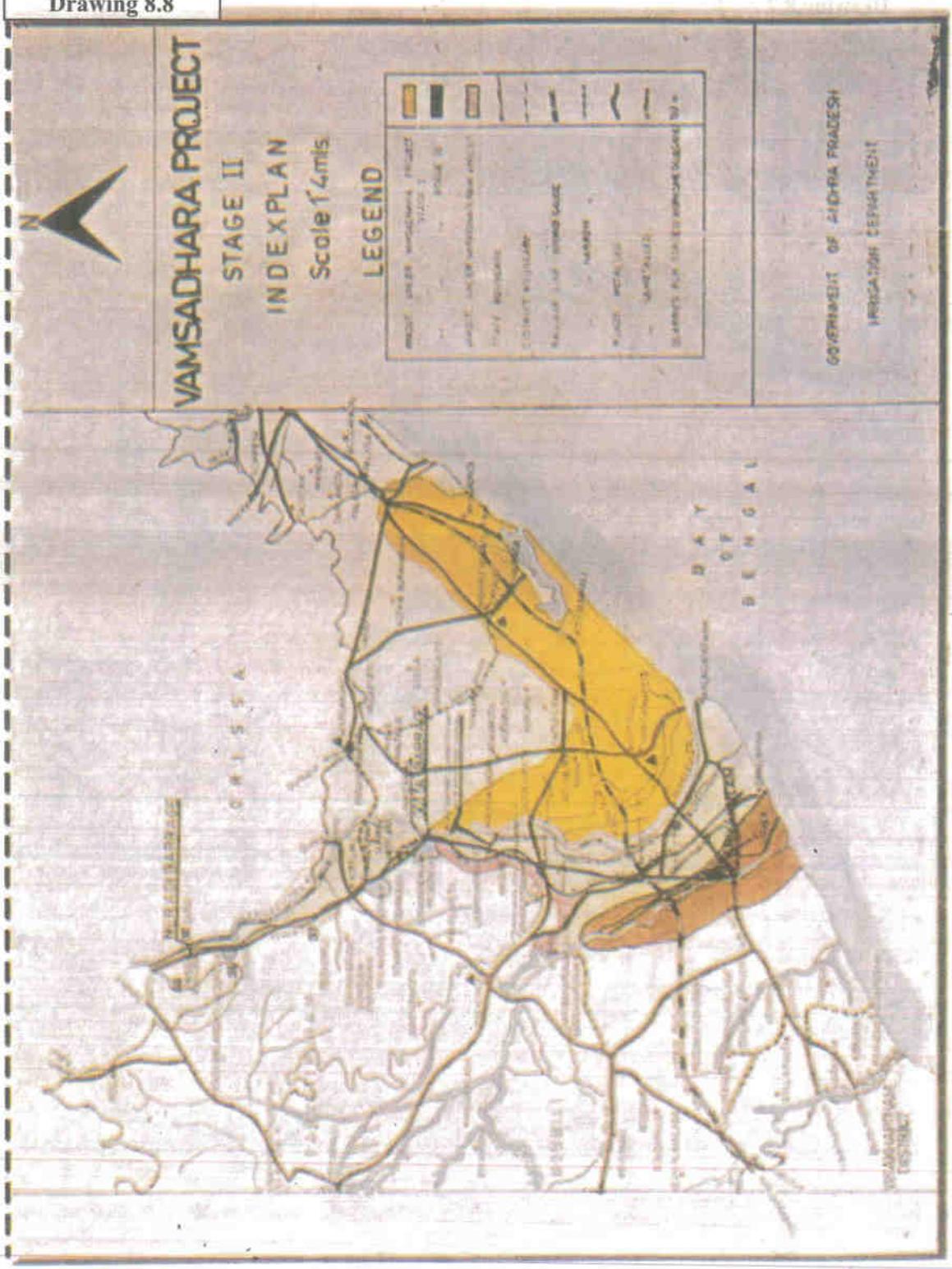
The ayacut proposed under left main canal is 54, 228 ha and that under right main canal is 4050 ha. The ayacut under Pithapuram branch canal is 16875 ha.

No new ayacut is contemplated under left canal under Phase I. Only stabilization of the existing upper part of ayacut of 27362 ha under Yeleru river irrigation system is contemplated besides tagging of lower part of the ayacut of 16983 ha to Godavari delta system by extending Samarlakota canal system.

Drawing 8.7



Drawing 8.8


VAMSADHARA PROJECT
STAGE II
INDEXPLAN
Scale 1'4mls
LEGEND
GOVERNMENT OF ANDHRA PRADESH
IRRIGATION DEPARTMENT
N
ORISSA
BAY
OF
BENGAL

Benefits :

On completion, the project will provide the following benefits.

1. Annual irrigation — 27362 ha
2. Additional yield
   - i. Paddy — 18.246 lakh tones
   - ii. Sugarcane — 7.466 lakh tones
   - iii. Chillies — 0.282 lakh tones
   - iv. Pulses — 0.183 lakh tones
   - v. Groundnut — 0.018 lakh tones
3. Industrial water supply to Visakapatnam steel plant is 0.332 Mcum per day (73 million gallons per day).
4. Benefit-cost ratio of the project (considering Rs.12 / per 1000 gallons for water supply to Visakapatnam steel plant) is 1.50.

Rehabilitation and Resettlement :

In all 10 villages come under submersion either partly or fully and 2326 families are affected. Rehabilitation and Resettlement of the oustees are being satisfactorily provided in the project. 1525.20 ha of forest land gets submerged. Compensatory land to be handed over to the Forest Department has been planned and catchment treatment proposals made to the Ministry of Environment and Forests of Government of India.

The salient features of this project are given in Annexure-XIII.

Gannavaram Aqueduct

This is a major irrigation scheme taken up in 1994 to continue the Gannavaram canal in the Godavari delta across the river Vynatheyam to irrigate an ayacut of 18211 ha (45000 acres) on the Nagaram Island.

The aqueduct will run on 32 piers founded on wells and will carry a road bridge with 7.6 m carriage way with 1.5 m wide footpaths on either side designed to carry the present traffic loads.

The scheme is estimated to cost Rs. 15.50 crores

Somasila Project

An integrated scheme to utilise the flood flows from the erratic river Pennar was prepared in 1971 to form a reservoir of capacity 453 Mcum (16 TMC) with the FRL at 86.87 m (+330.00') at Somasila village in Atmakur Taluk of Nellore District by constructing a dam. This reservoir besides stabilising the delta ayacut of 1.114 lakh ha under Nellore and Sangam anicuts brings in 56300 ha under new irrigation (Rabi) for irrigating 1st crop.

The project Stage I originally estimated to cost Rs.17.20 cores was started on 4.6.1975. The dam has the following components.

i) A non-over flow masonry dam 172.52 m long.
ii) A spillway of length 236.21 m with crest level at +86.868 m. 12 Nos. radial crest gates of size 15.24 m x 14.168 m with top at +100.736 m were installed in the II stage as a part of the Telugu Ganga Project.
iii) Earth dam of length 352 m practically bunding across the original course.
iv) Right Head Regulator + 20 m long with sill at + 80.95 m
v) North Feeder Channel 72.92 km long
vi) South Feeder Channel 76.20 km long and
vii) Kavali canal 67.50 km long

Most of the works in Stage I were completed by 1985 and the project benefits started flowing by 1987.

The Telugu Ganga Project

This is a joint project of Tamil Nadu and Andhra Pradesh successfully executed with partial benefits flowing from 1996 onwards, made possible through the mutual respect and co-operation extended to each other by the then Chief Ministers of these two States - Bharat Ratna Dr.M.G.Ramachandran and Dr.N.T.Rama Rao. The project has been aptly named by the then Chief Minister of Andhra Pradesh Sri N.T.Rama Rao to denote the precious waters that are to be carried across the river basins to the distant Chennai City meant for drinking water, since the first requirement of any habitation is as precious as Ganga waters.

The project was initiated with the main objective of carrying Krishna Waters for the drinking water supply to the Chennai City with the suggestion of giving irrigation facilities to the drought prone districts of Rayalascema en route tagged to it by Government of Andhra Pradesh the time the project was formulated.

Chennai City which developed around the Fort St.George built by the East India Company and occupied on 24th September 1641 as a stronghold to pursue their commercial activity started expanding fast particularly after the World War II with the population increasing from 5,40.000 in 1901 to 42,16,000 in 2001.

When Mr.Francis Day, an agent of the East Indian Company to whom the credit for the choice of the piece of land to build a fortress goes, negotiated with the then Damerla brothers who held sway over this area under the suzerainty of the Raja of Chandragiri for the purchase of the land, these brothers made a condition that they would prefer to get the developing town named after their father, a Telugu Naicker Sri Chennappa after which the land was handed over on 22nd July, 1639 by the Raja of Chandragiri. Accordingly, the town developed as Chennapattanam and is now shortly termed as 'CHENNAI', a Metropolis.

Unfortunately Chennai is situated in a coastal plain with no dependable perennial source of water for domestic use nearby. The city has been frequently experiencing water scarcity which became more and more acute in the recent decades. The water supply schemes undertaken from time to time to utilise the small storages existing and created in the neighbouring minor river valleys could not keep pace with the mounting demand since all these storages are dependent on the less dependable north east monsoon.

That river Krishna, which has the benefit of precipitation from the more dependable south west monsoon influence in the western ghats was considered to provide a sustainable source for the Chennai Water Supply since long. However, after reorganization of States, the Krishna basin part went to the Andhra Pradesh.

The first agreement regarding sparing of the waters for Chennai Water Supply by the Krishna Basin States was signed at New Delhi on 14.4.1976 in the presence of the then Union Minister, Irrigation and Agriculture, Shri Jagjivan Ram and in the second agreement which was signed on the 28th October, 1977 by the Officers of the respective States and Tamil Nadu in the presence of the Union Secretary a few modalities were defined for drawing 425 Mcum (15 TMC) of water annually from the Srisailam Reservoir already in place on Krishna. After necessary field investigations and preparation of the preliminary estimates the final Inter State Agreement was signed by the Hon'ble Chief Ministers of Tamil Nadu and Andhra Pradesh on the 18th April 1983 at Hyderabad. This Agreement defined the components of the project, the sharing of the cost of the project components between the States of Tamil Nadu and Andhra Pradesh and also the schedule of drawing the supplies over the year totalling upto 340 Mcum (12 TMC) to be delivered at the Tamil Nadu State border. The State of Andhra Pradesh agreed to deliver 340 Mcum (12 TMC) of water exclusively for drinking water supply to Chennai City over an year allowing 85 Mcum (3 TMC) as transmission loss from Srisailam out of the 425 Mcum (15 TMC) earlier agreed to be spared from Srisailam.

In the Project formulated by Government of Andhra Pradesh alongwith 425 Mcum (15 TMC) of waters of Krishna for Chennai Water Supply enroute irrigation is proposed. Water is proposed to be drawn from the foreshore of Srisailam Reservoir when the river is in floods between July and October and carried through a 30 metres deep rock cut, called Mittakondala cut, across the ridge separating the Krishna valley from the Pennar valley. After crossing and reaching the Banakacharla regulator, the water is diverted to reach a wayside reservoir called Velugodu Balancing Reservoir newly formed under this project. The Telugu Ganga Main canal carries the waters from this balancing reservoir for irrigating 50,607 ha (1.25 lakh acres) in Kurnool district ending up in another balancing reservoir called the Sri Pothuleri Veerabramendra Swamy Reservoir, which again irrigates another 60,729 ha (1.5 lakh acres) in the Sagileru valley in Cuddapah district. At chainage 107 km of this TGP Main canal a diversion to carry Chennai Water Supply quantity of 425 Mcum (15 TMC) alone is taken and let into the river Pennar through the Chennamukkupalli canal. The storage in the Somasila reservoir on Pennar already existing as an irrigation reservoir has been increased to 2209.6 Mcum (78 TMC) by erecting 13.7 m (45ft.) shutters over the spillway vents to afford facilities to store more of waters both from Pennar and Krishna and to create necessary driving head from where the flood waters are again carried to a new reservoir called the Kandaleru reservoir formed under this project to hold a storage of 1,671.4 Mcum (59 TMC), through a 45 km long Flood flow canal. The Kandaleru Reservoir serves as a carry over reservoir to hold waters for irrigation in Nellore and Chittoor districts and also a space of 141.6 Mcum (5 TMC) to store waters for Chennai Water Supply to be drawn in summer months.

The Kandaleru Poondi gravity canal carries both irrigation supplies and the Chennai Drinking water supplies to the border to deliver the 340 Mcum (12 TMC) annually as stipulated in the Agreement in accordance with a stipulated schedule of delivery. From the border Tamil Nadu has built a 24 km long lined canal to carry the flows to Poondi reservoir, which is the water supply reservoir for Chennai City. Poondi is also linked with Chembarambakkam and Redhills tanks which are part of the Chennai Water Supply sources which along with the flows from their catchment will also hold waters received from Krishna for distribution to the various parts of the city after treatment. Treatment and distribution in the City and suburbs is taken care of by the Chennai Metropolitan Water supply and Sewerage Board.

Thus this long conductor system to carry waters from the river Krishna to the Poondi reservoir consists of about 400 km of man made open gravity canal of various dimensions, 70 km of natural river course, building up three new reservoirs and improving two large reservoirs already in place, Srisailam on Krishna and Somasila on Pennar.

The cost of the project originally estimated as Rs.760 crores in 1983 has undergone many changes including additional works, escalation etc. and the cost as assessed in 1997 is reported to be about Rs.2545 crores. The State of Tamil Nadu is sharing part of the cost worked out component-wise as stipulated in the Agreement.

The Project inaugurated by late Smt. Indira Gandhi in Chennai on 25.5.1983 started giving partial benefits from 1996 onwards.

Quantity in Mcum (in TMC) delivered at the border in the past 5 years are as under

1996-97	2.15 (0.076)	1999-2000	51.8 (1.830)
1997-98	64.9 (2.292)	2000-2001	189.4 (6.687)
1998-99	79.7 (2.812)	2001-2002	9.5 (0.336)

These variations are expected to get stabilised as and when all the components of the project are completed and the reservoirs are developed to hold their designed storages after completion of land acquisition etc.

The Government of Maharashtra and Karnataka have objected to the enroute irrigation proposed by Government of Andhra Pradesh under the project and the project has not been given investment clearance by the Planning Commission.

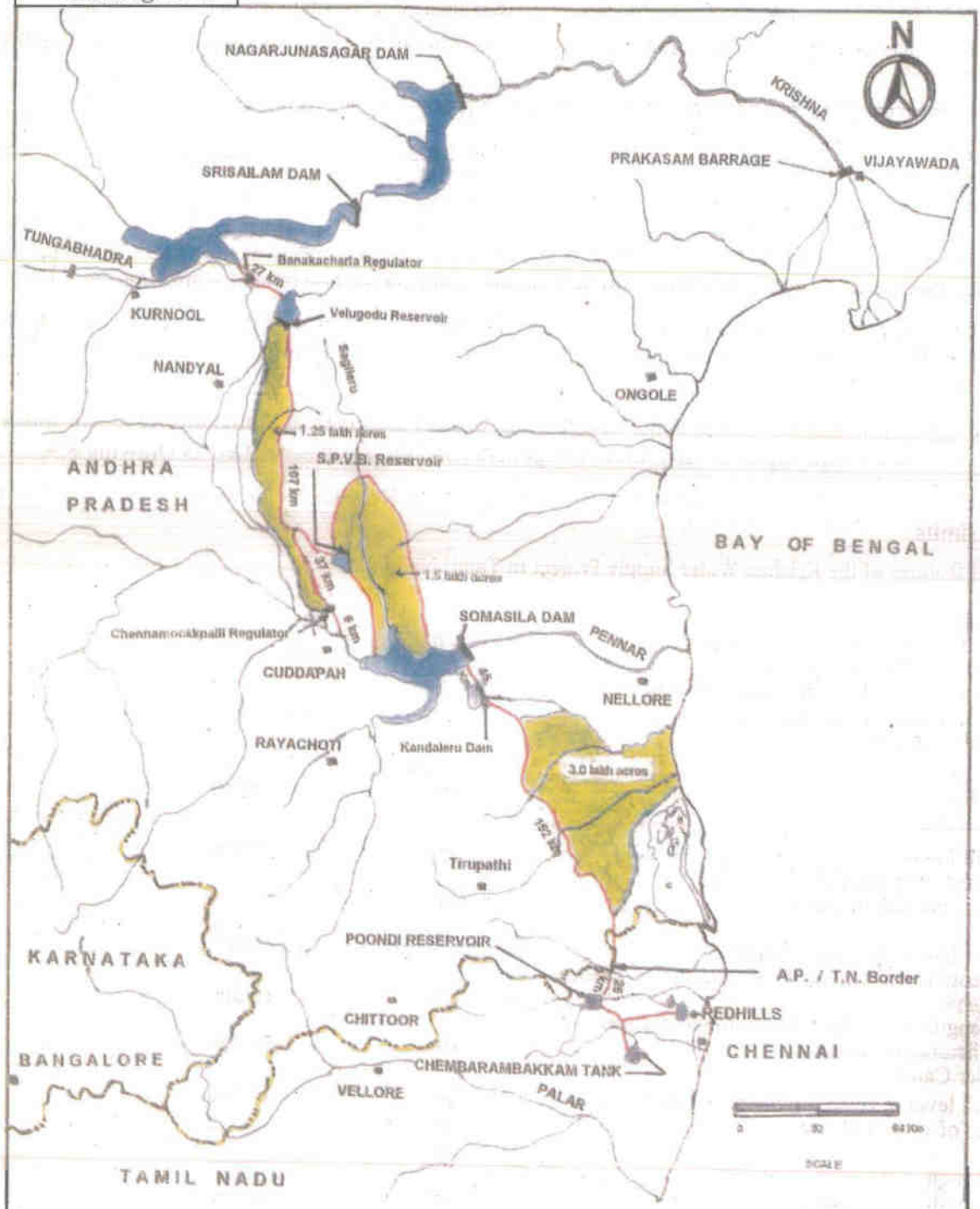
The salient features of the components of this mega project are given at Annexure XIV. An Index Map is also enclosed which explains the project components and the areas benefitted as Drawing 8.9,

The Telugu Ganga Project in Andhra Pradesh is continued as Krishna Water Supply Project in Tamil Nadu limits.

Salient features of the Krishna Water Supply Project in Tamil Nadu :

Krishna Water Supply Canal		
Length of canal from border to Poondi	km	25.275
Designed Discharge capacity	Cumecs (Cusecs)	28.3 (1000)
Bed level of the canal at the delivery	m	+
Grade of the canal		1 in 12000
Poondi Reservoir		
Capacity	Mcum (TMC)	91.5 (3.231)
F.R.L.	m	42.67
Link Canal		
Sill Level	m	37.250
Head Regulator		
No. and size of vents	Nos.	4
	m	2.0 x 2.0
Designed discharge capacity	Cumecs (Cusecs)	28.3 (1000)
Length upto the point of take off of Feeder Canal	km	10.360
Length from Head Regulator to Delivery at Chembarambakkam	km	25.754
Feeder Canal		
Sill level of Head Regulator for feeder canal	m	33.260
No of vents and size	Nos.	2
	m	1.5 x 1.5
Designed Discharge Capacity	Cumecs (Cusecs)	14.1 (500)
Length of the canal	km	21.500
Bed level at the delivery in Red Hills Tank	m	11.880
Red Hills Tank		
Capacity	Mcum (TMC)	93.5 (3.30)
F.R.L.	m	15.30
Lowest off-take Sill of Jones Tower	m	9.50
Lowest off-take Sill of Japanese Tower	m	7.62

Drawing 8.9



TELUGU GANGA PROJECT

A JOINT PROJECT OF ANDHRA PRADESH AND TAMIL NADU

INDEX MAP

Srisailam Right Branch Canal Project:

Srisailam reservoir is constructed on the Krishna River as a hydropower project near Srisailam temple town of Kurnool district. As per the Krishna Tribunal award, Andhra Pradesh has been allocated 22663 Mcum (800 TMC) of water besides 312 Mcum (11 TMC) of its share in the regenerated waters with provision for readjustment and reallocation within the allotment made specifically to the State.

Rayalaseema region in Andhra Pradesh is drought prone area. In order to improve the socio-economic status of the region, Srisailam Right Branch Canal Scheme utilising 538 Mcum (19 TMC) of waters (11 TMC regeneration and 8 TMC due to savings available from modernization of KC Canal), to irrigate an ayacut of 76,890 ha was executed. The Scheme draws its supplies from the Srisailam reservoir during flood flows.

Benefits:
The cropping pattern proposed and the irrigation benefit under the project are as shown below:

i) Annual Irrigation 1,00,800 ha
ii) Cropping pattern

	Kharif		Rabi	
Crop	Area (ha)	Yield (tonnes)	Area (ha)	Yield (tonnes)
Groundnut	10300	20600	7,466	16,425
Sunflower	5900	10620	9,018	18,036
Sunflower seed			403	403
Jowar seed	7700	16940	202	364
Tobacco			6,000	9,000
Pulses	6000	9000	4,181	6,272
Vegetables & others	900	10800	12,000	1,44,000
Total	**30800**	**67960**	**39,270**	**1,94,500**

Two seasonal	Area (ha)	Yield
Chillies	7,560	22,680
Cotton	16,732	50,196
Cotton seed	302	227
Turmeric	3,830	1,52,000
Sugarcane	1,520	3,672
Mulbery	706	500
Total	**30,730**	**2,47,659**

Besides the above 668 ha of stabilisation of existing ayacut under Owk is also proposed.

The benefit cost ratio is worked out to be 1.08 at 10% interest on the capital outlay of Rs.1185.58 crores with 1993-94 schedule of rates.

Project Clearance:

The Planning Commission accorded clearance to Srisailam Right Branch Canal Scheme in letter No.2(205/81-I & CAD) dated 16.5.1981 for an amount of Rs.220.22 crores (Annexure 1-1, P 6 and 7) with the following components.

Unit I – Head works	1) Approach Channel
	2) Head Regulator
Unit II – Canals	1) Main canal
	(Including Banakacherla Regulator)
	2) Srisailam Right Branch Canal
	3) Distributories
	4) Field channels
Unit III	Gorkallu Balancing Reservoir
Unit IV	Owk Balancing Reservoir

Water Availability :

The total water requirements for the project has been estimated to be 538.023 Mcum (19 TMC). Out of this, 311.487 Mcum (11 TMC) will be available as regeneration flow as per the allocation of Krishna Water Disputes Tribunal. The balance requirement of 226.536 Mcum (8 TMC) to Srisailam Right Branch Canal is proposed to be made available by the Modernisation of KC Canal System.

Resettlement and Rehabilitation :

The Resettlement and Rehabilitation problems of people displaced by the two balancing reservoirs have been satisfactorily provided for as desired by the Ministry of Welfare, Government of India. Two villages were affected by submergence and 834 families consisting of 2342 persons were rehabilitated.

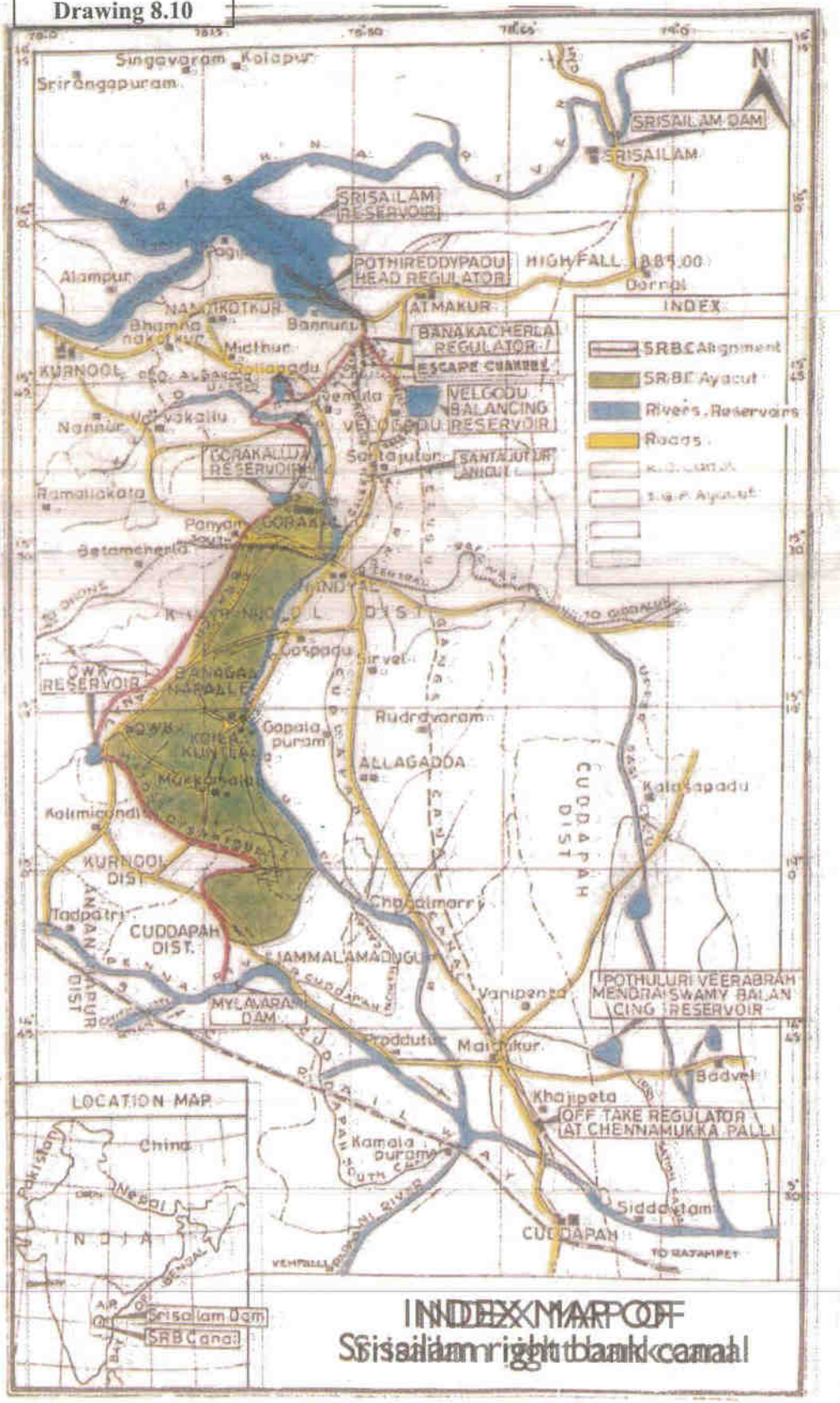
As much as 1052.496 ha of forest land had to be diverted for the project. Necessary clearance from Ministry of Environment and Forests were obtained after acquiring and handing over land to be compensated and catchment area treatment works taken up in the two balancing reservoirs at a cost of Rs.21.14 crores.

Drainage:

The command area of SRBC project lies on the left side of the main canal and extends upto river Kundu. The area is well drained through natural streams spread over the command. It is also crossed by Jurreru and Paleru Rivers which after traversing the command area laterally join Kundu river and as such no drainage problems are anticipated.

Salient features of Srisailam Right Branch Canal Project are given at Annexure-XV.

Drawing 8.10


Singavaram
Kolapur
Srirangapuram
SRISAILAM DAM
SRISAILAM
SRISAILAM RESERVOIR
POTHIREDDYPADU HEAD REGULATOR
HIGH FALL 885.00
Alampur
Darrol
NANDIKOTKUR
Bhamanakotkur
Bannuru
ATMAKUR
BANAKACHERLA REGULATOR
ESCAPE CHANNEL
KURNOOL
Midthur
Nannur
VELGODU BALANCING RESERVOIR
GORAKALLU RESERVOIR
Santajuturu
SANTAJUTUR ANICUT
Ramallakota
Betamcherla
Gospadu
Sirvel
OWK RESERVOIR
Rudravaram
Gopala puram
ALLAGADDA
Kalasapadu
Kolimigundla
KURNOOL DIST
CUDDAPAH DIST
Chapalmarri
Tadpatri
ANANTAPUR DIST
JAMMALAMADUGU
POTHULURI VEERABRAHMENDRASWAMY BALANCING RESERVOIR
Vanipenta
MYLAVARAM DAM
Proddutur
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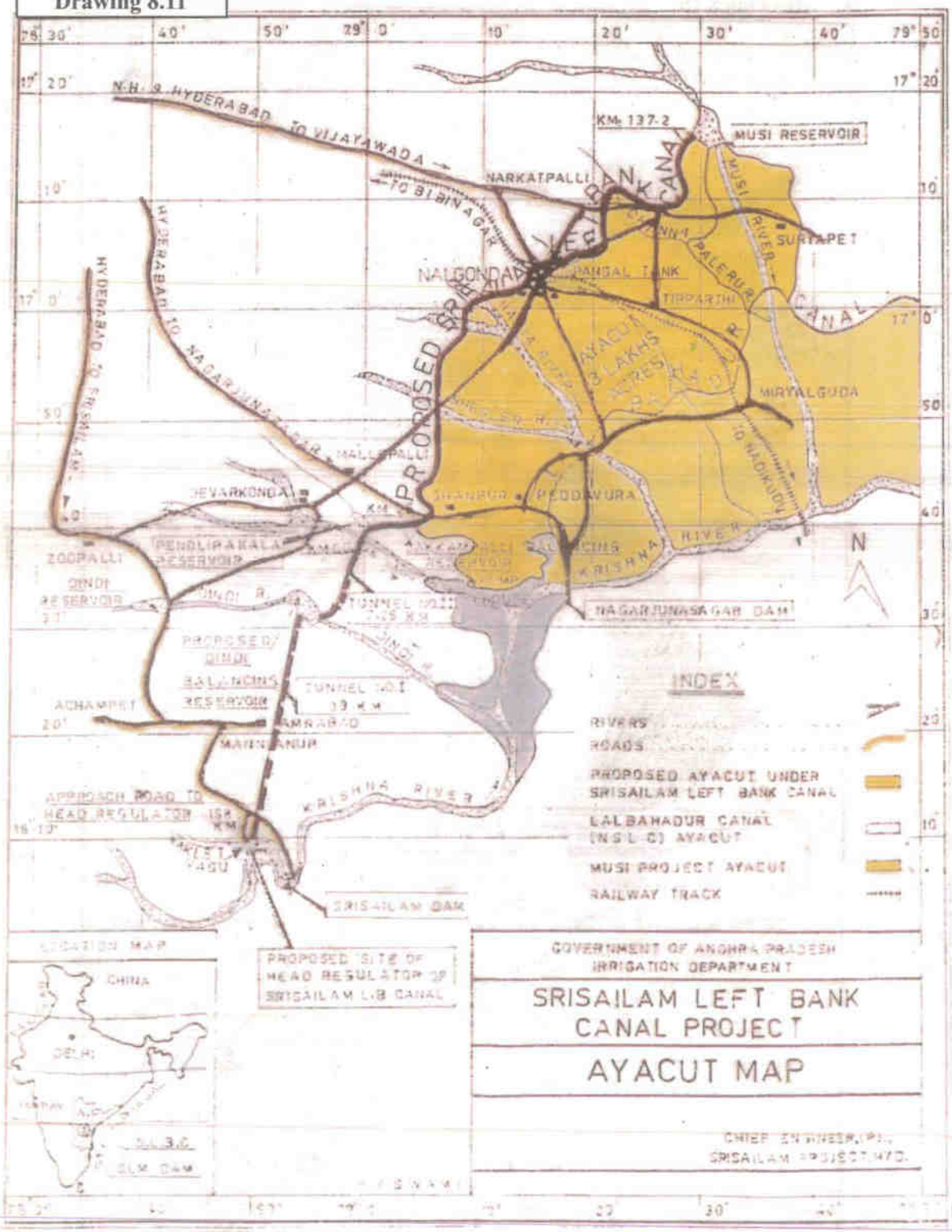
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MIRYALGUDA
HYDERABAD TO SRISAILAM
HYDERABAD TO NAGARJUNASAGAR
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CHAPTER 9

IRRIGATION DEVELOPMENT AFTER INDEPENDENCE – MEDIUM IRRIGATION PROJECTS

With reference to the Medium Irrigation Projects executed in the Five Year Plan periods more than eighty have been completed in the various river basins, the benefits from most of them confined within the districts in which they are located with a few of them of course spreading out even to the adjacent districts.

Information in respect of a few such medium irrigation projects to the extent that could be immediately gathered is furnished below.

Peddavaru Project

Peddavaru is a minor tributary of Godavari river. This medium irrigation project is meant to serve an ayacut of 6474 ha (16,000 acres), 2429 ha (6,000 acres) paddy and the rest irrigated dry. The ayacut is on both the flanks in Khammam district. The work was started in 1975 and completed in 1983 at a cost of Rs.810 lakhs.

An earthen dam is formed for a length of 2468 m with a maximum height of 15.10 m and a 75.18 m length gated spillway with ogee profile to discharge a designed flood of 1147 cumecs (40,500 cusecs). The crest gates are 3 Nos. 12.2 x 6.1 m (40' to 20').

Sathanavala Project

This is a medium irrigation project to form a reservoir on Sathanavala, which is a tributary of Penganga, which is a major tributary of Pranahita in Godavari basin. This project benefits 25 villages in Adilabad Taluk of Adilabad District with Irrigation for 7773 ha (19200 acres).

The work was inaugurated by the then Chief Minister Sri Jalagon Vengal Rao on 17.12.1976.

An earth bund 1814 m has been formed and an ogee spillway of 56 m with 4 gates 12.2 x 6.1 m (40' x 20') is meant to discharge a flood of 1275 cumecs (45,000 cusecs). The canal on the left is 6 km and that on right is 26 km long. Existence of pervious gravelly layer in the foundations required careful study by an expert team who suggested a grout curtain along the dam axis and 1.5 m thick clay blanket upstream.

The total cost went upto Rs.42.43 crores on revision.

Raiwada Reservoir Project

This medium project is executed in the Kotapadu Taluk of Visakapatnam District near Raiwada village.

A reservoir of 92.6 Mcum (3270 Mcft) live storage has been formed by an earth dam 5.75 km in length with a maximum height of 29.0 m. A spillway regulator on the right flank with 10 vents of 12.2 m x 4 m can discharge a flood of 1897 cumecs (76,000 cusecs)

Though a new ayacut of 2429 ha (6,000 acres) was contemplated in the scheme it was deleted by the Government later, confining the benefit to the stabilisation of the existing ayacut of 6194 ha (15,300 acres) of kharif paddy and sugarcane and also to give water supply to Visakapatnam city.

The scheme was sanctioned in 1977 and completed in 1982.

Jalleru Reservoir Scheme

This is a medium irrigation scheme to serve 1416 ha (3500 acres) in the Polavaram Taluk of West Godavari district. A reservoir is formed on Jalleru a tributary to Yerrakalvu. The scheme was inaugurated on 28.08.1976 by the then Chief Minister of Andhra Pradesh Sri J.Vengal Rao.

The reservoir has a live storage of 8.69 M cum (310.40 M.cft.). An earth dam of length 1.79 km (5800 ft) with a maximum height of 31.42 m (103 ft) has been formed and a flood regulator of 2 vents 12 m x 7.2 m with radial gates constructed to discharge 348 cumecs (12,300 cusecs). There is only one canal on the left flank to serve this ayacut.

The cost of the project is Rs.329.89 lakhs.

Boggulavagu Project

This is a medium irrigation project on Boggulavagu, a tributary of Manair, which is itself a tributary of Godavari. Eight villages in Manthani Taluk of Karimnagar district get the benefit of irrigation over an area of 2084 ha (5150 acres) on the right flank with a 16 km long canal.

A reservoir of 11.5 Mcum 407 Mcft capacity has been formed by raising an earth dam with a maximum height of 16.91 m (55.50 ft.) and a high coefficient uncontrolled weir of 140 m length to discharge a flood of 530 cumecs (18720 cusecs). The cost of the scheme is Rs.5.33 crores and it was completed in 1983.

Taliperu Project

This is a medium irrigation project across Taliperu River, a major tributary of the river Godavari, taken up in the V Plan period. The project is located near Peddamidisileru village in Aagur Taluk of Khammam district. This has been made possible after an accord has been reached with Madhya Pradesh on the use of Gadavari waters on 7.11.75. The proposed utilisation under the project is 141.6 Mcum (5 TMC) against the net yield available at the site of 993 Mcum (35.05 TMC). The capacity of the reservoir formed is 20.67 M.cum (729.96 Mcft) with a live storage of 6.244 M.cum (219.5 Mcft).

An earthen dam with maximum height of 9.70 m has been formed with an ogee spillway in the river bed with 25 vents of 12 m x 5.00 m to discharge 6799 cumces (2,40,000 cusecs). The 72 km canal taking off on the left flank, feeds an area of 9919 ha (24,500 acres). Though started in 7/76, it could be completed only in 1983. The cost of the project is Rs.906 lakhs.

On representation from riots, a canal on the let flank has also been now taken up to irrigate another 1619 ha (4000 acres). The total area benefited would thus be 11538 ha (28,500 acres). The cost of the scheme has gone upto Rs.52.15 crores by 1998.

Koilsagar Project

This is a medium project in the Mahabubnagar taluk of Mahabubnagar district in Krishna basin. The reservoir is just 4 km from the historic and ancient town of Koilkonda and hence the name. The project was taken up in 1948 and completed in 1955 at a cost of Rs.85 lakhs.

The reservoir of gross capacity of 50 Mcum (1767 Mcft) is over a stream called Peddavagu, a tributary of Krishna. The total length of the dam is 1376.5 m (3400 ft.) partly earth and partly masonry and the dam is 30.5 m high. The net flood discharge estimated as 4247 cumces (1,49,920 cusecs), is to be handled by a 274 m (900 ft.) long ogee spillway with a 3 m (10 ft.) head which can discharge 3223 cumecs (1,13,760 cusecs) found adequate taking into account the flood absorbing capacity of reservoir and flood routing. A special feature in this spillway is the provision of 25 buckets of Interacting Jet Dissipater type meant to destroy the kinetic energy by interacting jets, created by a splitter centrally located in the 11 m (36 feet) wide and 1.8 m (6 feet) deep bucket in the spillway section. This splitter and interacting jet energy dissipater was finalised after hydraulic model studies.

For dewatering during construction the well point equipment specially imported from U.K. was used. This was because the rock was found about 6.1 m (20 feet) below the sandy river bed and the open excavation had to be done braving the heavy springs.

The irrigation canals take off on both the flanks, to benefit 5858 ha. Totally 22 villages are served, paddy being the main crop

Bhairavanitippa Project

This is an irrigation scheme meant to serve an ayacut of 4856 ha (12000 acres) in the Ananthapur district of Andhra Pradesh. A reservoir of 65 Mcum (2.31 TMC) live capacity has been formed on Hagari a tributary of Tungabhadra by forming an earthen dam 2047 m (6714 feet) long and 16.5 m (54 feet) high. The spillway is 187.8 m (616 feet) long with 12 crest gates 12.2 x 4.6 m (40 feet x 15 feet), capable of discharging a flood of 1,20,000 cusecs. Two canals take of, one on each flank. The canal on the left runs for 25 km (15.4 miles) with a head discharge of 181 cusecs at the head sluice carrying one vent 5'0" x 15'0" to feed 3238 ha (8000 acres). The right bank canal runs for 14.5 km (9 miles) with a head discharge of 83 cusecs at the head sluice with one vent 2.5 feet x 4 feet to feed 1619 ha (4000 acres). Both the canals are unlined.

The project was commenced in 1954, partially completed in 1958 and fully completed by 1962. The project also stabilises the ayacut fed by 22 spring channels in Andhra Pradesh supporting 8500 acres and another 6 spring

channels in Kammam supporting 1575 acres for which supply is released from the dam through the 2 scour vents 16 feet x 10 feet provided in the spillway section.

Musi Project

This is an irrigation reservoir project executed in the Nalgonda district of Andhra Pradesh below the Musi water supply reservoir built by Sir M. Visvesvaraya.

A reservoir of 4.80 TMC live capacity has been formed on Musi, the tributary of Krishna by raising an earthen dam 13,020 feet long and a masonry section of 1970 feet with 70 feet height. There are 12 outlets 40 ft. x 20 ft., a regulator of 8 vents 40' x 15' and also ten scouring sluices 20' x 15' all together capable of discharging a flood of 3,75,000 cusecs.

The canal on the right flank is 31 km (19 miles) long with a head discharge of 320 cusecs feeding an ayacut of 19,000 acres and another on the left flank 34 km (21 miles) long with a head discharge of 330 cusecs feeding an ayacut 7689 ha (19,000 acres). The area benefited totally is 15378 ha (38,000 acres).

The reservoir was completed in 1965 at a cost of Rs.5.17 crores.

Janjavathi Reservoir Project

This medium irrigation project is taken up in Parvathipuram Taluk of Vizianagaram District to form a reservoir across Janjavati river a tributary of Nagavati river.

An earth bund 4.07 km long with a masonry 100.5 m spillway of ogee profile with crest gates 12 m x 9 m and discharging capacity 3398 cumecs (1,20,000 cusecs) will form the reservoir.

The gross capacity of the reservoir formed is 96 Mcum (3400 Mcft.)

An irrigation canal 60 km long on the left flank feeds an ayacut of 9970 ha (24,640 acres) in Parvathipuram, Bobbili and Saluru Taluks.

The cost of the scheme as revised work out to Rs.61.60 crores.

This project was taken up after the Chief Ministers Andhra Pradesh and Orissa agreed on 15.12.78 to share the waters of Janjavathi at 50:50 ratio.

However, for want of settlement of dispute with Orissa regarding submergence of lands in Orissa, the project could not be put to use even though it was taken up and some expenditure has also been incurred. Investment clearance for the project has not been given by the Planning Commission, so far.

Padankalam Anicut Scheme

This anicut scheme is a medium irrigation project executed in the Bobbili Taluk of Vizianagaram district built across Swarnamukhi river a tributary of Nagavali to stabilise an existing wet ayacut of 1756 ha (4338 acres) under tanks and to convert 1768 ha (4336 acres) of dry into wet benefiting sixteen villages in Bobbili and Palakonda taluks.

The anicut is a broad crested weir long 107.90 m (354 ft) with 0.6 m (2 feet) falling shutters. 4 Nos. scour vents 3 m x 2.13 m and the head sluice with 3 vents of size 1.23 m x 1.23 m (4' x 4') with a 25 km canal and its distributaries are the other components of the scheme.

The scheme cost is Rs.2.40 crores and was completed in 1979.

Pedderu Reservoir Project

This is a medium irrigation project in Kottala village in Madanapalle taluk in Chittoor district across Pedderu river a tributary of Papaghni which in turn is a tributary of river Pennar.

A masonry dam 590 m in length with a maximum height of 26.5 m over the deepest foundation has been constructed to form a reservoir of gross capacity 15.86 M.cum (560 Mcft.). In the river bed portion an ungated spillway of 130 m (427 ft.) is designed to discharge a flood of 3170 cumecs (1,11,948 cusecs). Two canals one on each flank take off to irrigate an ayacut of 2575 ha (6360 acres). The estimated cost is Rs.5.74 crores, which has gone upto Rs.7.92 crores. However, investment clearance has not been given by the Planning Commission, so far.

CHAPTER 10

IRRIGATION DEVELOPMENT AFTER INDEPENDENCE – PROJECTS UNDER CONTEMPLATION

Apart from the Major and Medium Irrigation Projects both completed and on-going, there are very many projects in both the categories under contemplation. They are all in various stages of investigation, project preparation and project clearance for sanction. It is difficult to trace all of them individually in this short history.

A few details obtained on some of the oft-reported schemes under contemplation may perhaps be added here for information.

Srisailam Left Bank Canal

This canal is proposed to be excavated on the left bank of Krishna to carry water pumped from Srisailam dam to run for 23.20 km to Akkampalli balancing reservoir and thereafter run for another 134 km to provide irrigation for an extent of 109250 ha spread over 21 Mandals consisting of 212 villages in the dry district of Nalgonda and to provide drinking water to Nalgonda town and several fluoride affected villages en route.

The updated cost of the scheme is Rs.1260 crores. The works are in preliminary stages. Investment clearance for the project has not yet been given by the Planning Commission, so far.

Bhima Lift Irrigation Project

This is proposed to serve parts of the drought affected district of Mahaboobnagar by extending irrigation for 82151 ha and stabilise 1628 ha in Makthal, Atmakur, Wanarpathy and Kollapur taluks mainly for growing irrigated dry crops.

The first lift unit is from Krishna river near Panchadenpa village in Atmakur Taluk for a height of 60 m and the second lift unit is from the existing Ookachettyvagu pondage in Wanarpathy taluk for a height of 53.66 m. The total utilisation under the project will be 566.6 Mcum (20 TMC) and the total power requirements for both these left units is 58.75 MW.

A few balancing reservoirs are to be formed and named: Sanbanbanda balancing reservoir, Budpur balancing reservoir, Shankara Samudram balancing reservoir, Yenucunta balancing reservoir and Rangasamudram balancing reservoir. The formation of these balancing reservoirs is in progress. The entire ayacut lies on the left flank of Krishna in contours higher than that commanded by Priyardharshini Jurala Project.

Galeru Nagari Sujala Sravanthi

This is a proposal to extend irrigation facilities to the chronically drought affected areas in the districts of Cuddappah, Chithoor and Nellore districts, for 52632 ha, 64771 ha and 14170 ha respectively totaling 131579 ha. This is to be through drawing 1190 Mcum (42 TMC) of surplus floods waters from the foreshore of the Srisailam reservoir on Krishna and linking about 18 km on line balancing reservoir en route all by gravity flow over a distance of about 600 km.

Different options have been under investigation since 1990 for this ambitious project and the cost is tentatively assessed as Rs. 3300 crores.

Thotapalli Barrage

This is a scheme under contemplation to utilise 453.2 Mcum (16 TMC) of Nagavali waters by building a barrage on Nagavali river near Thotapalli. The scope is for stabilising an existing ayacut of 25911 (64000 acres) and to create new area of irrigation for 66802 ha (165000 acres) in Vijayanagaram and Srikakulam districts on the right flank of Nagavali. Alternative proposals are under examination.

Pulichintala Project:

As early as 1911 Col.Ellis prepared a scheme for reservoir at Pulichintala on Krishna about 84 km (52 miles) upstream of Vijayawada. Subsequent developments in Krishna basin have made those proposals infeasible.

Now a reservoir of capacity 1275 Mcum (45 TMC) is under contemplation at Pulichintala village in Guntur district to hold the run-off in the catchment below Nagarjunasagar Dam only for the stabilisation of Krishna

Delta. This balancing reservoir will have an FRL of 53.3 m (+175.00 ft.) and essentially help timely supply for transplantation in the months of June and July.

The proposal is under serious consideration for being taken up in the Tenth Five Year Plan and may cost around Rs.510 crores.

Polavaram Multipurpose Project:

This is in lieu of the Ramapadasagar Project investigated long back in the composite Madras Presidency and since abandoned on technical consideration (Dealt with in good detail elsewhere above).

This new proposal is under investigation as a multi purpose scheme to extend irrigation benefits to the upland areas of Visakapatnam, East Godavari, West Godavari and Krishna districts and also offer drinking water facilities and ensure industrial water supply to the Visakapatnam steel plant and other industries, generation of hydel power and to enable diversion of 2399 Mcum (84.70 TMC) of Godavari waters to Krishna basin (part accepted in interstate parley). The tentative cost is Rs. 8916 crores.

The irrigation potential proposed is 2.91 lakh ha (7.20 lakh acres) and the total utilisation is 8.53 TMCum or 301.04 TMCft. The possible break up of water use may be

Utilisation	TMC	TM Cum
Irrigation under LMC	103.70	2.94
Irrigation under RMC	89.54	2.34
Water supply	23.44	0.66
Diversion to Krishna	84.70	2.40

The project proposal is under examination at various levels including the Environmental and Forest Ministry.

Shri Guru Raghavendra Diversion Scheme:

This is a proposal under investigation to pump 153 Mcum (5.4 TMC) of waters at three locations from the River Thungabadra - Madhavaram village, Chanipalli village and Gangavarm village and storing in three proposed reservoirs mainly to close the gap of about 20243 ha (50000 acres) in the tail end areas of the High level canal of Tungabadhra reservoir because of loss in reservoir capacity through silting.

Veligonda Project:

This project envisages utilisation of the flood waters of Krishna from the Srisailam reservoir during the monsoon to provide irrigation facilities to about 1.77 lakh ha (4.38 lakh acres) and provide drinking water facility utilising 1232 Mcum (43.50 TMC) of the flood waters from the foreshore of the Srisailam reservoir.

The tentative estimate is Rs.980 crores.

Handri Niva Sujala Sravanthi Scheme:

This scheme is contemplated for provide irrigation facilities to 2.438 lakh ha. (6.025 lakh acres) in the districts of Kurnool, Cuddappah, Chittoor and Ananthapur in Royalaseema and drinking waters to about 20 lakh people en route. The utilisation contemplated is 1133 Mcum (40 TMC) of the flood waters of the Krishna through lift from Srisailam reservoir during the monsoon period when the reservoir goes above +266.67 m. Eight balancing reservoirs are planned en route the 565 km lift canal. Estimated to cost about Rs. 1500 crores, it is planned to take up parts of the scheme in stages.

Inchampally Project

This multipurpose, interstate, joint project between the three States of Maharashtra, Madhya Pradesh and Andhra Pradesh is contemplated to irrigate 63530 ha (1.5 lakh acres) in the upland areas in the Karimnagar, Warangal and Khammam districts of Andhra Pradesh and to generate hydel power 975 MW.

A dam is proposed to be built across Godavari 11 km downstream of the confluence of Indravathi river near Mulkanur village in Karimnagar district with a powerhouse and canals on either flank.

Various alternatives are under examination and this also involves submersion of large forest areas and several interstate, ecological and environment issues.

The utilisation will be around 2408 Mcum (85 TMC) for irrigation.

CHAPTER 11

MINOR IRRIGATION

In the minor irrigation sector too there has been considerable progress after Independence. Andhra Pradesh inherited more than 70,000 minor irrigation tanks formed over centuries as other neighboring States like Karnataka and Tamil Nadu. Many efforts have been made periodically to regulate these tanks and maintain these assets.

Andhra Pradesh has launched a programme for rehabilitation of old canals and structures with the World Bank aid at a cost of about Rs. 1500 crores to bridge a gap of 445164 ha. (11 lakh acres) in the entire State through a scheme called "Andhra Pradesh Economic Reconstruction Project" in all the districts. This programme was started on 1998-99 and will run for five years. The Minor Irrigation schemes taken up for rehabilitation under this Project include 917 in number at a cost of Rs.302.05 crores and would benefit 55969 ha (1,38,300 acres).

CHAPTER 12

IRRIGATION POTENTIAL

The Irrigation potential created, potential utilised in major, medium and minor irrigation sector and the investment made and source wise use etc., are presented below to the end of VIII Plan.

An attempt has also been made to present district wise information on the major and medium projects completed, on going and also completed. This compilation is included in Annexure-XVI in the form of 22 statements each relating to one district. The readers may find this compilation quite useful. The readers may also visualize the large scope for further irrigation extension in the river basins of the State from the projects contemplated shown in these district wise statements.

The district wise status of Minor Irrigation sources and the growth in the well population in a period 1971-72 to 1993-94 are at Annexure-XVII and XVIII.

Table 12.1

Planwise Irrigation Potential Created/ Utilised In Andhra Pradesh

Major & Medium Irrigation (Surface Water) (Cumulative)

(Unit:'000 Hectare)

Sl.No	Period	Potential Created	Potential Utilised
	Ultimate Potential	5000	
1	Sixth Plan (1980-85)	2902	2695
2	Seventh Plan (1985-90)	2991	2836
3	Annual Plan (1990-92)	2999	2847
4	Eighth Plan (1992-97)	3045	2884
5	Ninth Plan (1997-2002) Target	3624	3390
6	Annual Plan 1997-98	3122	2896
7	Annual Plan (1998-99) Anticipated	3238	3055
8	Annual Plan (1999-2000) Target	3389	3206

Percentage of Potential created till 1999-2000 to Ultimate Potential: 65
Percentage of Potential Utilised till 1999-2000 to corresponding potential created: 94
Source: Water and Related Statistics, Central Water Commission, March, 2002 (Table 2.15)

Table 12.2
Planwise Irrigation Potential
Created/Utilised In Andhra Pradesh

Minor Irrigation (Surface Water) (Cumulative)

(Unit: '000 Hectare)

Sl.No	Period	Potential Created	Potential Utilised
	Ultimate Potential	2300	
1	Sixth Plan (1980-85)	1112.0	996.0
2	Seventh Plan (1985-90)	1253.0	1088.8
3	Annual Plan (1990-92)	1283.8	1107.3
4	Eighth Plan (1992-97)	1919.3	1127.6
5	Ninth Plan (1997-2002) Target	Not Available	
6	Annual Plan (1997-98)	1979.3	1166.5
7	Annual Plan (1998-99)	2029.2	1206.4
8	Annual Plan (1999-2000)	2134.4	1285.7

Percentage of Potential created till 1999-2000 to Ultimate Potential: 93
Percentage of Potential Utilised till 1999-2000 to corresponding potential created: 60
Source: Water and Related Statistics, Central Water Commission, March, 2002 (Table 2.16)

Table 12.3

Planwise Irrigation Potential
Created/Utilised In Andhra Pradesh

Minor Irrigation (Ground Water) (Cumulative)

(Unit: '000 Hectare)

Sl.No	Period	Potential Created	Potential Utilised
	Ultimate Potential	3960	
1	Sixth Plan (1980-85)	1229.0	1200.0
2	Seventh Plan (1985-90)	1544.0	1507.1
3	Annual Plan (1990-92)	1593.5	1555.3
4	Eighth Plan (1992-97)	2936.1	2138.4
5	Ninth Plan (1997-2002) Target	Not Available	
6	Annual Plan 1997-98	3032.6	2177.2
7	Annual Plan (1998-99) Provisional	3081.8	2226.4
8	Annual Plan (1999-2000) Provisional	3161.4	2274.7

Percentage of Potential created till 1999-2000 to Ultimate Potential: 79.8
Percentage of Potential Utilised till 1999-2000 to corresponding potential created: 72.0

Source: Water and Related Statistics, Central Water Commission, March, 2002 (Table 2.17)

Table 12.3A

Planwise Total Irrigation Potential Created/Utilised In Andhra Pradesh

Major, Medium & Minor Irrigation Schemes (Cumulative)

Sl.No	Plan	Potential Created	Potential Utilised
	Ultimate Potential	11260	
1	Sixth Plan (1980-85)	5243	4891
2	Seventh Plan (1985-90)	5788	5432
3	Annual Plan (1990-92)	5876	5510
4	Eighth Plan (1992-97)	7900	6150
5	Ninth Plan (1997-2002) Target	Not Available	
6	Annual Plan 1997-98	8133.9	6239.8
7	Annual Plan (1998-99) Anticipated	8349	6487.9
8	Annual Plan (1999-2000) Provisional	8684.8	6766.5

Percentage of Potential created till 1999-2000 to Ultimate Potential: 77
Percentage of Potential Utilised till 1999-2000 to corresponding potential created: 78

Source: Water and Related Statistics, Central Water Commission, March, 2002 (Table 2.19)

Table 12.4

The Amount Spent on Major, Medium and Minor Irrigation Schemes Plan wise is given below:

S.No	Period	Amount spent (Rs. In crores)		
		Major & Medium Irrigation	Minor Irrigation	Total
1	I - Plan (1951-60)	37.47	3.52	40.99
2	II - Plan (1960-61)	57.43	4.38	61.81
3	III - Plan (1961-66)	91.52	18.60	110.12
4	3 Annual Plans (1966-69)	60.87	10.81	71.68
5	IV - Plan (1969-74)	118.71	18.15	136.86
6	V - Plan (1974-78)	269.11	38.82	307.93
7	Two Annual Plans (1978-80)	257.69	23.79	281.48
8	VI - Plan (1980-85)	729.59	50.73	780.32
9	VII - Plan (1985-90)	1306.40	131.40	1437.80
10	Annual Plan (1990-91)	282.75	63.23	345.98
11	Annual Plan (1991-92)	333.92	57.93	391.85
12	VIII-Plan (1992-97)	2754.35	431.56	3185.91
	Total	6299.81	852.92	7152.73

Table 12.5

Net Area Irrigated By Sources (in Ha)

S.No	Sources of Irrigation	1995-96	1996-97	1997-98	1998-99	1999-2000
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	Canals	1538613	1628606	1537708	1634279	1634252
2	Tanks	746631	843890	562730	810489	651427
3	Tube wells	709346	740769	773510	915910	999625
4	Other wells	947468	987668	902950	980661	900304
5	Other Sources	181167	193986	167704	197148	198516
	Total	4123225	4394919	3944602	4538485	4384124

Source: Directorate of Economics and Statistics, Andhra Pradesh.

CHAPTER 13

PARTICIPATORY IRRIGATION MANAGEMENT USHERED IN ANDHRA PRADESH

As we have seen earlier Andhra Pradesh was carved out of the erstwhile Madras State and the Nizam State and has naturally imbibed the traditions of those States. This is particularly true in the irrigation sector. A century earlier, when irrigation was essentially in the category of minor irrigation, mainly tanks and channels, and when no major irrigation projects had been put on ground, the management of irrigation was in the hands of the beneficiary themselves including periodical maintenance. This was termed as 'Kudimaramath' and was in vogue informally in most of the areas now comprised in Andhra Pradesh. As has been the case in Madras with the British trying to officialise the irrigation sector with the hierarchial administration structure and with the country's independence giving a false notion that thereafter the benevolent democratic government will cater to all the needs of all the people in the country, the Kudimaramath system faded away fast and now these minor irrigation systems have deteriorated to such an extent that we are formulating schemes for their rejuvenation. The management by the beneficiary is also to be renewed and this is being attempted through the 'Participatory Irrigation Management' concept vigorously being introduced in the country. This has become particularly necessary when the large major and medium irrigation projects were executed and the development of the command area and its management on a sustainable basis had to be organised.

In Andhra Pradesh, it was found that even after large scale investment in the irrigation sector, the systems' performance is unsatisfactory with a large gap in ayacut and the ayacut of several commands shrinking. Apart from physical deficiencies in the system, a purely Governmental approach, despite the limited capacity for the government to intervene, especially at the lower levels of the system and the lack of participation by farmers have been identified as some of the most important reasons for the under-performance of the irrigation sector.

Based on the pilot studies carried out in the command during 1995-96 with the involvement of two NGO groups, important issues to be taken care of were identified. Early in 1996, the Chief Minister of Andhra Pradesh gave a lead to the dynamic process of promoting Participatory Irrigation Management (PIM) in the State. A series of consultation meetings were also held with the farmers, public representatives, administrators and officials of the Irrigation Department. In May 1996, a factual note on the irrigation sector was laid on the table of the Legislative Assembly.

Andhra Pradesh Farmers' Management of Irrigation Systems Act: and its Implementation:

1) This Act was enacted in April 1997 as Act No.11 of 1997 after the passing of the Bill in the Andhra Pradesh Legislative Assembly on 27.3.1997. Details of the Act are given at Annexure XIX. All land holders or tenants as recorded in the record of rights are members of the Water Users' Associations (WUAs) with voting rights. All other water users who are not registered as land holders or tenants but are in occupation of the lands are members without voting rights.

2) Elections to constitute the Farmers' Associations (Water Users' Associations (WUAs) and Distributory Committees (DCs) were held in June – 1997.

3) The Act Provides for constituting a Three tier organisation structure as detailed below:

   I. Water Users' Associations (WUAs) with 4 or 6 or 8 or 10 Territorial Constituencies (the command area is divided into a number of Territorial Constituencies with almost equal areas).

   II. Distributory Committees (DCs) (Comprising of a group of WUAs)

   III. Project Committees (PCs) comprising of a group of DCs) (These are to be constituted only under Major and Medium Irrigation Systems)

   IV. The tenure of all these Associations is 5 years.

4) Totally 10292 Associations were constituted through elections by secret Ballot comprising 1673 Nos. under Major Irrigation Systems, 304 Nos. under Medium Irrigation Systems and 8315 Nos. under Minor Irrigation systems, covering a command area of 48.0 lakh hectares, spread over the entire State. 1977 WUAs under Major and Medium Irrigation systems cover 80% of the ayacut (32 lakh hectares) and 8315 WUAs under Minor Irrigation Systems the balance 20% of ayacut (16 lakh hectares).

5) During November 1997, 174 Distributory Committees were constituted. However the constitution of Project Committees was postponed for a later period.

6) Eight Stages of PIM Program Implementation as adopted in Andhra Pradesh are listed below:

Stage - i	General political support at the highest level – this is essential to provide the required motivation.
Stage - ii	Creating favourable environment
Stage - iii	Developing Legal Frame work
Stage – iv	Formation of Farmers Organisation: Water Users' Associations and Distributory Committees
Stage - v	Implementation of the programme with clarity of roles of the Farmers' Organisation, irrigation department and other government agencies.
Stage – vi	Capacity building (Training) of members of Farmers' Organisation, and officials of irrigation department and other government agencies.
Stage- vii	Ensuring of transparency, accountability in the working of the Farmers' Organisation and social audit.
Stage-viii	Monitoring, Evaluation and Mid Course corrections.

7) The Act provides for recall of any of the Members and President of the Managing Committee by the members after one year, by giving a written notice signed by not less than one third of the members of the Farmers' Organisation. The motion for recall has to be adopted by a simple majority of the members present in the meeting specially convened for the purpose.

8) The water charges have been raised three fold by issue of an ordinance on January 3 - 1997, amending AP Water Tax Act and bringing the changes into force from July-1, 1996

		in Rupees
i.)	First or single wet crop	60 to 200
ii.)	Second and third wet Crop	60 to 150
iii.)	First crop irrigated dry	40 to 100
iv.)	Second and third crop irrigated dry	40 to 100
v.)	Dufassal crop in fasli year	120 to 350
vi.)	Acqua culture	0 to 500

The Government of Andhra Pradesh have ordered transfer of 90% of the Water charges collected to the Farmers' Organisations from 2001-2002 onwards.

Level	Sharing of Water Charges (Percentage) Irrigation Projects		
	Major	Medium	Minor
Water Users' Association	50	60	90
Distributory Committee	20	30	-
Project Committee	20	-	-
Panchayat	10	10	10
Total	100	100	100

Capacity Building:

Series of training programmes are being organised both for the Presidents of Water Users' Associations and officials of irrigation department and other agencies. State Level orientation workshop, District Level Training of Competent Authorities (officials of irrigation department who are made responsible to assist the farmers' organisations at different levels), Project level and district level and State level conferences were organised with the involvement of WALAMTARI (Training Institute) and NGOs. This process is continuing.

The Act and the Farmers' organisation:

The Act facilitates the following to a Farmers' Organisation:

i.) Gives water rights and control of the Irrigation systems.

ii.) Provides for functional and administrative autonomy to the associations.

iii.) Makes irrigation department accountable to the farmers' organisation (WUA etc.). The Competent Authority, who is an official from the irrigation department and attached to a group of Water Users Associations has to implement the decisions of Water Users Association.

iv.) Enables Water Users Associations to resolve conflicts within themselves.

v.) Attempts to improve the irrigation systems to become more effective as it is to be done by the Water Users Associations only.

vi.) Allows access to information to the Water Users Associations on scheme operations.

vii.) Preparation of the operational and maintenance plans.

viii.) Provides freedom of cropping pattern to farmers.

Transparency and Accountability:

One of the essential requirements for the successful functioning of any organisation is that it should be transparent in all its dealings and also develop accountability to its members. Transparency necessarily demands that each and every decision of the Water Users' Association be discussed in the General Body meetings. Establishing credibility in a transparent manner proposed are the two critical ingredients, which have drawn the involvement of farmers in a big way in Andhra Pradesh. Social Audit is a new concept introduced in the whole of scheme of things mainly to ensure the quality of the functioning of the Water Users Associations. This is to be done by the local respected persons.

Some Experiences of PIM implementation in Andhra Pradesh:

The Institute of Resource Development and Social Management (IRDAS) a Non-Governmental organisation functioning at Hyderabad provides some information about the experiences of PIM implementation in Andhra Pradesh. A quick survey of presidents of 6525 Water Users' Associations of the total 10292 Waters Users' Associations in the state was carried out to assess their status and perception in August – 1998.

Contrary to the normal expectations that only large farmers will be elected as presidents, we find small and marginal farmers constitute the bulk of the posts of the presidents.

Large farmers – 23%; Small farmers-35%; Marginal farmers-42%

The overall literacy rate of the presidents is generally high. More than 10% are graduates or Post graduates.

Literate	84%
Illiterate	16%
Graduate and Post Graduates	11%
Above 10^{th} Std. and below Graduation	45%
Upto 10^{th} Standard	28%

It had also been observed that youth are actively involved in WUAs.

Age group of Presidents: Above 50 years – 29%; 25-50 years – 69%; Below 25 years– 2%

A feed back survey conducted reveals that;

WUA Presidents are conscious about the need for sustainability of their Associations.

The main items identified are on training, execution of all maintenance works through WUAs, entrustment of collection of water cess to WUAs and the need for the members of the WUAs to contribute funds to raise financial resources of the associations.

Some of the observed impact of implementation of APFMIS Act are listed below.

Increased farmers' participation
Emergence of young leadership.
Development of educated and trained youth as leaders
Emergence of new opportunities to Socially Backward farmers as leaders
Emergence of increased awareness among the WUAs
Creation of new environment for satisfaction of WUAs
Development of positive attitudinal environment among the WUAs.
Emergence of increased interaction between the officials of irrigation department and the WUAs.
Increased realisation on achievement motivation and sustainability by the WUAs.

The Federation of Krishna Delta WUAs in association with India NPIM; New Delhi and IRDAS, Hyderabad have organised All India Water Users' Associations convention during 28-30, January 2002 at Vijayawada. Officials and WUA representatives were drawn from the States of Tamil Nadu, Maharashtra, Karnataka, Andhra Pradesh, Gujarat, Madhya Pradesh, Uttar Pradesh and other States, and allowed to participate in this convention and exchange their views and experiences through effective presentations, discussions and field visits to some of the WUAs in Krishna Delta.

From some of the discussions with the Andhra Pradesh irrigation department officials as well the WUAs Managing Committee Members, the information gathered indicates that the WUAs formed under Major and Medium Irrigation systems with assured water supply covering about 80% of the total command area are generally functioning well, whereas the impact of WUAs under minor irrigation, especially under tanks, where assured water supply is not available, is not very encouraging.

CHAPTER 14

INTER - STATE ISSUES

All the major rivers in the country drain more than one State and Indus, Ganges and Brahmaputra cross the national borders too. Andhra Pradesh is no exception. Besides the major rivers Godavari, Krishna and Pennar, a few of the medium rivers like Vamsadhara, Nagavalli, Palar and Kortaliar and minor rivers like Jhangavathi, Bahuda and Araniar, have interstate drainage basins.

The Godavari, the largest in the Peninsula, has a drainage area of 312,812 sq.km of which 48.6% lies is Maharashtra, 20.7% in Madhya Pradesh, and Chhatisgarh, 1.4% in Karnataka, 5.5% in Orissa and 23.8% in Andhra Pradesh. Similarly Krishna basin has a catchment of 258,948 sq.km of which 26.8% lies in Maharashtra, 43.8% in Karnataka and 29.4% in Andhra Pradesh. Though its extent within the Andhra Pradesh is low, it tails into the State to reach the sea and brings in all the inter state problems in its development and utilisation. Pennar has a basin extending to 55,213 sq.km of which only 12% lies in Karnataka and the rest in Andhra Pradesh.

Water in any country is the most required natural resource next to air even for the very sustenance of life and this is again a constant in the world even though it may vary largely from place to place. With the use of waters increasing in general all over the world, because of improved standards of living and also because of the fast increasing population, several countries are slipping into the category of water stressed while some have already become water scarce areas. Water as a commodity is becoming scarcer and scarcer and there is bound to be competitive demand for the same from several countries and from several parts of the same country. Fortunately India is endowed with rich water resources and may not get water stressed immediately, the country in general. But within the country, why even within the same river basin, there are water stressed areas and water scarce areas, while some other areas are rich in potential. Man being emotionally attached to water and rightly so, water being the most important and most needed resource, there is bound to be conflict in its use among individuals, among groups of individuals, among the States in the same countries and among the countries. Several inter state issues therefore arise in water resources in the river basins, in the country. Consensus in water sharing and water allocation among the States has been all the time eluding and in recent times legal remedy has been sought to resolve such conflicts in water use as and when they arise.

The Indian Constitution gives clear direction in respect of the rights for the use of the waters, in our river systems and their governance. While defining the powers of law making, by the Parliament and the State Legislatures in Article 246, three lists are made and included in the Seventh Schedule under the Article, one the Union List enumerating the subjects exclusively within the competence of the Union, one the State list exclusively to be handled by the State and a third called the concurrent list containing subjects in which both the Union and the States have jurisdiction.

Item 17 in the State List states, "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 the Union List" and entry 56 of the Union List deals with Inter States Waters and reads:

"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".

Article 262 of the Constitution deals with the disputes relating to waters and reads:

Adjudication of disputes relating to waters of inter-State rivers or river valleys –

(1) Parliament may by law provide for the adjudication of any dispute or complaint with respect to the use, distribution or control of the waters of, or in, any inter-state river or river valley.

(2) Notwithstanding anything in this Constitution, Parliament may by law provide that neither the Supreme Court nor any other court shall exercise jurisdiction in respect of any such dispute or complaint as is referred to in clause (1)

(Ss. 131,132,133, G.I. Act)

Pursuant to the above, the Parliament passed THE INTERSTATE WATER DISPUTES ACT 1956 (ACT 33 of 1956) to provide for the adjudication of disputes relating to the waters of Inter-State rivers and river valleys on the

28th August. 1956 and the related THE INTER STATE WATER DISPUTES RULES 1959 were made on the 23rd June, 1959 by the Central Government after consultation with the State Governments. This Act has had a few amendments since then. This Act provides for the Constitution of a Tribunal for the adjudication of the Water Disputes that arise between the States with the exclusion of the jurisdiction of the Supreme Court or any other court in the country.

The Interstate Water Dispute Act was amended in the year 2002 to specify the time limit for the Interstate Water Dispute Tribunals for settlement of disputes.

A few water disputes have since been referred to the Tribunals constituted under this Act and they are as under

Tribunals	Date of constitution	Date of Award
The Godavari Water Disputes Tribunal	10.04.1969	27.11.1979
The Krishna Water Disputes Tribunal	10.04.1969	24.12.1973
The Narmada Water Disputes Tribunal	06.10.1969	16.08.1978
The Cauvery Water Disputes Tribunal	02.06.1990	Interim Award given in June 1991. Proceedings in progress.
The Ravi Beas Water Disputes Tribunal	02.04.1986	Interim Award was given in January, 1987. Final award yet to be passed

Disputes arising out of use of Inter-State waters have been adjudicated and solved either through Arbitration or through negotiation and mutual understandings in our country over a long time and some of the compacts/agreements drawn through bilateral discussions and mutual understandings are more than a century old.

The Indenture made between the Secretary of State for India at London and the Maharaja of Travancore in respect of the lease of certain territory in the Travancore State in connection with the Periyar Irrigation Project signed and made on the twenty ninth day of October 1886 may perhaps be cited as the earliest such formal Inter-State Agreement available on record.

The next such century old formal agreement that can be cited is the agreement dated 18th February, 1892 between the Governments of Mysore and Madras regarding restoration and recommendation of certain irrigation works in Mysore State. In this agreement in Schedule A, certain tributaries in the Krishna and Pennar Basins now lying in the present Andhra Pradesh are mentioned.

Since then a number of such Inter State agreements have been signed through mutual good will and in a spirit of give and take which have all become law and which are respected and acted upon, irrespective of changes in political boundaries and changes in governments.

Even though the rivers Godavari and Krishna now carry large flows during flood and spill heavily in the Dowaleshwaram and the Vijayawada anicuts respectively, there were disputes in the sharing of flows in their tributaries and sub tributaries for long hindering the development of irrigation potential through execution of irrigation projects. The basin States had therefore been asking for constitution of Tribunals to settle those disputes and allocate the waters in those two river systems among the basin States so that they may go ahead with projects for further developments in those river basins.

As a prelude to the constitution of the Tribunals for adjudicating the disputes that had arisen in the use of waters in these two major basins Godavari and Krishna, the Government of India in the Ministry of Irrigation and Power constituted a High Level Commission called the 'Krishna Godavari Commission' on the 1st May 1961. The Commission gave its report in July 1962.

This Commission was chaired by the eminent irrigation engineer the late Shri N.D. Gulati, ISE (Retired) and had two more Members Shri D.D.Jaini, ISE (Retd.) and Dr.R.C.Hon the then Director, Central Water and Power Commission. The terms of reference to the Commission in short were:

1. To report on the availability of supplies in Krishna
2. To report on the requirements of the projects on the Krishna
3. To report on the availability of supplies in Godavari
4. To report on the requirements of the projects on Godavari and
5. To report on the feasibility of diverting any surplus supplies in the Godavari to Krishna indicating the quantity to be diverted and the order of cost involved.

As a first step the Commission visited Hyderabad, Bombay, Bhopal, Bangalore and Bhuvaneshwar and held preliminary discussions with the Government representatives. A detailed proforma was evolved and the States were requested to supply the data and the statistics in that common format. It was also agreed that the information furnished to the Commission would also be supplied to the other States for their information and verification wherever necessary.

The Commission found that the river flow data in most situations were scanty, unpublished and so were the technical details of several of the schemes and projects existing and proposed. The Commission noted that most of the important data and information relating to water resources development in the two basins were either non-existent or had not been compiled and analysed any time before. The Commission's task was therefore to obtain, compile and analyse whatever data was available and the large mass of information they had furnished in their Report with eighteen Annexures in separate volumes turned out to be the first attempt for a basin-wide survey of the technical information relevant to the water resource development in those two major basins. As regards the technical details of the projects, information was compiled in three categories; schemes of irrigation and power in operation as on 31st March 1951, schemes which came into operation after 31st March 1951, and the schemes under construction. These served as a treasure of information for use in planning for future development of the water resources in the basin States.

These also led to the transparency in the development in the basin States competing for use of the waters in these basins, the status in availability and demand in the several sub basins of the two river systems.

A few of the recommendations of this Commission which deserve mention here are given below. They are relevant even today after four decades.

a) All general statistics particularly data on land utilisation are to be collected and compiled river basin and sub basin wise instead of administration unit wise

b) Adequate rain gauge stations and weather stations are to be established in the river basins and the observations published on a monthly basis and periodically analysed.

c) Daily flow discharge observation sites are to be established at all critical locations along the river course and observation data are to be periodically published: Sediment transport should also be measured at appropriate sites.

d) Rules of regulation are to be formulated for all storages and diversion structures and withdrawals are to be accurately measured.

e) Ground water observations are to be continuously made in each river basin to study the ground water level fluctuation.

f) Performance of each of the irrigation projects is to be reviewed periodically with reference to water utilisation and the benefits that accrued.

g) Power Boards may be established in each river basin to bring about a co-operative approach and establish necessary co-ordination among the States for Planning and operation of the various systems in the basin in an integrated way.

Though much of the information available in their Report with as many as eighteen Annexures may be out dated at this distant date, the methodology they have followed in collecting the information, their approach to the problem, the thoroughness with which they have analysed the problem and the enthusiasm they have shown in presenting the Report with their long experience brought to bear in their recommendations are all worth emulating.

The Commission estimated the average yield of River Godavari at Dowleshwaram as 118045 Mcum (4167 TMC) and that of Krishna at Vijayawada as 67819 Mcum (2394 TMC) on an average.

The Godavari Water Disputes Tribunal was the first such body constituted by the Government of India under the Inter State Waters Dispute Act, 1956 closely followed by the Krishna Water Disputes Tribunal, in both of which Andhra Pradesh participated as the Basin State. In both those cases the disputes arose on the use of waters in the sub basins and the prayers were for an allocation of the use of the waters of those rivers and river valleys among them from the assessed availability in the river systems.

The Godavari Water dispute Tribunal constituted by the Government of India on the 10th April 1969 was chaired by Shri R.S.Bachawat and had two other Members. The Krishna Water Disputes Tribunal was constituted by the Government of India as per their Notification No.SO 1419 dated 10th April, 1969 had again the same Justice R.S. Bachawat as Chairman with Justice D.M.Bhandari and Justice D.M.Sen as Members.

Several attempts made earlier to resolve the dispute by the Planning Commission in 1951 and the Central Water Commission were not successful. The efforts of the Central Government to settle the disputes by negotiation failed and hence these Tribunals were constituted on the 10th April 1969 for adjudication of the dispute.

The Government of India in their reference also requested the Tribunal to consider the representation of some of the States concerning the possibility of diversion of Godavari waters to the Krishna river and the objection to such diversion from some other States. In a subsequent reference, the dispute arising out of submergence of its territories by the projects Pochampad, Inchampally, Suvarna and Suddavagu of Andhra Pradesh from the State of Maharashtra, were also made.

In both these cases the Tribunal awards and decisions given after due investigation of the matters referred to them as per Section 5 (2) of the Act were again referred to them for further consideration under Section 5 (3) of the Act and duly got modified giving such explanation or guidance or clarifications as considered necessary before they were published by the Central Government as per section 6 of the Act as the Final Order.

These Final orders in these two cases have been compiled by the Central Water Commission in their Inter State Matters Directorate, New Delhi in November 1997 under the title "Legal instrument on Rivers in India" Vol.II. They are not dealt with in this brief history separately.

In the case of Godavari basin, perhaps because of the elaborate exercise already made bringing out the facts by the Krishna Godavari Commission earlier discussed above, the basin States urged by the compulsion to get certain disputes arising out of the use of waters in the sub basins of Godavari to go ahead with their impending development projects, discussed among themselves and entered into agreements between them and filed the same before the Godavari Water Disputes Tribunal. Many issues and sub-issues had to be framed. It was seen that as many as 84 tributaries or sub tributaries of the Godavari River System lay in more than one State bringing in heavy complications in resolving disputes. The Tribunal examined the bilateral and multilateral agreements already concluded among the basin States. They observed that those agreements determined their respective rights and obligations and constitute the agreed 'law' on the subject and also the competent arbitral awards and judicial decisions are to be respected. Equitable apportionments can be thought of only for the rest. Any way most satisfactory solution of such disputes is by agreement by the parties concerned. The Tribunal also observed that there is no rigid formula for the equitable apportionment of waters of a river. Each river system has its own peculiarities.

After a careful study of the peculiarities of the Godavari River system, the Tribunal came to the conclusion that there should be no objection in allotting to one or more State or States its water upto a defined point or points or project sites or within certain sub basins or reaches of the rivers. In this context the Tribunal examined all the Agreements already in force.

The Tribunal endorsed these Agreements and suitably brought them in their final award in Clause V. As seen in this clause as many as ten such inter state Agreements got solemnized at one stroke through the Final Orders of the Tribunal. These bilateral and multilateral agreements were signed by the basin States after due discussion over a long period from 17th September, 1975 to 2nd April, 1980. Those agreements specifically facilitated execution of several major and medium projects in the sub basins of Godavari.

The Tribunal gave their Final order on the 27th November 1979. The Tribunal also gave their further report under section 5 (3) of the Inter State Water Disputes Act 1956 on the 7th July 1980 as an unanimous report.

A few clauses in this Final award which may receive attention are

Clause I: All the States can make use of underground water within their respective States' territories in the Godavari basin and such use shall not be reckoned as use of the waters of the river Godavari.

Clause IV: Each of the States concerned will be at liberty to divert any part of the share of the Godavari waters allocated to it from the Godavari basin to any other basin.

Clause VII: Nothing in the order of the Tribunal shall impair the right or power or authority of any State to regulate within its boundaries the use of water or to enjoy the benefit of waters within that State in a manner not inconsistent with the orders of the Tribunal.

Clause VIII: Any use of the waters of the river Godavari by any person or entity of any nature whatsoever within the territories of a State shall be reckoned as use by that State.

Clause IX: Nothing contained herein shall prevent the alteration, amendment or modification of all or any of the foregoing clauses by agreement between parties or by legislation by Parliament.

The final orders of Krishna Water Disputes Tribunal was published by the Government of India in their Notification dated 31st May, 1976. This Tribunal had made an elaborate exercise in investigating on the disputes that had arisen among the basin States Maharashtra, Karnataka and Andhra Pradesh and spelt out their decision with clarity in respect of their allocation of the waters among them .

Clause XIV of the Final Order says

A. "Any time after the 31st May, 2000, the order may be reviewed or revised by a competent authority or Tribunal, but such review or revision shall not so as far as possible disturb any utilisation that may have been undertaken by any State within the limits of allocation made to it under the foregoing clauses".

In pursuance to this, on the basis of requests made by basin States, the Government of India have decided to set up a new Krishna Water Dispute Tribunal.

Broadly, the earlier Tribunal determined for the purposes of allocation among the basin States the 75% dependable flow of the river Krishna upto Vijayawada as 58.36 T Mcum (2060 TMC) and allocated the same as 15.86 T Mcum (560 TMC) for Maharashtra, 19.83 T Mcum (700 TMC) for Karnataka and 22.66 T Mcum (800 TMC) for Andhra Pradesh. The Tribunal conceded that return flows will be available and allocated to each State besides the above, 10% of the average annual utilisation from its own projects using 85 Mcum (3 TMC) or more annually assumed to be available as return flow but in stages of three year time periods from 1975-76 onwards.

In Clause IX of the order certain restrictions have also been placed on use in some sub-basins in all the basin States. Such sub-basinwise allocation and regulations and restrictions became necessary since the utilisation in some sub-basins were fast exceeding the availability.

In clause X the Tribunal clearly brought out that Irrigation has a priority over power and decided that the present diversion of Krishna Waters by the State of Maharashtra outside the basin for the Koyna Hydel Project should be curtailed in stages to 1912 Mcum (67.5 TMC). This is because the river Krishna is also fast becoming a river with demands for use of its waters exceeding the availability.

The Tribunal also specified certain regulations in respect of gaugings and gauging sites in the Krishna River Systems.

The Tribunal refrained from ordering the setting up of the Krishna River Authority for monitoring and implementing their orders since there was no consensus among the basin States on such a constitution of the Authority. It was left to the basin States and the normal channels of authorities sanctioning schemes for utilisation of waters in the river system, to regulate the State wise use in accordance with the allocation made by the Tribunal.

A few disputes have arisen in the implementation of the Tribunal orders which were taken to the Supreme Court for their verdict and more and more of disputes of the kind may surface with the utilisation narrowing down on the availability in the sub basins and the river basin as a whole.

As expressed in the beginning, conflicts in the use of waters in the Inter state river basins are bound to arise and have to be solved to the satisfaction of the parties to the disputes upholding the tenets of justice and striving for an equitable distribution of the benefits. Water laws are still in the offing, and Helsinki Rules and the Law of Non-Navigational uses of International Water Courses framed at the instance of the United Nations may serve as guidelines besides the Tribunal awards already passed and other court judgement serving as case laws.

The real solution would be in maintaining a constant vigil by each State in utilising the waters over which it has secured a right by law and taking concerted efforts to economise on its use in every sphere of its use.

CHAPTER 15

CYCLONES, FLOODS AND DRAINAGE

It may be said that leaving the narrow coastal plain and the large deltas of the major rivers Godavari, Krishna and Pennar, the physiological structure of the State of Andhra Pradesh is such that it facilitates fast drainage of the rainfall-run off. Essentially situated in the dipping Deccan Plateau interspersed with discontinuous hilly tracts of the Eastern ghats here and there to the west of the coastal plains, we find that the river valleys are clearly defined and in some places they are so constricted that the rivers erode and flow in deep gorges as in the case of river Krishna near Srisailam and Pennar near Gandhikota.

Besides the major rivers Godavari, Krishna and Pennar a number of medium rivers such as the Budameru, the Thammileru, the Yerrakalva, the Thandara, the Varaha etc. and several minor rivers draining the eastern ghats run down through the narrow coastal plain carrying large volumes of their floods during the monsoon and dumping in the coastal area creating often a flood expanse of vast area with the drainage impeded by the tidal action at the sea front. This is compounded by the heavy monsoon rains often triggered by deep depressions and cyclones in the Bay of Bengal.

The Andhra coast popularly known as the Coramandel coast extending over a length of about 870 km from Pulicat lake in the south on the borders of the Madras State to Rushikulya in the north on the borders of Orissa State is so situated on the shores of the Bay of Bengal narrowing towards the north, that many of the depressions deepening into cyclones emanating in the Bay move on and strike the coast. These cause high intensity rains and heavy floods, breaches in the rivers and canal systems particularly in the Delta and large-scale devastation occurs.

Though the average rainfall in the State as a whole may be in the order of 890 mm with large tracts of dry area like the Telengana and Royalaseema pulling down the average, the rainfall in the eastern ghats is of the order of 1500 to 1800 mm. Coastal areas are influenced by both the south west and north east monsoons. The major rivers Godavari, Krishna and Pennar are by themselves of high water potential and flood prone causing heavy inundation in their own deltas. The maximum flood discharge recorded at Dowleshwaram in 1953 was 88100 Cumecs (31.13 lakh cusecs), that recorded in Vijayawada anicut on Krishna in 1903 was about 33,800 cumecs (11.9 lakh cusecs) and that in Pennar was 14,700 cumecs (5.2 lakh cusecs). A number of storages created on Pennar and Krishna in the recent decades have to a certain extent regulated the floods; but Godavari continues to be a fiery, mighty river difficult to harness and control.

The Kolleru lake, a large natural depression of land about 30 km inland from the sea with an expanse of about 955 sq.km has a storage capacity of 1525 Mcum (54 TMC), when full, with water level at 3.28 m (10.70 ft.) above sea level deserves special mention. This fresh water lake, a little beyond the reach of the ocean tides, plays a significant part in the flood management lying in between the Godavari and Krishna Deltas. It receives the Budameru, the Ranileru, the Tamileru and the Gunderu besides many other minor streams from its large catchment and has only one short link to the sea through Uppuleru. The lake rises fast during flood days and with inadequate capacity to discharge into the sea there is large-scale submersion and backing up in the very infalling drains and rivers and several drains in the adjacent deltas causing flood damages to the crops in large areas. Even towns like Vijayawada, Eluru suffer submersion in low-lying areas. It is said that on an average about 40486 ha (1 lakh acres) of cropped land are affected during floods each year inflicting loss of a few crores of rupees. The State Government has been implementing several flood control measures by forming small reservoirs, constructing regulators over rivers and drains. But the problem is too large and complex to be totally solved.

The occurrence of several deep depressions some times turning into elevating cyclones is reported in detail in the MAUSAM, a quarterly periodical of the India Meteorological Department. It is seen that the coastal Andhra Pradesh experiences deep depressions and cyclones almost every year particularly during the month of October and November and heavy rainfall in some stations exceeding 300 mm in a day is not unusual.

The Chirala cyclone of Nov 77 and the Machilipattanam severe storm cyclone of 5-11 May 1990 are the worst recorded cyclones in the recent memory. In the former, the Diviseema islands at the estuary of Krishna were

totally destroyed, the sea water rushed in upto a maximum of 12 km inland, more than 10,000 human lives were lost, unprecedented floods were caused and several crores worth of flood damages had to be borne as a great natural calamity. In the latter, which is a premonsoon cyclone of similar severe nature, thanks to the timely warning more than 6.5 Lakh people from the vulnerable coastal areas from 546 coastal villages were evacuated to safe places and the loss of human losses was hence just 967. However the flood damages to properties and crops through heavy rains and inundation was quite high with the Machilipattanam itself going under 3 to 6 ft of water for 3 to 4 days and Visakhapatnam airport under water for about a week. Road traffic and all communications were cut. Gale was in the order of 200 to 250 kmph. The storm affected a population of about 7.78 million in 5160 villages. More than about 3.61 million live stock perished and the flood damages assessed were of the order of Rs.2289 crores.

Both the State and the Central Governments have been organising expert teams to go into the aspects of flood and cyclone damages in the coastal districts and suggest measures to control and mitigate floods. One such Expert Committee on Floods for Delta Areas of Krishna, Godavari and Guntur districts of Andhra Pradesh was constituted by the Ministry of Irrigation and Power, Government of India on the 9th October, 1964 under the Chairmanship of Shri A.C.Misra, Engineer in Chief, Uttar Pradesh, with four other Members and a Chief Engineer, Central Water Commission as Member Secretary. Sri U.Ananda Rao, who was Chief Engineer, Irrigation in Tamil Nadu was included as one of the Members in the capacity of a consultant in the Ministry of Irrigation and Power. This Expert Committee have furnished a valuable report to the Ministry on the 6th January, 1966. This Committee has gone into the question of flood proneness of the coastal Andhra Pradesh with special reference to the Kolleru Lake, drains in the Krishna Western Delta and drains in the Godavari Eastern and Central Deltas. The Committee has made a detailed study of the several river systems and drainages in the areas, and come up with valuable recommendations in a comprehensive way for the control of floods in the river systems and improvements to the drainage systems. Besides analysing the existing storages and regulators they have suggested formation of several new reservoirs, raising of flood banks, creating straight cuts at the sea end and improvements to the drains. A number of their recommendations are being implemented according to the priority which the Committee themselves have suggested.

Following the 1990 devasting cyclone which disrupted the delta irrigation systems in both Krishna and Godavari deltas, a Committee headed by the late Sri Sreerama Krishnayya was constituted by the Andhra Pradesh Government to assess the damages and suggest measures for restoring the disrupted irrigation systems and also propose plans for containing the damages in future cyclones. On the basis of their report the Andhra Pradesh Government has taken up restoration works and large-scale improvements to major and minor drains in the coastal districts of Nellore, East Godavari, Krishna and Prakasam districts with World Bank Aid under the Andhra Pradesh Hazard Mitigation and Emergency Cyclone Recovery Project. Under this project nearly 50 km of the flood banks of the river Godavari in the East Godavari district are also proposed to be improved.

Cyclones in Andhra Pradesh coast are a recurring phenomenon. They had cyclonic storms again in May, October and November, 1995 damaging the flood banks in a number of places and disrupting the works.

Given the cyclone prone nature of Andhra Pradesh coast and its vulnerability and the complexity of the problems it will take Government some more time to instal in place cyclone protection measures and flood protection works even with all the technological advances we might have acquired in the recent times.

CHAPTER 16

HYDRO - ELECTRIC SCHEMES

Two Hydro Electric Schemes undertaken after independence which have largely helped in augmenting the power production in the State are mentioned below:-

Machkund Hydro Electric Scheme

This is built exclusively as a hydro electric scheme on Machkund (Sileru) a minor tributary of Godavari.

A reservoir of 892.4 Mcum (31.50 TMC) live capacity has been formed by building masonry gravity dam 396.3 m (1300 feet) long and 45.1 m (148 ft.) high. The spillway is of Ogee type with 8 gates of 18.3 m x 6.1 m (60 ft. x 20 ft.). Three power pipes 2.6 m (8'6") dia with a capacity of 62.3 cumecs (2200 cusecs) each carry the flow to the diversion dam 22.5 km (14 miles) downstream. The diversion dam has an overflow section (560 ft.) long fitted with 8 gates 18.3 x 6.1 m (60 ft. x 20 ft.) each. A lined power channel 3658.5 m (12,000 ft.) long with a capacity of 548.8 cumecs (1800 cusecs) takes off from the right flank of the diversion dam through two sluices 3.66 x 2.43 m (12'0" x 8'0") and connects the power house. The power potential is 114 MW.

The scheme was taken up in 1947 and came into operation by 1955. Machkund Hydro Electric Scheme has gone a long way in expediting industrialisation in the coastal districts of Andhra Pradesh from Srikakulam to Nellore. The project was taken up as a joint venture with Orissa with whom the power is shared in the ratio of 70:30.

Upper Sileru Hydro Electric Project

This is exclusively a Hydro Electric Project of the flow cum storage type on Sileru a minor tributary of Godavari built near Guntevada downstream of the Machkund hydroelectric scheme.

A weir 420.7 m (1380 feet) long 107 m (35 feet) high with 6.1 m (20 feet) high crest gates across Sileru in Godavari basin has been built to create a pondage of 87.8 Mcum (3.1 TMC) from where a short canal of capacity 283.2 cumecs (10,000 cusecs) connects the forebay. The power potential is 120 MW with 2 units of 60 MW each with an operational head of 94.5 m (310 feet).

The work was taken up in December 1959 after entering into an agreement with Orissa since part of the submersion is in that State and the power house became operational by 1964.

CHAPTER 17

FUTURE PERSPECTIVES

The State of Andhra Pradesh is endowed with rich natural resources including the water resources. Equally so it is, in human resources. Counting 75.73 millions as per 2001 census with 38.29 millions males and 37.44 millions female, their literacy percentage is also high with 70.85 among males and 51.17 among females. While its work force is 30 millions, it holds a high percentage of intelligentsia as well. The State is forging ahead to reach the first rank in Information Technology in the country in the recent years and is proudly announcing 'e' governance in the world arena under the able stewardship of the present Chief Minister.

The ancestors of the great visionary, the doyen of Engineering profession, Bharat Ratna Sir M. Viswesvaraya, a Telugu Brahmin, hailed from Mokshagundam, a village in Andhra Pradesh. The State had the fortune of enlisting the services of the most illustrious irrigation engineer of the nineteenth century of British origin Sir Arthur Cotton in developing the water resources of the State. He was succeeded by many others indigenous who had contributed significantly for the development of irrigation in the State of which a few may be remembered in Nawab Ali Nawaz Jung Bahadur, Vepa Krishnamurthy, Dr. K.L.Rao, Mr.K.R.Chary, Dr. Bulusu Laksmana Deekshatalu, J.A.R. Murray, G.A. Narasimha Rao, Mr.L. Venkatakrishna Iyer, J.Visweswar Rao and Dr. Sri Ramakrishnayya.

The future of the State is therefore quite bright in the development and management of the water resources in the State, which is assumed as about 77.8 Mcum (2746 TMC). With 60% of its geographical area being cultivable, it is gradually increasing the cultivated area, which is presently around 71% of the cultivable area. With the rich coastal plains on the east, the undulating eastern-ghats region covered by forest ranges to its west and the arid Deccan plateau reasonably elevated, the topography presents a varied picture with ample scope for water resources development by creating storages big and small on the numerous river systems traversing the State from west to east.

The State has been creating the irrigation potential rather in a rapid stride consistent with the heavy investment needs and has raised the irrigation percentage over the cultivable area to nearly 43. The Godavari and Krishna Deltas form the rich rice bowls for the State.

Of the large river systems, the Pennar has been mostly tapped and the several major projects implemented in the Krishna basin have enabled Andhra Pradesh to exhaust the water allocation made to the State much ahead of the other basin States, Karnataka and Maharashtra. The State has launched a few more major and medium irrigation projects to utilise the surplus waters in the Krishna basin which it is entitled to utilise presently, without claiming the right for utilisation, in anticipation of its possible share from out of the surplus flows as and when a review is made for an allocation of the surplus among the basin States.

The Godavari river system, the largest in the Peninsula, has a large potential still left untapped and the future prospects for further irrigation development in the State lies in that basin.

The State which has predominantly an agricultural economy has been giving a high priority in financial investments for creating irrigation infrastructure. In its vision 2020 called SWARNA ANDHRA PRADESH the State has planned to harness all the utilisable waters in the State by 2020 both surface and ground. The State has launched a drive for mobilising financial resources to achieve this objective from external sources like the World Bank (about Rs.1300 crores) the Overseas Economic Co-operation Fund (OECF) Japan (about Rs. 550 crores) and the National Bank for Agricultural and Rural Development (NABARD) (about Rs. 500 crores). The State has also taken extra-ordinary steps to raise money by issuing Development Bonds to an extent of about Rs.370 crores. The State has been vigilant to apply for and obtain Rs. 500 crores from the Government of India though their Accelerated Irrigation Benefit Programme (AIBP) for early completion of on-going projects.

A perspective on the utilisation of the water resources in the Godavari River System in Andhra Pradesh may be useful in this context. The following 10 districts lie in the basin.

Sl, No	Name	Percentage lying in the basin	Sl. No.	Name	Percentage lying in the basin
i.	Adilabad	100.00	vi.	Khammam	51.18
ii.	Nizamabad	100.00	vii.	Warangal	52.50
iii.	Medak	84.80	viii.	East Godavari	66.80
iv.	Karimnagar	99.70	ix.	West Godavari	20.00
v.	Ranga Reddy	1.50	x.	Vishakhapatnam	27.50

Of the 85 T Mcum (3000 TMC) assessed as the potential to be allocated among the basin States by the Godavari Water Disputes Tribunal Award, 33.2 T Mcum (1172.78 TMC) came to the share of Andhra Pradesh as per the ten inter State Agreements and the State is planning to utilise 41.93 T Mcum (1480 TMC) including the regeneration etc.

Besides the utilisation in the large Delta, thanks to Sir Arthur Cotton, and the Sri Ram Sagar Project, I stage, as many as ten major projects and thirty medium Irrigation projects are under investigation or contemplation to utilise the large potential yet to be tapped in this basin. Inchampally and Polavaram reservoir projects are the most promising among the ten major projects under contemplation, the rest being Yellampalli barrage, Dummugudem anicut, Pranahita, Lower Penganga storages, Nizamsagar Lift and Lendi.

The Inchampally project will be a multipurpose project proposed across River Godavari 12 km downstream of the confluence of Indravathi. This project when executed to the ultimate stage will utilise 2408 Mcum (85 TMC) of water to irrigate 63606 ha (1,57,106 acres) Kharif and 70285 (1,73,603 acre) in Rabi with the generation of 975 MW of power. The cost is estimated at more than Rs.3500 crores. This will be a joint project involving Maharashtra, Madhya Pradesh and Andhra Pradesh. A High Level Committee of experts at the Government of India under the Chairmanship of the Member (WP&P) of CWC examined various aspects of this joint project including submergence, rehabilitation, forest and environmental clearances etc. and have submitted its report to the Ministry of Water Resources in June, 2001.

Inchampally will serve as a Central facility for the proposed diversion of 2266 Mcum (80 TMC) of Godavari waters to the Krishna basin and also as a transit nodal point for the proposed Peninsular Grid linking Mahanadi and Cauvery and Vaigai to the south being actively pursued by the National Water Development Agency.

The Polavaram project, the other major project has thrown up many technical problems in view of the permeable foundations, to be examined and carefully studied with the aid of model studies, structural analysis etc. and the efforts are on to find suitable and safe solutions for the same. Alternatives are also to be seriously considered. Besides, submergence problems in Orissa and Madhya Pradesh due to the Project have also to be resolved through discussions with the concerned States.

The State has rightly initiated measures for rehabilitating its old irrigation schemes including Delta irrigation on a sustainable basis through involvement of farmers by several proposals for modernisation. This will help bridging the gap between the designed irrigation potential and the actual irrigation extent served. The Andhra Pradesh Economic Restructuring Project is under implementation since 1998-99 with World Bank Aid. A number of other measures are being taken to improve the performance of the existing irrigation systems qualitatively while the efforts to launch new irrigation projects are on.

The most important and impressive measure in this context can be said to be the creation of the Water Users Associations in all irrigation commands which has been laid on stable foundation with the passing of the Andhra Pradesh Farmers Management of Irrigation Systems Act (1997) discussed in detail in Chapter 8. This has led to a strong binding of the beneficiary with the operation, maintenance and management of the irrigation systems, leading to the widely desired Participatory Irrigation Management (PIM).

In order to spread the message and create awareness among the Water Users, farmers in particular, on the need for economising on water and conservation the Chief Minister has recently launched a popular movement in MEERU NEERU (Water and You) meaning thereby that Water is Everbody's Business and each one is expected to be conscious to harness, safeguard and judiciously utilise the water resources Nature has endowed on the State rather graciously.

ANNEXURE –1

CHRONOLOGICAL TABLE OF SUZERAINTY IN SOUTH INDIA.

300 BC THE SANGAM AGE

Chera Chola Pandyas were ruling in the Tamil country. Of course they were at war with each other frequently. Cholas were very prominent Mauryan empire held sway to the north of Vindhyas. Chandraguptha, Asoka were prominent. Sakas and Kushans followed. Kanishka of Kushan dynasty was prominent.

300 AD DARK PERIOD IN HISTORY. NO INFORMATION

Kalabhras, evil rulers overthrew a number of kings and got a stranglehold on the country. In the north however the Gupthas rose to power and brought in Hindu Renaissance. Chandragupta II and Vikramaditya are prominent.

600 AD CHALUKYAS OF BADAMI IN DECCAN

Pulikesi was a very powerful king who halted Harshavardhan from conquering from the north.

CHALUKYAS OF VENGI IN EASTERN DECCAN OR EASTERN CHALUKYAS, a division of Chalukyas

Pallavas and Pandyas rule the Tamil country almost eclipsing the Cholas

Narasimhavarma Pallava defeated the Chalukyas of Badami (642 AD)

750 AD RASHTRAKUTAS COME IN WITH THE DECLINE OF CHALUKYAS OF BADAMI

850 AD IMPERIAL CHOLAS RISE TO POWER IN THE TAMIL COUNTRY

Paranthaka, Rajaraja I and Rajendra were prominent

1050 AD CHALUKYAS OF KALAYANI revived the Chalukyan supremacy rise to power with the fall of Rashtrakulas

Vikramaditya I was a powerful king

Eastern Chalukyas of Vengi continue and have friendship with Cholas.

The ruler of Vengi himself took the Chola throne as Kulothunga Chola (1070 AD)

1150 AD — Hoysalas of Dwarasamudra, the Yadavas of Devagiri and Kakatiyas of Warangal occupied the Deccan north of Tamil country. Imperial Cholas continue in the Tamil country. The Rajputs were powerful to the north of Vindhyas in this period.

1250 AD — Pandyas become powerful and the Chola kingdom falls to them. Hoysalas were powerful in western Deccan and yadhavas and Kakatiyas were prominent to the north of the Tamil country

1300 AD — Khiljis and Tughlaks intrude, plunder and leave Colonies of Muslim soldiers to rule and convert people to Islam.

1350 AD — BAHAMANI Kingdom of Gulbarga, a Muslim State rise in the northern Deccan.

VIJAYANAGAR Kingdom a Hindu State paved way for resurgence of Hindu culture

1500 AD — Bahmani Kingdom splits into five sultanates, of which Bijapur and Golkonda were important and slowly they were all absorbed in the Moghal empire

Vijayanagar started declining after its great rise under Krishnadevaraya who kept the Muslim rulers from the north and the west under check

The European Trading Companies started infiltrating and intruding in the local politics.

ANNEXURE - II

WATER POTENTIAL IN ALL RIVER BASINS IN ANDHRA PRADESH

Sl. No.	Name of the River Basin	Catchment Area in		Yield in Mc.ft. (about 75% dependability)
		Sq.miles	Sq.km.	
1.	Bahuda	110.87	287.15	2293
2.	Mahendratanaya	170.16	440.71	4876
3.	Poondi Minor Drainages	141.00	365.19	1444
4.	Naupada Minor Drainages	316.96	820.93	4599
5.	Vamasdhara	746.54	1933.54	15575
6.	Nagavallai	1865.95	4832.81	48400
7.	Peddagedda	168.95	437.58	2533
8.	Kandivalsagedda	117.39	304.04	1917
9.	Champavathi	589.23	1526.11	8350
10	Gostani	601.60	1558.14	8616
11	Mathurawada	106.60	276.09	1148
12	Narvagedda	189.65	491.19	1610
13	Ankapalli Minor Drainages	163.80	424.24	1235
14	Sarada	1017.50	2635.33	12506
15	Varaha	477.27	1236.13	7218
16	Thandava	567.25	1469.18	10717
17	Pa.npa	227.30	588.71	3415
18	Suddagedda	254.17	658.30	3642
19	Yeluru	1298.90	3364.15	20379
20	Godavari (Within Andhra Pradesh)	28263.00	73201.17	1495000
21	Errakalva	1497.92	3879.61	32415
22	Thammileru	577.40	1495.47	9664
23	Ramileru	131.53	340.66	2080
24	Budameru	737.69	1910.62	10800
25	Krishna (within Andhra Pradesh)	28719.00	74382.21	811000
26	Romperu	662.97	1717.09	6603
27	Gundlakamma	3164.35	8195.67	20479
28	Minor Drainages between Musi & Gundlakamma	268.64	695.78	2125
29	Musi	845.14	2188.91	5133
30	Paleru	916.15	2372.83	5817
31	Kandaleru	413.36	1070.60	4425
32	Manneru	1373.60	3557.62	11450
33	Pennar (within Andhra Pradesh)	18576.00	48111.84	97649
34	Upputeru	1301.61	3371.17	16580
35	Swarnamuki	1208.00	3128.72	17331
36	Kalangi	572.45	1482.65	8689
37	Arniar	433.95	1123.93	6319
38	Kortaliar	341.20	883.71	5233
39	Palar	1867.00	4835.53	16596
40	Ponniar	35.00	90.65	179
		101037.05	**261685.96**	**2746040 or 2746 TMC**

Source: Decades of Andhra Pradesh (Engineers (Contribution) by the Institution of Engineers (India) Vol.I, 1991

ANNEXURE-III

SALIENT FEATURES OF THE NAGARJUNASAGAR PROJECT

Location	: Nalgonda District, Andhra Pradesh
Latitude	: 16^0-34'-24" N
Longitude	: 79^0-18'-47" E
Hydrology	
Catchment Area at dam site	: 2,15,185 sq. km
Maximum Annual rainfall in the catchment	: 889 mm
Maximum observed flood	: 30,050 cumecs
Minimum dry weather flow	: 2.80 cumecs
1000 years design flood	: 58,340 cumecs
Routed flood	: 45,310 cumecs
Reservoir	
FRL	: 179.83 m
Maximum water level	: 181.05 m.
Dead storage level	: 149.05 m.
M.D.D.Ls.	
(i) As per Nandikonda Project Report	: 155.45 m.
(ii) As agreed by Govt. for COPPs report	: 156.38 m.
(iii) For starting Khariff from 1st June	: 160.02 m.
Water spread area	: 285 sq.km.
Live storage above 155.45 m.	: 5,519 M.cum. (195 TMC)
Masonry Dam	
Length of Spillway	: 470.92 m
Length of Non-over Flow Dam	: 978.71 m.
Total length of Masonry Dam	: 1,449.63 m.
Maximum height of dam above deepest foundation	: 124.66 m.
Top width of dam	: 8.54 m.
Maximum base width of dam	: 97.54 m
Top width of roadway	: 9.37 m.
Deepest foundation level El.	: 59.741 m.
Average riverbed level El.	: 74.68 m.
Spillway crest level El.	: 166.42 m
Top of crest gates El.	: 179.83 m
Top of dam El.	: 184.40 m.
Invert level of flip bucket El	: 73.15 m.
No. and size of crest gates	: 26 Nos. of size 13.72 m. x 13.41 m.
Capacity of chute sluices	: 2 vents of size 3.05 m x 7.62 m. with sill at 137.16 m. discharging 481.1 cumecs.
Capacity of diversion tunnel	: 2 vents of size 3.05 m x 7.62 m. with sill at 137.16 m. discharging 481.1 cumecs
Right Canal Head Sluice	: 9 vents of size 3.05 m. x 7.62 m. with sill at 149.05 m.
Left Canal Head Sluice	: 3 vents of size 3.05 m. x 7.62 m. with sill at 149.05 m.

Earth Dam

Length of Left Earth Dam	: 2,560.32 m.
Length of Right Earth Dam	: 853.44 m.
Total Length	: 3,413.76 m.
Maximum height	: 25.91 m.
Top width	: 9.30 m.
Top level	: 185.93 m.

Power Generation

Penstocks (8 numbers)	: 4.88 m. dia
Center line elevation	: 123.40 m.
Power units	: 1 No. conventional (110 MW and 7 Nos. x 100 MW reversible)
MDDL	: 154.23 m. (for conventional) 150.88 m.(for reversible)
Discharge capacity	: 133.09 cumecs (for conventional) 121.76 (for reversible)

Right Canal Power House

Sluices	: 3 Nos. of size of 4.57 m x 11.58 m.
Sill level El.	: 146.00 m.
Units	: 3 Nos. conventional
Capacity	: 90 MW (30 MW each)
Discharging capacity	: 311.50 cumecs

Left Canal Power House

Units	: 2 Nos.
Capacity	: 60 MW (30 MW each)

Jawahar Canal (Right) and Lal Bahadur Canal (Left)

	Right Canal	Left Canal
Length of Main Canal	202 km	178 km.
Max. bed width	73.5 m.	29 m.
Max. Depth (Head reach)	3.78 m.	6.71 m.
Max discharge	419 cumecs	388 cumecs
Head Regulator		
(a) Sill level	149.05 m.	149.05 m.
(b) No. of vents	9 Nos.	3 Nos.
(c) size of vents	3.05 m. x 4.58 m.	3.05 m. x 7.62 m.
Length of branches and distributories	5,312 km.	7,680 km.
Length of field channels	14,400 km.	9,600 km
Net Irrigable Area	4.75 lakhs ha.	4.20 lakhs ha.

Details of Irrigation Potential

Ayacut contemplated		
NSRC	Guntur district	2,84,365 ha
	Prakasam district	1,91,100 ha
	Total	4,75,465 ha
NSLC	Nalgonda district	1,50,957 ha
	Khammam district	92,679 ha
	Krishna district	1,52,980 ha
	Additional area to be identified in Telengana area	23,200 ha
	Total	**4,19,816 ha**

ANNEXURE-IV

SALIENT FEATURES OF THE SRISAILAM HYDRO ELECTRIC PROJECT

Location	: Kurnool District, Andhra Pradesh
Purposes	: Hydro Power
River	: Krishna
Area of Catchment	: 206.242 km^2
Mean annual runoff in the catchment	: 52,160,000,000m^3
Design flood discharge	: 38.347 m^3/s
Year of commencement of construction work	: 1965
Year of completion	: Under Construction (1981)

Dam

Type	: Straight gravity dam in stone masonry and concrete
Bed rock	: Quartzite intercolated with shales
Maximum height above the lowest point of foundation	: 143 m
Length at the top of the dam	:
(i) Non overflow	: 246 m
(ii) Spillway	: 266 m
Total volume content	: 1,953,000 m^3
Spillway	
Type	: Ogee Spillway
Type and number of gates	: 12 Nos. radial gates of size (18.20m x 16.76 m)
Maximum discharge capacity	: 37,400 m^3/s
Reservoir	
Area at F.R.L.	: 617 km^2
Gross storage capacity	: 8,722,000,000 m^3
Effective storage capacity	: 7,080,000,000 m^3
Available drawdown	: 17 m

Power Plant

Type	: Francis Vertical Turbine
Hydraulic Head	: 91.4 m
Maximum discharge	: 991 $m^3/2$
Installed capacity	: 440 MW in 1 phase and another 330 MW in II phase
Generating Units	
Type	: Suspension type
Number	: 7 Nos.
Capacity	
Firm	: 180 MW
Secondary	: 590 MW

ANNEXURE – V

SALIENT FEATURES OF PRAKASAM (KRISHNA) BARRAGE

Location	: Vijayawada Town, Andhra Pradesh
Purpose	: Irrigation
River/Tributory	: Krishna
Area of Catchment	: 251.358 km^2
Mean Annual Rainfall in the Catchment	: 89 cm
Total Annual Yield of Catchment	: 48,810 Mm^3 (75% dependable yield)
Design Flood Discharge	: 33,984 m^3/s
Year of Commencement of Construction Works	: 1954
Year of Completion	: 1957

Hydraulic Particulars

Length of Barrage/Anicut	: 1,138.73 m
No. of Undersluice Bays	: 14
No. of Barrage/Weir Bays	: 70
Width of undersluice Bays	: 5.18 m.
Width of Barrage/Weir Bays	: 12.19 m
Thickness of intermediate Piers	: 2.44 m
Gates:	
(a) Number	: 70
(b) Size	: 12.19 m x 3.66 m
Pond Level	: 17.38 m
Means for Dissipating Energy	: Cistern

ANNEXURE – VI

THE TUNGABHADRA BOARD
CONSTITUTION OF THE BOARD (1955)
NOTIFICIATION No.DW.VI 4(9) DATED 19.3.1955.

1. In pursuance of Sub-Section (4) of Section 66 of the Andhra State Act (30 of 1953) and in super-session of the Notification of the Government of India in the Ministry of Irrigation and Power dated 29.9.1953, the President hereby gives the following directions in regard to the Tungabhadra Board namely;-

   There shall be established with effect from the 15th March 1955, a Board by the name of the Tungabhadra Board consisting of:-

CHAIRMAN: Nominated by the Government of India.
xx xx xx xx xx
MEMBERS: (Representative of Government of Andhra Pradesh)
1. xx xx xx xx xx
(Representative of Government of Karnataka)
2. xx xx xx xx xx
Representative of Government of India)
xx xx xx xx xx

2. The Chairman, if present, shall preside over a meeting of the Board, but if the Chairman is absent from any meeting of the Board, the Members shall choose one of their Members to preside.

3. (i) All matters relating to the project works of common interest to the State of Andhra Pradesh and Karnataka, brought before any Meeting of the Board shall be decided by a majority of the Members of the Board present and voting at the Meeting before which such matters are brought and the decision of the Board shall be final.

   Provided that where with reference to any matter brought before the Board, the Chairman is satisfied that there is a difference of opinion among the Members of any question of policy or the rights of the States concerned involved in the consideration of such matter, the Chairman shall refer the matter to the Central Government whose decision thereon shall be final.

Explantions:

I. If any member raises at any meeting of the Board any point as to whether a question is question of policy or whether any rights of the States concerned are involved in the consideration of a matter before the Board a decision on the points so raised shall be given by the Chairman.

II. Where any Member dissents from any decision so given by the Chairman it shall be lawful for the State Government whose representative that Member is to represent to the Government of India through the Chairman the matter on which a decision has been given by the Chairman and where this is so done, the Chairman shall refer the matter to the Central Government whose decision thereon shall be final.

(ii) Subject to the provisions of sub-paragraph (i) the Board may make rules for the conduct of its own business.

(iii) No act or proceedings of the Board shall be invalid merely on the ground of the existence of any vacancy…….

4. (i) The Board shall take charge of, and deal with, all matters relating to works on or connected with the Tungabhadra Project which are common to both the States of Andhra Pradesh and Karnataka but nothing in this sub-paragraph shall be deemed to authorize the Board to deal with any matter in respect of works which relate to only one of the State or in which only one State is interstate.

   (ii) In particular and without prejudice to the generality of the foregoing powers, the functions of the Board shall include:-

   (a) the completion of the construction of the sanctioned Tungabhadra Project;

   (b) the regulation of supplies of water and power in accordance with such rules as may be made in this behalf by the Board;

   (c) the maintenance of the main canal and of other works common to both the states of Andhra Pradesh and Karnataka

   (d) the maintenance of the dam and reservoir of the project;

   (e) the granting of leases of fisheries in the reservoir and in the main canal;

   (f) the proper utilisation of land acquired for the purposes of the project; and

   (g) any other function incidental to, or connected with the functions specified in clauses (a) to (f).

5. i. For the efficient performance of its functions, the Board may appoint a whole time Secretary and such other officers and servants as it considers necessary.

   ii. During any absence on leave of the Secretary, the Board shall appoint a person to act as Secretary and every person so appointed shall exercise the powers conferred and perform the duties imposed on the Secretary by or under this Notification.

   iii. All orders and decisions of the Board shall be authenticated by the signature of the Secretary of the Board.

6. i. The Government of Andhra Pradesh and Karnataka shall provide at all times the necessary funds for the construction and maintenance of the Tungabhadra Project;

   Provided that the liability for the expenditure on the Tungabhadra Project shall be apportioned between the States of Andhra Pradesh and Karnataka in such proportion as may be agreed upon between the two state Governments and in the absence of any such agreement, in such proportion as may be fixed in this behalf by the Central Government.

   The Governments of Andhra Pradesh and Karnataka shall continue to give the same facilities to the Audit Officer of the project and other officers engaged in connection with the project for the payment of moneys into and withdrawal of money from the Treasuries and sub-Treasuries located in their respective territories as were enjoyed by such officers immediately before the commencement of the Notification.

7. The Board shall in relation to the technical sanction, administrative approval, and other sanctions required for the construction and maintenance of Tungabhadra Project, and in relation to any other administrative matters concerning the project exercise the powers of a State Government under the various Codes, Manuals, Rules and Regulations specified in the Schedule annexed here to, as in force in the State of Madras immediately before the 1st day of October, 1953, and may adopt such of the amendments made thereto, or executive instructions, orders and directions issued there under, by the Government of Andhra Pradesh from time to time, which the Board considers necessary.

Provided also that in relation to administrative matters concerning the Government servants of the State of Andhra Pradesh employed by the Board in connection with the project , the various Codes, Manuals, Rules and Regulations as in force in the Madras State immediately before the 1st October, 1953, and any amendments made thereto or any executive instructions, orders and directions issued thereunder by the Government of Andhra Pradesh from time to time after the said date shall apply;

Provided that in relation to administrative matters concerning the Government servants of States other than Andhra Pradesh employed by the Board in connection with the project, the corresponding Codes, Manuals, Rules and Regulations as in force in the State concerned and any amendments made thereto or any executive instructions, orders and directions issued there under by the Government of the said State from time to time shall apply. (Para 7 as substituted by Notification No.34 (4)/56-#. W.VI dt.11.7.56).

8. All contracts to be made in connection with the Tungabhadra project shall be expressed to be made jointly by and in the names of the Governments of Andhra Pradesh and Karnataka and all such contracts shall be executed on behalf of the said Governments by the Secretary of the Board or such other officer as may be authorized by the Board in this behalf but neither the Secretary, nor the authorized officer shall be personally liable in respect of anything under such contracts.

9. (i) The staff which immediately before the commencement of this notification was engaged in the construction and maintenance of the Tungabhadra project shall, after such commencement continue to be employed by the Board in connection with the said project but the Government of Andhra Pradesh and Karnataka may, if they so think fit, replace any members of the existing staff by other persons in such manner and in such proportion as may be agreed upon between the said State Governments and in the absence of any such agreement as may be determined in this behalf by the Board.

   Provided that all correspondence between the State Governments with respect to such agreements shall be carried on through the Chairman.

   (ii) The staff for the time being employed in connection with the project shall be deemed to be employed under the administrative control of the Board.

10. Plant, machinery, equipment and stores purchased for and in connection with the Tungabhadra project shall be under the control of the Board and shall be used on the entire project under the directions of the Board.

11. The Government of Andhra Pradesh and Karnataka may depute such persons as they may nominate or designate generally or specially to inspect the works on or connected with the Tungabhadra Project which are common to both the States of Andhra Pradesh and Karnataka.

Schedule

(Please see Para 7)

a. Madras Public Works Account Code with Appendices.
b. Madras Public Works Department Code.
c. Madras Detailed Standard specifications.
d. Madras Account Code
e. Madras Electricity Manual
f. Madras Financial Code
g. Madras Treasury Code.
h. Madras Budget Manual
i. Fundamental Rules and Subsidiary Rules of the Madras Government.
j. Madras Manual of Special Pay and Allowances

k. Madras Pension Code.
l. General Provident Fund (Madras) Rules
m. Contributory Provident Fund (Madras) Rules.
n. Madras Contributory Provident Fund Pension Insurance Rules 1950.
o. Madras Security Rules 1937.
p. Madras Services Manual.
q. Madras Commercial Taxes Manual Volume I to III.
r. Madras Printing Manual
s. Madras Stationery Manual

ANNEXURE – VII

SALIENT FEATURES OF THE TUNGABHADRA PROJECT

Location:	Longitude 76°-20'-10" Latitude 15°-15'-49" About 5 km from Hospet
Nearby village	Mallapur
Taluk	Hospet
District	Bellary & Raichur
Catchment area	28,179 sq.km
Yield	11,977 M.cum (423 TMC) at 75% dependability
Dam	
Type	Central Masonry with composite Section in one saddle and earth dam in another saddle
Total Length in meters	2449 m
Average Height above River Bed Level in metres	35.36 m
Max. Water Level in metres	
Sill Level in metres	
a) R.B.L.L.C.	+ 472.44 m
b) R.B.H.L.C.	+ 483.11 m
Spillway	
Location	Central
Length in metres	701 m
Discharging capacity in (cumecs / cusecs)	18,408 cum./sec (6,50,000 Cusec)
Storage capacity in M.cum (TMC)	
Gross Storage (Planning Stage)	3766 M.cum .(133 TMC ft)
Live Storage (Planning Stage)	3701 M.cum (130.7 TMC ft)
Dead Storage	65 M.cum (2.30 TMC ft)
Present Storage (As per 1993 surveys)	3153 M.cum (111,507 TMC ft)
Submersion	
Area in ha (acres)	34,923 (86,823)
Villages affected	90
Population affected	54,432
Canals	
Length in km	
a. Left Bank Canal	227
b. Left Bank High Level Canal	15
c. Right Bank Low Level Canal	251 km. Board limit (Another 73 km. beyond under the control of Irrigation Dept. of Andhra Pradesh)
d. Right Bank High Level Canal	105
Capacity in Cumecs (Cusecs)	
a. Left Bank Canal	198.10 (7,000)
b. Left Bank High Level Canal	0.95 (33.50)
c. Right Bank Power Canal	71 (2,500)
d. Right Bank High Level Canal	116 (4,100)
Irrigable area in ha	
a. Left Bank Canal	2,43,900
b. Left Bank High Level Canal	468
c. Right Bank Low Level Canal	37,503 in Karnataka & 63522 in Andhra Pradesh
d. Right Bank High Level Canal	80,908 in Karnataka & 76,937 in Andhra Pradesh

ANNEXURE – VIII

SALIENT FEATURES OF THE GODAVARI BARRAGE PROJECT

Location	:Dowlaiswaram, Andhra Pradesh
Purpose	: Irrigation with facility for Navigation in Canals
River/Tributary	: Godavari
Area of Catchment	: 3,13,649 km^2
Mean Annual Rainfall in the Catchment	: 114.3 cm
Total Annual Yield of Catchment	:1,54,400 Mm^3
Design Flood Discharge	: 91.475 m^3/s

Hydraulic Particulars

Width of the River	: 5.86 km
Length of Barrage/Anicut	: 3.599 m
No. of Undersluice Bays	: 3
No. of Barrage/Weir Bays	: 175
Width of undersluice Bays	: (i) 12.19 m. for 8 vents (ii) 15.24 m for 2 vents
Width of Barrage/Weir Bays	: 18.29 m
Thickness of intermediate Piers	: 2.13 m single pier 4.26 m double pier
Gates:	
(a) Number	: 175
(b) Size	: 18.29 m x 3.35 m lift gates
Pond Level	: 13.64 m
Sediment Excluding Devices	: Scour sluices
Means for Dissipating Energy	: 6 rows of C.C. blocks

Canal Head Regulator

	Eastern Delta H.R.	Central Delta H.R.	Western Delta H.R.
Width of Head Regulator	55.15 m.	42.83 m	69.47 m
No. of Bays and their width	4	3 (Each 12.19 m width)	5
Thickness of Piers	2.13 m	2.13 m	2.13 m
Orientation with respect of Barrage Axis	Left side of Dowlaiswaram Branch	Right side of Ralli Branch	Right side of Wizzeswaram Branch
Means for Dissipating Energy below Head Regulator	Water cushion and staggered blocks		
Maximum Discharge of Canal	170 m^3/s	181 m^3/s	281 m^3/s

ANNEXURE - IX

SALIENT FEATURES OF THE SRI RAMA SAGAR PROJECT – POCHAMPAD PROJECT

Location	
District	Nizamabad
River, River Basin	Godavari River, Godavari Basin
Nearest village	Pochampad
Latitude	E 78° - 20' – 0"
Longitude	N 18° - 58' – 0"
Topo sheet number	56 I/4
Hydrology	
Catchment area	91751 sq.km.
Rainfall	
i. Average annual rain fall in catchment	980 mm
ii. Mean monsoon rain fall in catchment	94.14 mm
Available run off at the dam	
75% dependable run off	5553 Mcum or 196.10 TMC
Design flood	
i. Peak flood	45307 cumecs (16 lakh cusecs)
ii. Moderated flood	25740 cumes (9.09 lakh cusecs)
Reservoir Data	
Top of dam level	+337.718 m (+1108 ft.)
Maximum water level	+333.146 m (+1093 ft.)
Full Reservoir level	+332.537 m (+1091 ft.)
i. Lowest sill level	993 ft.
ii. Minimum draw down level	+324.307/1064.00 ft.
iii. River bed level (deepest)	982.65 ft.
Gross storage capacity	112 TMC at FRL
Live storage capacity	82 TMC
Dead storage capacity	30.829 TMC
Water speed area at MWL	453.00 sq.km.
Details of Submergence	
Forest area at FRL	NIL
Number of village affected	91 villages
Particulars of Dam	
Type of dam	Masonry dam
Maximum height of dam	42.672 m
Length of dam	0.958 km Masonry, 14.50 km Earthen dam
Spill way	Ogee Spillway
Number of gates	42 Nos. size 15.24 m x 10.66 m
Details of Irrigation	
Gross command area	7.897 lakhs ha
Culturable command area	5.467 lakhs ha
a. Cultivated area in command	3.904 lakhs ha
b. Present culturable area	3.904 lakhs ha

Annual irrigation

a. Kharif	151402 ha
b. Rabi	205293 ha
c. Two seasonal	57388 ha
Total	4.140 lakhs ha.
1. Canal system	
a) Kakatiya Canal (Lined) (Extension under Stage-II)	Stage-I 284 km Stage-II 347 km
b) Saraswathi Canal (lined)	47.00 km
c) Laxmi Canal (lined)	3.50 km
Full supply head discharge	
a. Kakatiya canal	4.72 m^3
b. Saraswathi canal	2.75 m^3
c. Laxmi canal	1.70 m^3
Number of Districts to be served by canal system	Nizamabad, Karimnagar, Warangal, Khammam, Nalgonda, Adilabad

Estimate cost as per SSR 1993-94

Estimated Cost:	
Unit I Head works	
SRSP Dam	Rs. 238 crores
LAM Dam	
Unit II Kakatiya Canal	
Saraswathi Canal	Rs.2005 crores
Laxmi Canal	Rs.2243 crores
Apportioned cost chargeable to	
a. Irrigation	Rs.2243 crores
b. Industrial and domestic water supplies	NIL
Cost of irrigation area	Rs. 56451 per ha
Cost of annual irrigation	Rs. 56451 per ha

Benefits

Cropping pattern under SRS project stage-I (1993-94)

Khariff			
1.	Sorgham	34209 acres	81487 ha
2.	Maize	201273 acres	81487 ha
3.	Groundnut	335402 acres	135790 ha
4.	Pulses	134209 acres	54336 ha
Rabi			
1.	Sorgham	45311 acres	18345 ha
2.	Maize	151004 acres	61135 ha
3.	Groundnut	249238 acres	100906 ha
4.	Pulses	45311 acres	18345 ha
TWO SEASONAL			
1.	Chillies	78539 acres	31797 ha
2.	Cotton	98189 acres	39752 ha
	TOTAL	**1472730 acres**	**596229 ha**

Annual Additional Yield

Sorgham	127140 Tonnes
Maize	477593 Tonnes
Groundnut	404290 Tonnes
Pulses	108977 Tonnes
Chillies	63566 Tonnes
Cotton	99343 Tonnes
Water supply to Industries	7 TMC to NTPC
Fish production	The reservoir can be utilised to develop fish production

Financial Aspects

a. Percentage return at the end of 10th year	0.04
b. Benefit cost ratio at 10% interest	2.467

ANNEXURE-X

SALIENT FEATURES OF THE-SINGUR PROJECT

Lecation of the Storage Navarvoir Near Singur Village, Andole Taluk, Medak Distt., A.P.		Latitude – 17°-45' Longitude – 77o-56'
Hydrology		
(a)	Catchment area upto dam site	16,097 sq.kms (6215 sq. miles)
(b)	(i) Village annual rainfall ieaghted upto Raipelli	66 cm (26 inches)
	(ii) 75% Dependable monsoon rainfall (upto Raipalli)	73 cm (28.7 inches)
	(iii) Av. monsoon rainfall (upto Raipalli)	80 cm (31.4 inches)
(c)	Design flood Discharge	23,785 cumecs (8,40,000 cusecs)
(d)	Annual 75% dependable net yield at Singur dam site	842 Mcum (29.7 TMC)
Reservoir		
(i)	F.R.L. and M.W.L.	+ 523. 60M (+1717.41 ft)
(ii)	D.S.L.	518.25M (1700.4 ft.)
(iii)	Gross Storage capacity at FRL	851 Maum (30 TMC)
(iv)	Dead Stroage capacity	284 Mcum (10 TMC)
(v)	Live storage capacity	567 Mcum (20 TMC)
(vi)	T.B.L.	+ 527.30 Mts (+1729.71ft)
(vii)	Area of Submergence at FRL/MWL 523.60 Mts.) (Gross)	a) A.P. 15,390 ha b) Karnataka, 1,150 ha.
Spillway		
(i)	Maximum Flood Discharge	23,785 cumecs (8,40,000 cusecs)
(ii)	Lowest Bed level	+ 500.00 Mts (1640.00)
(iii)	Crest level	+ 510.60 Mts. (1675.28)
(iv)	Head of discharge	13.00 Mts (42.65 ft.)
(v)	Top of Crest gates	+ 523.60 Mts (1717.41 ft.)
(vi)	No. of redial gates size (15m×13m)	17 Nos.
(vii)	Length of Spillway	341.10 Mts (1119 ft)
(viii)	Thickness of Piers	4.50 M (14.764 ft.)
Earthen Dam.		
Type of Dam		Homogeneous & Zonal Earthen type.
	T.B.L.	+ 527.35 Mts (1729.71 ft.)
a)	Left Flank from Ch. (-) 76.00 to Ch. 126.94	4059 Mts. (13318 ft.)
b)	Right Flank from Ch. 144.00 to Ch. 231.00	1740 Mts. (5,709 ft.)
c)	Total length of the earthen dam	5799 Mts (19027 ft.)
d)	Total length of dam + Spillway	6140 Mts. (20,146 ft.)

Irrigation

i)	Benefits under existing Nizam Sagar ayacut (Stabilisation)	17,726 ha (43800 acret)
ii)	Benefits under existing Mehboobnahar Canal	3035 ha (97500 acres)
iii)	Benefits under existing Fatehnahar	2752 ha (6800 acres)
Estimated cost of the Project		Rs. 42.34 crores
i)	Cost allocated to irrigation	Rs. 27.14 crores
ii)	Cost allocated to Water supply	Rs. 15.20 crores
iii)	Unit cost of Storage (live)	Rs. 7.4 lakhs/Mcum.
	B.C. Ratio	
i)	B.C. Ratio considering Nizam Sagar ayacut only	2.63
ii)	B.C. ratio considering Nizam Sagar ayacut and Mehboobnahar and Fateh-nahar ayacut also	2.43

ANNEXURE-XI

SALIENT FEATURES OF THE PRIYADARSHINI JURALA PROJECT

Masonry Dam

Location	: Mehboobnagar Distt. Of Andhra Pradesh
Latitude	: 77^0 – 42' – 15" E
Longitude	: 16^0 – 20' – 15" N
River	: Krishna
Catchment area	: 1,29,499 sq.km.
Max. flood discharge for 1000 years frequency	: 35,390 cumecs
Gross Storage at FRL/MWL	: 338.10 Mcum
FRL/MWL	: +318.52 m.
Crest Level	: +310 m.
Top of Road Level	: +325 m.
Hoist Platform Level	: +328 m.
MDDL	: +314.86 m.
Live Storage above MDDL	: 192.27 Mcum.
Average Bank of Krishna River	: 301.36 m.
Water Spread at FRL/MWL	: 67.68 M. Sqm.
Length of barrage between abutments (including spillway and non-overflow)	: 1,322 m.
No.& size of Spillway Gates	: 62 vents of 12 x 8.52 m.
Length of Spillway incl. Piers	: 927 m.

Earth Dam

Length of Left Flank	: 1,740 m.
Right Flank	: 1,470 m.
TBL of Earth Dam	: 321.50 m.
Free Board	: 2.93 m.
Top width of Earth Dam	: 8 m.

Head Regulators

	Left Flank	Right Flank
No. of vents	: 8 Nos.	4 Nos.
Size	: 2.50 x 2 m.	1.50 x 2 m.
Sill level	: 312.42 m.	312.42 m.
Discharge	: 41.35 cumec	20.84 cumec

Main Canals

Length	: 85.277 km.	50.03 km.
Designed Discharge	: 41.35 cumec.	20.80 cumec.
Section adopted	: 21 x 1.95 m.	9.74 x 1.90 m.
Bed Slope	: 1 in 9,000	1 in 9,000
Value of 'n'	: 0.025	0.018
GCA	: (Unlined) 42,504 ha	(Lined) 20,841 ha
CCA	: " 26,103 ha	" 15,257 ha
Irrigation Intensity	: 100%	
Annual Irrigation (Ultimate)	: 41,360 ha	

ANNEXURE – XII

SALIENT FEATURES OF VAMSADHARA PROJECT, STAGE – I

Hydrology	
Catchment area at the site of the Barrage	9,731 Sq. Kms.
Mean Annual Rain Fall 1,194 M.M.	
Average Monsoon Rain Fall	1,067 M.M.
Maximum flood discharge	
for 200 years recurrence period	290,000 cusecs
Maximum Fllowd discharge for 500	
for 500 Years recurrence period	3,26,000 C/S
Design flood (with 20% concentration)	2,90,000 cusecs
75% dependable yield at 50% share	57.5 T.M.C.
Barrage	
Location Longitude	83° – 58' – 8"
Latitude	18° -12' 0"
Pond Level	(+) 38.10 M (+) 125.00
U/s IFI.L. for	
2,90,000 C/S flood	(+) 38.07 M (+) 124.90
(a) D/s M.F.L. for	(+) 38.03 M
2,90,000 C/S flood	
(b) D/S M.F.L. for	
4,05,000 C/s Flood	(+) 38.10 M
Length of Barrage	
(Between abutments)	475.78 M
Number and size of Spill way vents	22 Nos. 18.29 M x 4.57 M
Sill level of Spillway	(+) 33.53 M
Number and size of seeuring sluice vents.	2 Nos. of 12.19 M
Sill level of scouring sluice	(+) 33.22 M
Top Levol of the Gates	(+) 38.25 M
Top of Road Level	(+) 41.45 M
Vidth of Road between Kerbs	6.71 M
Hoist Platform Level	(+) 47.39 M
Width of Hoist platform	3.658 M
Length of U/s Flood benks right side	6.436 Km.
Left side	3.862 Km.
Left Main Canal	
Sill of the Head Sluice	(+) 34.44 M
No & size of Vents	9 Nos.
	2.44 M x 2.44 M.
Starting F.S.L. of Canal	(+) 37.795 M
Starting Sed Level of Canal.	(+) 34.88 M
Section of Canal in Head Reach	29.26 M x 2.9 M
Length of Canal	107.80 Km.
Ayacut	59,987.87 ha.
Discharge at Head	2480 Cusecs

SALIENT PEATURES VAMSADHARA PROJECT, STAGE II

NERADI BARRAGE :

Location :

Latitude	18° – 58' – 0" N
Longitude	83° – 19' – 0" E
District	Srikakulam (Andhra Pradesh).

Hydrology :

Catchment area at Neradi Barrage site	7899.50 Sq. kms.
Mean annual Rainfall	1194 mm.
Average monsoon rainfall	1067 mm.
maximum flood discharge for 200 years recurrence flood	2,60,000 c/s.
Maximum flood discharge for 500 years recurrence period	2,93,800 c/s
75% dependable yield at Gotta.	115 TMC (as agreed by Orissa & A.P.)

Barrage :

Pond level	+ 71.628 M.
U/S MFL for 2,60,000 c/s	+ 72.847 M.
D/s MFL for 2,60,000 c/s as per rating curve	+ 72.512 M.
Length of barrage between the abutments.	600.46 M.
No. and size of spill way ents.	26 nos. of 18.29 M x 3.52 M.
Sill level of the spill way	68.12 M.
No. and size of scouring sluices.	
a) Right side	3 Nos. of 12.192 M x 4.572 M.
b) Left side	12.912 m x 4.57 M.
Sill level of scouring sluices on left and right.	+ 67.056 M.
No. and size of head sluice vents	
Left	+ 67.96 M.
Right	+ 67.96 M.
Sill level of head sluice	
Left	+ 67.96 M.
Right	+ 67.96 M
Discharge capacity Left	375 cusecs.
Right	8000 cusecs.
Top level of the gates.	+ 72.238 M.
Road level	+ 75.554 M
Width of road kerbs	6.706 M.
Hoist platform level	+ 82.448 M.
Width of hoist platform	3.658 M.
Length of U/s flood bank – Left	8.70 KM
– Right	9.98 KM.

FLOOD FLOW CANAL (Lined) :

Sill level of head regulator	+ 67.96 M.
No. and size of vents.	13 nos. 4.57 x 3.66 M.
Starting FSL of canal	+ 71.475 M.
Starting bed level of the canal	+ 67.96 M.

Bed width of the canal	36.58 M
F.S. Depth of canal	4.27 M.
Slope of the canal	1 in 10,000.
Length of canal.	31.80 KM.
Designed discharge	8000 c/s.
Ayacut under flood flow canal	8093.72 Hect.

HIRAMANDALAM RESERVOIR :

Location :

Longitude	83° – 57' – 00" E
Latitude	18° – 40' – 00" N
District	Srikalulam (Andhra Pradesh)
Self catchment area	79.00 sq. km.
Discharge from self catchment	15,600 cusecs.
Storage capacity	
a) Gross storage at FRL	19.05 TMC
b) Live storage at FRL	16.43 TMC
c) Dead storage at MDDL	2.62 TMC
F.R.L.	+ 67.056 M.
T.B.L.	+ 70.104 M.
Minimum draw down level	+ 45.11 M.
Area of foreshore submersion	3080 Hect.
No. of villages affected	21 Nos.
Length of earth dam	7.08 Km.
Discharge for which spillway is designed (surplus)	23,600 cusecs.
No. and size of spillway gates (surplus)	62.556 M.
Crest level of spillway (surplus)	62.556 M.
No. and size of vents of head sluice for right main canal	4 nos. of 2.75 x 2.75 M.
Sill level of head sluice	+ 42 M.
No. and size of vents of link canal head sluice	5 nos. of 3.4 x 2.7 M.
Sill level of link canal head sluice.	+ 42 M.

LINK CANAL TO GOTTA GARRAGE :

Bed level of canal at start	+ 41.76 M.
Length of canal	2.9 Km.
Bed width	18.90 m.
F.S. Depth	3.048 M.
Discharge provided for	2498 cusecs.

RIGHT MAIN CANAL :

FSL of the canal at Head reach	+ 44.81 M.
bed level of canal at head reach	+ 41.91 M.
Starting section of the canal	18.59 x 2.9 M
Starting section of the canal	18.59 x 2.9 M.
Designed discharge	1587 cusecs.
Sill level of the head sluice.	+ 42 M.

ANNEXURE –XI7II

SALIENT FEATURES OF YELERU RESERVOIR PROJECT

Location of Dam	
District	East Godavari district
River, River basin	Yeleru river / Yeleru basin
Name of the nearest village	Yeleswaram
Latitude	17°-18'-00" N
Longitude	82°-05'-30" E
Survey of India sheet numbers	65 G/NE, 65 G/NW 65 G/SE, 65 G/SW
Hydrology	
Catchment area	2232 sq.km
Rainfall	
i. Average annual rainfall in catchment	1183 mm
ii. Mean monsoon rainfall in catchment	1023 mm
iii. 75% dependable rainfall	879 mm
iv. 75% dependable monsoon rainfall	984 mm
Available run-off at dam	652.1 M.cum (23.03) TMC
i. Average annual run-off	487.8 M.cum (17.22 TMC)
ii. 75% dependable run-off	
Design flood	
i. Peak flood	8070 cumec
ii. Moderated flood	Essentially same as peak flood since it is a low dam.
Reservoir Data	
Top of dam level	+90.00 m
Maximum water level	+86.56 m
Full Reservoir level	+86.56 m
i. Lowest sill level	+68.88 m
ii. Minimum draw-down level	+72.54 m
iii. Deepest river bed level	+61.72 m
Gross storage capacity	682.7 Mcum (24.11 TMC)
Live storage capacity (between minimum draw-down level and full reservoir level)	508.3 Mcum (17.95 TMC)
Dead storage capacity (at + 72.54 m)	174.4 Mcum (6.16 TMC)
Water spread area at maximum water level	59.36 sq.km
Water spread area at full reservoir level	59.36 sq.km
Details of Submergence	
a) Culturable area at full reservoir level	3476 ha
b) Un-culturable area	833 ha
Forest at full reservoir level	1525.20 ha
Road and residences area	19 ha
Number of villages affected	10 (either fully or partly)
Dam Particulars	
Type of dam	Earth dam
a) Maximum height of dam	+42.93 m
b) Crest level of spillway	+76.56 m
Length of dam (including spillway)	2534 m (2387 m + 147m)
Spillway	Ogee type
Number of gates	10

Irrigation

Gross command area	90394 ha
Culturable command area	74389 ha
a) Cultivated area in command	58280 ha
b) Present culturable area	22865 ha
Annual Irrigation	
a) Kharif 85%	49513 ha
b) Rabi 80%	46600 ha
Canal system	
i) Canals	
a) Right bank canal	24 km
b) Left bank canal	113.43 km
ii) Length of distributaries	Does not arise in phase I
Full supply head discharge	
i. Left bank canal	36 cumec
ii. Right bank canal	2.83 cumec

Estimated Cost

Estimated cost	
i. Unit I head works	Rs.10998.859 lakhs
ii. Unit II canals including lining	Rs.22534.404 lakhs
Total	Rs.33533.263 lakhs
(or say)	Rs.335.34 crores
Apportioned cost chargeable to	
a. Irrigation	Rs.29622.093 lakhs
b. Industrial and domestic water supplies (To Visakapatnam steel plant)	Rs. 3911.17 lakhs

ANNEXURE -XIV

THE SALIENT FEATURES OF THE COMPONENTS OF TELUGU GANGA PROJECT

Srisailam Reservoir		
Period of construction		1963 – 1982
Reservoir capacity	Mcum (TMC)	8725 (308.00)
F.R.L.	m	+ 260.75
M.D.D.L.	m	+ 260.30
Maximum height of Dam	M (ft.)	143.3 (470)
Sill level of the Pothireddipadu Regulator	M	+ 256.33
Regulator vents	Nos	4
	M	10.00 x 8.57
Length of Approach channel to the Regulator	km.	3.40
Designed carrying capacity of Approach channel	Cumecs (Cusecs)	512.7 (18,100)
Canal from Pothireddipaddu Regulator to Banakacharla Regulator		
Length	km	16.80
Designed carrying capacity	Cusecs	18,100
Maximum depth of cutting across Mittakondla ridge	m	30.00
Banakacharla Cross Regulator		
Right vents to feed the Srisailam Right Bank Canal		
No. and size of Vents	Sill Level	+ 254.30 m
	Nos.	3
	M	10.00 x 8.50
Discharge Capacity	Cumecs (Cusecs)	315.9 (11,150)
Central vent to be an escape into Kunderu valley		
No. and size of Vents	Sill Level	+ 254.30 m
	Nos.	3
	m	10.00 x 8.50
Discharge Capacity	Cumecs (Cusecs)	283.3 (10,000)
Left vent to feed the Telugu Ganga Canal		
No. and size of Vents	Sill Level	+ 254.30 m
	Nos.	3
	m	10.00 x 8.50
Discharge Capacity		
Flood	Cumecs (cusecs)	315.9 (11,150)
Normal		63.7 (2,250)
Link Canal from Banakacharla Regulator to Velugodu Reservoir		
Length	km	7.73
Designed carrying capacity	Cumecs (Cusecs)	315.9 (11,150)
Command area served		Nil
Velugodu Balancing Reservoir		
Capacity	Mcum (TMC)	480.1 (16.95)
F.R.L.	m	264.70
Head Regulator of Telugu Ganga Canal		
Sill	m	+248.50
No. and size of Vents	Nos.	4

	m	2.50 x 4.00
Command area served	Ha	50607
	(Acres)	(1,25,000)
		(Rabi)

Telugu Ganga Main Canal

Length upto take off point for Chennai water supply	km	107
Discharging capacity at the take off point	Cumecs	141.6
	(cusecs)	(5000)
Length beyond takes off point upto Sri. Pothuleri Veera Brahmendra Swamy Reservoir	Km	32.151

Sri Pothuleri Veera Brahmendra Swamy Reservoir (SPVBS)

Capacity	Mcum (TMC)	502.4 (17.735)
F.R.L.	m	+ 216.50
Head Regulator of Telugu Ganga Canal		
Right Sill	m	+ 186.00
Left Sill	m	+ 192.00
Length of the Canals taking off		
Right	km	44.35
Left	km	107.685
Designed carrying capacity		
Right	Cumecs	12.7
	(cusecs)	(450)
Left	Cumecs	65.9
	(cusecs)	(2325)
Command area to be served	Ha	60729
	(Acres)	(1,50,000)

Chennamukkapalli Canal (exclusively for Chennai water supply)

Length	km	42.50
Head Regulator		
Sill	m	248.50
Number and size of Vents	Nos.	
	m	
Designed carrying capacity at the head	Cumces	141.6
	(Cusecs)	(5000)

Somasila Reservoir

Period of construction	I stage		1973-88
	II stage		1989-96
Reservoir capacity	I stage	Mcum (TMC)	463.4 (16.36)
	II stage	Mcum (TMC)	2209 (78.00)
F.R.L.	I stage	m	85.48
	II stage	m	100.60
Maximum Height of Dam		M (ft.)	38.1 (125)
Length of Earth Dam		M (ft.)	323.2 (1060)
Length of spillway		M	+ 236.21
No. and size of spillway vents		Nos.	12
		M	15.24 x 14.17
Maximum flood discharging capacity of spillway		Cumecs (Cusecs)	19688
			(6,95,000)
North Feeder Canal – Length		Km	72.920
Head Regulator			
	Sill		79.25

No. and size of vents	Nos.	2
	m	2 x 2
Head discharge	Cumecs (Cusecs)	10.8 (380)
Ayacut in Atmakur Taluk	Ha (Acres)	1215 (3,000)
South Feeder Canal – Length	km	76.20
Head Regulator		
Sill		80.95
No. and size of vents	No.	1
	m	1.80 x 1.50
Head discharge	Cumecs (Cusecs)	9.9 (350)
Ayacut in Atmakur and Rapur Taluk	Ha (Acres)	12213 (30,166)
Length of common canal	km	3.05
Flood Flow Canal To Kandaleru Reservoir		
Sill at the point of off-take on the common canal from Somasila	m	81.38
No. and size of vents	Nos.	3
	m	3.0 x 7.5
Length of Canal	km	45.125
Designed carrying capacity	Cumecs (Cusecs)	326 (11,500)
Kandaleru Reservoir		
Period of construction		
Reservoir capacity	Mcum (TMC)	1671 (59.00)
F.R.L.	m	85.00
Crest of Spillway	m	+ 77.00
Maximum flood discharging capacity of spillway	Cumecs (Cusecs)	1926 (68, 000)
Maximum Height of dam	M	46.00
Length of dam		
Right flank	M	2240.00
Left flank	M	8760.00
Command area to be served	Ha	123482
	(Acres)	(3,05,000)
Kandaleru - Poondi Canal		
Designed carrying capacity at the head at Kandaleru	Cumecs	113
	(Cusecs)	(4,000)
Head Regulator		
Sill	m	+ 60.00
No. and size of vents	Nos.	5
	m	2.00 x 5.55
Length of canal from Kandaleru reservoir to last irrigation off-take	km	119.961
Designed carrying capacity below the last irrigation off-take	Cumecs (Cusecs)	28.3 (1,000)
Length from last irrigation point to the Tamil Nadu border	km	31.926
Total length of canal from Kandaleru to Poondi	Km	151.887
Grade of the canal	-	1 in 7500 to 1 in 15000

Irrigation extent under Telugu Ganga Project

		Ha (Acres)
Under the Telugu Ganga Project Canal		
Kurnool District		
	Atmakur Taluk	1215 (3000)
	Nandiyal Taluk	12146 (30000)
	Allagadda Taluk	30364 (75000)
	Total	**43725 (108000)**
Cuddappa District		
	Proddattur	6883 (17000)
	Badwal	48582 (120000)
	Siddhavattam	12146 (30000)
	Total	**64611 (167000)**
Total Under the Telugu Ganga Project Canal		**111336 (275000)**
Under the Kandaleru Poondi Canal		
Chittoor district		
	Sri Kalahasthi Taluk	13353 (32984)
	Satyavedu Taluk	7851 (19391)
	Total	**21204 (52375)**
Nellore District		
	Nellore Taluk	3820 (9435)
	Rapur Taluk	12213 (30166)
	Venkatagiri Taluk	10261 (25344)
	Gudur Taluk	51043 (126077)
	Sulurpet Taluk	21063 (52027)
	Total	**98400 (243049)**
Total Under the Kandaleru Poondi Canal		**119604 (295424)**
Grand Total		**230940 (570424)**
		2.3 lakhs (or) say 5.7 lakhs)

ANNEXURE-XV

SALIENT FEATURES OF SRISAILAM RIGHT BRANCH CANAL PROJECT

(i) An approach channel 3.4 Kms long from Srisailam reservoir to carry a maximum discharge of 315.73 cumecs upto the head regulator.

(ii) Head regulator comprising 4 vents of size 10 m x 8,75 m for a design discharge of 315.75 cumecs.

(iii) 16.34 km long main canal to carry discharge of 63.71 cumecs at MDDL condition in the Srisailam reservoir and a discharge of 315.73 cumecs under flood flow conditions (this will serve as carrier of 425 Mcum (15 TMC) of water for Chennai Water Supply also).

(iv) A Cross Regulator at tail end of the main canal. (Banakacharla Regulator)

(v) Right Branch Canal 112.73 Km long with a maximum carrying capacity of 140.45 cumecs. The length of the canal from Gorakallu reservoir to Owk Reservoir also includes tunnel of 1.56 Km length.

(vi) By pass channel on the down stream side of Gorakallu dam to facilitate drawal of water for kharif irrigation required from Srisailam reservoir without having to route through Gorakallu reservoir.

(vii) Two balancing reservoirs ie., Gorakallu and Owk with live storage of 303.81 M cubic metres and 78.52 M.cubic metres respectively.

Salient features of balancing reservoirs:

Name of the project : Srisailam Right Branch Canal Scheme
District : Kurnool District
River, River basin : Krishna, Krishna basin

	Gorakallu Balancing Reservoir(GBR)	Owk Balancing Reservoir (OBR)
Name of nearest village	Gorakallu (v)	Owk (v)
Latitude	E 15° - 33' – 39"	E 15° - 12' – 06
Longitude	N 78° - 24' – 45"	N 78° - 7' - 06
Survey of India sheets	57 I/2, 57 I/3, 57 I/4	57 I/6, 57 J/5

Hydrology

Catchment area	77.70 sq.km	246.04 sq.km
Rainfall		
i) Annual average rainfall in the Catchment	635.00 mm	652.78 mm
ii) 75% dependable rainfall	497.58 mm	652.78 mm
Discharge from self catchment area	988.00 cumec	913.22 cumec
Full reservoir level	+ 261.000 m	+ 227.000 m
Maximum water level	+ 261.600 m	+ 231.000 m
Deep bed level	+ 281.000 m	+ 199.000 m
Sill level of the offtake regulator	+ 231.682 m	+ 216.500 m
Water spread area at FRL	15.10 sq.km	12.14 sq.km
Gross storage capacity	352.05 Mcum (12.44 TMC)	137.87 Mcum (4.88 TMC)
Live storage capacity	291.21 Mcum (10.29 TMC)	78.52 Mcum (2.77 TMC)
Dead storage capacity	60.85 Mcum (2.15 TMC)	59.35 Mcum (2.09 TMC)

Details of submergence

i) Patta land (culturable)	608 ha	581 ha
ii) Forest land	770 ha	28 ha
iii) Number of villages affected	1 village (Sugalithanda)	1 village (Cherolopally)

Details of dam

Type of dam	Rockfill & Masonry	Masonry	
Crest level of spill way	+ 257.40 m	+ 220.90 m	
Length of dam	4472 m	i) Paleru dam	1471 m
		ii) Gollaleru dam	1167 m
		iii)Thimmaraju dam	1278 m
Spillway	Ogee	Chute spillway	
Number of gates	7	4	
Size of gate	9m x 3.6 m	12.20m x 6.10	

Details of Irrigation

Gross command area		97386 ha
Culturable command area		76890 ha
Annual Irrigation	Kharif	30800 ha
	Rabi	39270 ha
	Two seasonal	30730 ha
Canal system		
i) km 0 –50		Unlined
ii) km 50 – 198		lined
Number of villages to be served by canal system		128

Cost estimates as per SSR 1993-94

Canals	Rs.66,686.49 lakhs
Sri Narasimharaya Sagar (Gorakallu Balancing Reservoir)	Rs.28,988.08 lakhs
Owk Balancing reservoir	Rs.10,983.14 lakhs
Direct and indirect charges	Rs.11,900.22 lakhs
	Rs.1,18,557.93 lakhs
Total	Or 1,185.58 crores

DISTRICT : ADILABAD

A. STATEMENT OF MAJOR AND MEDIUM PROJECTS COMPLETED AND ONGOING

Sl. No	Name of the Project	Name of the Vagu, Stream, River	Catch-ment Area sq.km.	FRL m	Gross Capacity at FRL M.cum	DAM Earth Dam	DAM Spillway m	DAM Non-Overflow m	CANALS Left Main Canal km	CANALS Right Main Canal km	Irrigation Potential Ultimate ha	Irrigation Potential Created to end of VIII Plan (by 6/97) ha	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
I a	**Major Irrigation Projects Completed schemes**												
	1 Kadam Project	Kadam	6708.1	213.36	7.603	---	378	10360	77		26305	26305	
	Sub Total										**26305**	**26305**	
b	**On going schemes**												
	1 SRSP Stage-I(Part)	Godavari	91750	332.537	3172	14600	765	193	Kakatya canal: 284 Saraswathi: 47 Lakshmi: 3.5		14151	8509	
	Sub Total										**14151**	**8509**	
II a	**Medium Irrigation Projects Completed schemes**												
1	Khanapur Channel	Godavari	---	---	---	---	---	---	22	---	4580	4580	
2	Sirala Project	Bolsa	81.58	143.5	---	---	---	---	9.5	---	526	526	
3	Swarna Project	Swarna	290.08	360.58	42.012	3200	82.32	3204.25	14	8	4206	3277	
	Sub Total										**9312**	**8383**	
b	**On going schemes**												
1	Chelmalvagu project	Chelmalvagu	103	326.3	10.49	244	56.5	---	6	10.8	2429	Nil	
2	Vattivagu project	Vattivagu	327.52	239.5	82.003	2920	85.75	2920	13.5	24	9919	Nil	
3	Satnala Project	Satnala	206.78	286.5	35.11	2760	59	---	6.4	3.6	9712	5532	
	Sub Total										**22060**	**5532**	

B. STATEMENT OF MAJOR AND MEDIUM PROJECTS CONTEMPLATED

I	**Major Irrigation Projects**												
1	Lower Penganga Project	---	---	262.1	35.87	---	---	---	---	---	16133	---	
2	Pranahita Project (II (II Schemes Sirpur tq.) service reservoir at Gandipet	---	---	150	2.463	---	---	---	---	---	23472	---	
3	SRSP Stage-II (part) (beyond Kaddam)	---	---	---	0.084	---	---	---	---	---	59590	---	
	Sub Total										**99195**		
II	**Medium irrigation Projects**												
1	Peddavagu Project Ada (V) Asifabad Tq.	---	---	243	10.39	---	---	---	---	---	9915	---	
2	Yeeravagu Project Dehagam(v)	---	---	147.5	0.85	---	---	---	---	---	1801	---	
3	Suddavagu Project Bhainsa (M)	---	---	358.7	1.853	---	---	---	---	---	5666	---	
4	Peddavagu Project Dasnapur(V),Asiafadbad	---	---	267	1.93	---	---	---	---	---	2883	---	
5	Gollavagu Project Chinnoor Taluk	---	---	150	0.44	---	---	---	---	---	3068	---	
6	Peddavagu Project Barakgudem (V) Sirpur(tq.)	---	---	158.5	NA	---	---	---	---	---	2995	---	
7	Palavagu Projects	---	---	---	---	---	---	---	---	---	4050	---	
8	Kuntala Hydro Electric scheme (Power generation)	---	---	---	---	---	---	---	---	---	2024	---	
9	Chikkilivagu Project	---	---	---	---	---	---	---	---	---	2025	---	
10	Peddavagu Project at Vandham	---	---	---	---	---	---	---	---	---	2027.5	---	
11	Mandamari Project	---	---	---	---	---	---	---	---	---	2430	---	
12	Peddavagu Project at Kargi	---	---	---	---	---	---	---	---	---	4047	---	
	Sub Total										**42931.5**		

DISTRICT : NIZAMABAD

A. STATEMENT OF MAJOR AND MEDIUM PROJECTS COMPLETED AND ONGOING

Sl. No	Name of the Project	Name of the Vagu, Stream, River	Catch-ment Area	FRL	Gross Capacity at FRL	DAM			CANALS		Irrigation Poteritial		Remarks
						Earth Dam	Spillway	Non-Overflow	Left Main Canal	Right Main Canal	Ultimate	Created to end of VIII Plan (by 6/97)	
			sq.km.	m	M.cum	m	m	m	km	km	ha	ha	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
I	**Major Irrigation Projects**												
a	**Completed schemes**												
1	Nizamsagar Project	Manjeera	21693	428.25	504.04	4.64	585.18	4050.12	154.4	---	96722	96722	
2	Remodelling of Nizamsagar Project	---	21693	---	---	---	---	---	---	---	Stabilisation		Investment Clearance
	Sub Total										**96722**	**96722**	not given by PC
b	**On going schemes**												
1	1 S.R.S.P. Stage-I (Part)	Godavari	91750	332.54	3172	14600	765	193	50.5	284	11300	7888	
	Sub Total										**108022**	**104610**	
II	**Medium Irrigation Projects**												
a	**Completed schemes**												
1	Pocharam Project	Aliar	621.6	446.22	51.536	548.64	121.92	640.1	---	57.92	4047	4047	
2	Ramadugu Project	Bhimgalvagu	398.86	388.16	18.6	1847.95	332.54	---	9.6	19.2	2023	2023	
3	Nallavagu Project (part)	Nallavagu	287.49	455.07	21.1	15.85	341.7	---	11.21	19.5	634	634	
	Sub Total										**6704**	**6704**	
b	**On going schemes**												
1	Kaulasnala Project (Sanjay Project)	Kaulasanala	426.83	458	35.02	1008	132	---	6.14	2	4127	Nil	
	Sub Total										4127		

B. STATEMENT OF MAJOR AND MEDIUM PROJECTS CONTEMPLATED

I	**Major Irrigation Projects**	NIL											
	Nil												
II	**Medium Irrigation Projects**				Nil								
1	Tendi Project (Manoor Taluq ayacut in A.P.)	---	---	---	---	---	---	---	---	---	8903	---	
2	Koppala vagu	---	---	---	---	---	---	---	---	---	3238	---	
3	Anicut across Majeera river near Komalancha village	---	---	---	---	---	---	---	---	---	2428	---	
	Sub Total										**14569**		

DISTRICT : KARIMNAGAR

A. STATEMENT OF MAJOR AND MEDIUM PROJECTS COMPLETED AND ONGOING

Sl. No	Name of the Project	Name of the Vagu, Stream, River	Catch-ment Area	FRL	Gross Capacity at FRL	DAM			CANALS		Irrigation Potential		Remarks
						Earth Dam	Spillway	Non-Overflow	Left Main Canal	Right Main Canal	Ultimate	Created to end of VIII Plan (by 6/97)	
			sq.km.	m	M.cum	m	m	m	km	km	ha	ha	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
I	**Major Irrigation Projects**												
a	**Completed schemes**	NIL											
b	**On going schemes**												
1	1 S.R.S.P. Stage-I (Part)	Godavari	91750	332.537	3172	14600	765	193	Kakatya canal: 284 Saraswathi: 47 Lakshmi: 3.5		217137	217137	
2	2 Lower Manair Dam	Manair	6465	280.416	680.458	10100	363	278		---			
	Sub Total										**217137**	**217137**	
II	**Medium Irrigation Projects**												
a	**Completed schemes**												
1	Upper Manair Project (Year of Completion 1950)	Manair	2165.23	451.87	84.97	3261	828	2068	3.21	38.07	5766	5766	
2	Shanigaram Project (Year of Completion 1867)	Siddipet vagu	321.16	357.47	30.92	646.5	265.5	---	11	---	1376	1376	
3	Boggulavagu Project	Boggulavagu	60.18	159.41	11.51	1668	140	---	---	12.6	2084	2084	
	Sub Total										**2084**	**2084**	
b	**On going schemes**												
	NIL												
	Sub Total												

B. STATEMENT OF MAJOR AND MEDIUM PROJECTS CONTEMPLATED

I	**Major Irrigation Projects**												
1	Inchampalli Multipurpose (Part)	---	---	112.77	10.374	---	---	---	---	---	46400	---	
	Joint Project near Kukhunur (V) Part										---	---	
	(a) Palemvagu	---	---	94.154	0.12	---	---	---	---	---	---	---	
2	Lift Irrigation Scheme to irrigate drought prone areas flood flow canal from SRSP (part)	---	---	---	---	---	---	---	---	---	22263	---	
3	Yellampalli Barrage	---	---	153	1981.13	---	---	---	---	---	W.S Scheme		
	Sub Total												
II	**Medium Irrigation Projects**												
1	Lift Irrigation Scheme Unit-1 from Kakathiya Canal to feed tanks for stabilisation of the gap	---	---	387.08	0.54	---	---	---	---	---	3273	---	
											---	---	
	Ayacut in Mallial, Gangadhara,	---	---	---	0.102	---	---	---	---	---	1899	---	
	taluks	---	---	---	---	---	---	---	---	---	stabilisation		
	Sub Total												

DISTRICT : MEDAK

A. STATEMENT OF MAJOR AND MEDIUM PROJECTS COMPLETED AND ONGOING

Sl. No	Name of the Project	Name of the Vagu, Stream, River	Catch-ment Area	FRL	Gross Capacity at FRL	DAM			CANALS		Irrigation Potential		Remarks
						Earth Dam	Spillway	Non-Overflow	Left Main Canal	Right Main Canal	Ultimate	Created to end of VIII Plan (by 6/97)	
			sq.km.	m	M.cum	m	m	m	km	km	ha	ha	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
I a	**Major Irrigation Projects Completed schemes**												
	NIL						NIL						
b	**On going schemes**												
1	Singur project	Manjeera	16101	523.6	849	7110	327	81	---	---	16000	Nil	
	Sub Total										**16000**	**0**	
II a	**Medium Irrigation Projects Completed schemes**												
1	Ghanpur Anicut	Manjeera	8130	Diversion Scheme & length of anicut is 724.5 m					39	42.8	---	---	
	i) Mahaboobnahar canal		---	---	---	---	---	---	---	---	3686	3686	
	ii) Fathenahar canal	---	---	---	---	---	---	---	---	---	3319	3319	
2	Nallavagu (Part)	Nallavagu	287.49	455.07	21.15	1585	341.7	---	11.21	19.5	2495	2495	
	Sub Total										**9500**	**9500**	
b	**On going schemes**												
	NIL						NIL						
	Sub Total												

B. STATEMENT OF MAJOR AND MEDIUM PROJECTS CONTEMPLATED

I	**Major Irrigation Projects**												
	NIL						NIL						
	Sub Total												
II	**Medium Irrigation Projects**												
	NIL						NIL						
	Sub Total												

DISTRICT : RANGAREDDY

A. STATEMENT OF MAJOR AND MEDIUM PROJECTS COMPLETED AND ONGOING

Sl. No	Name of the Project	Name of the Vagu, Stream, River	Catch-ment Area sq.km.	FRL m	Gross Capacity at FRL M.cum	DAM			CANALS		Irrigation Potential		Remarks
						Earth Dam m	Spillway m	Non-Overflow m	Left Main Canal km	Right Main Canal km	Ultimate ha	Created to end of VIII Plan (by 6/97) ha	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
I a	**Major Irrigation Projects Completed schemes**												
	NIL						NIL						
b	**On going schemes**												
	NIL						NIL						
	Sub Total												
II a	**Medium Irrigation Projects Completed schemes**												
	1 Kotipallivagu Project (Completed in 1967)	Kottipalli	308.21	514.8	46.86	1798	390.14	---	14.2	24	3722	3722	
	2 Jutepallivagu Project (Completed in 1966)	Jutepalli	90.65	475.5	8.74	963	213.4	---	4.511	4.69	843	843	
	3 Laknapur Project (Completed in 1968)	Parginala	82.88	549.3	9.11	1263	76.2	12.8	9.6	---	1071	1071	
	Sub Total										**5636**	**5636**	
b	**On going schemes**												
	NIL												
	Sub Total												

B. STATEMENT OF MAJOR AND MEDIUM PROJECTS CONTEMPLATED

I	**Major Irrigation Projects**												
	NIL						NIL						
	Sub Total												
II	**Medium Irrigation Projects**												
	NIL						NIL						
	Sub Total												

DISTRICT : MAHABOOBNAGAR

A. STATEMENT OF MAJOR AND MEDIUM PROJECTS COMPLETED AND ONGOING

Sl No	Name of the Project	Name of the Vagu, Stream, River	Catch-ment Area	FRL	Gross Capacity at FRL	DAM			CANALS		Irrigation Potential		Remarks
						Earth Dam	Spillway	Non-Overflow	Left Main Canal	Right Main Canal	Ultimate	Created to end of VIII Plan (by 6/97)	
			sq.km.	m	M.cum	m	m	m	km	km	ha	ha	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
I	**Major Irrigation Projects**												
a	**Completed schemes**												
1	Rajol.banda Diversion scheme (part)	Thungabhadra	61427	Diversion Scheme					100.4	---	34099	34099	
	Sub Total										**34099**	**34099**	
b	**On going schemes**												
1	Priyadarshini Jurala project	Krishna	129499	318.516	338.1	3208	927	395	89.733	50.44	41376	10000	
2	Amarchintala	PJPLMC	Lift Irrgation Scheme								1943	---	
3	Kurumurthy L.I.Scheme	OVPBR of PJPLMC	Lift Irrgation Scheme								1821	---	
4	Kondadoddi L.I.Scheme	PJP Resr.	Lift Irrgation Scheme								607	---	
	Sub Total										**79846**	**44099**	
II	**Medium Irrigation Projects**												
a	**Completed schemes**												
1	Koilsagar Project (Year of completion 1955)	Peddavagu	535	411.33	64.449	655.5	274.3	106.7	14.4	25.6	4856	4856	
2	Sarlasagar Project (Year of completion 1959)	Chinnavagu	171	331.12	13.91	1078	119.2	158.5	16.9	4.02	1700	1190	
3	K.L.I.Scheme	Krishna	Lift Irrigation Scheme						21.4	---	4047	3710	
4	Ookachettyvagu Project	Ookachettyvagu	4071	306.63	2.08	594	256	23	---	10.58	2428	1652	
	Sub Total										**13031**	**11408**	
b	**On going schemes**				NIL								

B. STATEMENT OF MAJOR AND MEDIUM PROJECTS CONTEMPLATED

I	**Major Irrigation Projects**												
1	BHIMA LIFE IRRIGATION PROJECT												
	a) Budpur balancing reservoir	---	---	352	1.31	---	---	---	---	---	18939	---	
	b) Sangambanda balancing reservoir	---	---	364	3.317	---	---	---	---	---	25981	---	
	c) Yenukunta balance reservoir	---	---	340	0.12	---	---	---	---	---	8499	---	
	d) Rangasamudram balancing reseroir	---	---	325.5	1.9	---	---	---	---	---	5665	---	
	e) Shankarasamudram balancing reservoir	---	---	358.19	1.92	---	---	---	---	---	23067	---	
2	KALWAKURTHY L. I. PROJECT	---	---	---	---	---	---	---	---	---	---	---	
	a) Chinakothapalli	---	---	413.5	1.038	---	---	---	---	---	6475	---	
	b) Bopally	---	---	468.75	1.704	---	---	---	---	---	44112	---	
	c) Rachalapally	---	---	506	1.2966	---	---	---	---	---	20235	---	
	d)Nallacheru	---	---	484	0.1314	---	---	---	---	---	2428	---	
	e) Lingasamudram	---	---	506.5	0.350	---	---	---	---	---	7689	---	
3	NATTAMPAD L.I. PROJECT	---	---	---	---	---	---	---	---	---	---	---	
	a) Yudamdoddi balancing reservoir	---	---	345	---	---	---	---	---	---	25091	---	
	b) Ralampadu Balancing Reservoir	---	---	397	---	---	---	---	---	---	55847	---	
4	KOILSAGAR L.I. PROJECT	---	---	---	---	---	---	---	---	---	58681	---	
	a) Nallacheru reservoir	---	---	391.3	---	---	---	---	---	---	---	---	
	b) Koil sagar reservoir	---	---	415.635	---	---	---	---	---	---	---	---	
	c) Tarakarama reservoir	---	---	397	---	---	---	---	---	---	---	---	
	Sub Total												
II	**Medium Irrigation Projects**					NIL							

DISTRICT : NALGONDA

A. STATEMENT OF MAJOR AND MEDIUM PROJECTS COMPLETED AND ONGOING

Sl. No	Name of the Project	Name of the Vagu, Stream, River	Catch-ment Area	FRL	Gross Capacity at FRL	DAM			CANALS		Irrigation Potential		Remarks
						Earth Dam	Spillway	Non-Overflow	Left Main Canal	Right Main Canal	Ultimate	Created to end of VIII Plan (by 6/97)	
			sq.km.	m	M.cum	m	m	m	km	km	ha	ha	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
I a	**Major Irrigation Projects Completed schemes**												
	Nil					Nil							
	Sub Total												
b	**On going schemes**												
1	Nagarjunasagar Project	Krishna	215185	179.83	11560	3413	472.5	979	179	203	150957	150957	
2	Srisailam Left Bank Canal (S.L.B.C.)	Krishna	215185	179.83	11560	3413	472.5	979	134.2	---	109250	Nil	Investment Clearance
	Sub Total										**260207**	.	not given bu P.C.
II a	**Medium Irrigation Projects Completed schemes**												
1	Dindi Project	Dindi	290.74	395.6	73.9	1510	823	---	---	---	6070	2671	
2	Musi project (Year of Completion 1963)	Musi	9091	196.6	136.94	4694	399.3	---	---	---	14731	13355	
3	Bheemanapalli Project (Plan Scheme)	Bheemanapalli	441.6	303.88	6.25	1680	342	---	---	---	486	486	
4	Pendli Pakala Project	Uppauvagu	292.2	236.43	15.32	504.14	873.86	---	---	---	2023	2023	
5	Utkuru Marepalli Project	---	---	---	---	---	---	---	---	---	20	20	
6	Asifnahar Project	---	---	---	---	---	---	---	---	---	6170	4000	
	Sub Total										**29500**	**22555**	
b	**On going schemes**												
	Nil					Nil							
	Sub Total												

B. STATEMENT OF MAJOR AND MEDIUM PROJECTS CONTEMPLATED

I	**Major Irrigation Projects**												
1	S.R.S.P. Stage II (part)	---	---	---	---	---	---	---	---	---	104213	---	
2	Flood Flow Canal from S.R.S.P. (part)	---	---	---	---	---	---	---	---	---	89029	---	
	Sub Total												
II	**Medium Irrigation Projects**												
	Nil					Nil							
	Sub Total												

DISTRICT : WARANGAL

A. STATEMENT OF MAJOR AND MEDIUM PROJECTS COMPLETED AND ONGOING

Sl. No	Name of the Project	Name of the Vagu, Stream, River	Catch-ment Area sq.km.	FRL m	Gross Capacity at FRL M.cum	DAM			CANALS		Irrigation Potential		Remarks
						Earth Dam m	Spillway m	Non-Overflow m	Left Main Canal km	Right Main Canal km	Ultimate ha	Created to end of VIII Plan (by 6/97) ha	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
I a	**Major Irrigation Projects Completed schemes**												
	NIL					NIL							
b	**On going schemes**												
1	Sriramasagar Project Stage-I (Part)	Godavari	91750	332.537	3172	14600	765	193	Kakatya canal: 284 Saraswathi: 47 Lakshmi: 3.5		147400	19015	
	Sub Total										**147400**	**19015**	
II a	**Medium Irrigation Projects Completed schemes**												
1	Salivagu Project	Salivagu	507.64	217.01	17.27	1598	552	---	8.8	4.2	1238	1238	
2	Ramappa Lake	---	183.88	202.96	82.47	610	18	---	12.33	8.8	1967	1967	
3	Pakhal Lake	---	271.95	252.92	92.36	1372.5	122	---	19.2	14.4	5278	5278	
4	Laknavaram Project	---	268.06	97.23	60.46	610	97.25	---	14.28	12.67	3521	3521	
5	Malluru Vagu	Malluru	43.52	115.25	10.402	1300	75	90	7	15	3035	3035	
	Sub Total										**15039**	**15039**	
b	**On going schemes**												
	NIL					NIL							

B. STATEMENT OF MAJOR AND MEDIUM PROJECTS CONTEMPLATED

I	**Major Irrigation Projects**												
1	Sriramasagar Project Stage -II (Part)	---	---	332.53	112.02	---	---	---	---	---	45964		
2	Flood Flow Canal from S.R.S.P. (Part)	---	---	---	---	---	---	---	---	---	46135		
3	Inchampalli Project (Part)	---	---	112.77	10.374	---	---	---	---	---	17180		
	Sub Total										**109279**		
II	**Medium Irrigation Projects**												
	1 Manneruvagu project										12950		
	Sub Total										**12950**		

DISTRICT : KHAMMAM

A. STATEMENT OF MAJOR AND MEDIUM PROJECTS COMPLETED AND ONGOING

Sl. No	Name of the Project	Name of the Vagu, Stream, River	Catch-ment Area	FRL	Gross Capacity at FRL	DAM			CANALS		Irrigation Potential		Remarks
						Earth Dam	Spillway	Non-Overflow	Left Main Canal	Right Main Canal	Ultimate	Created to end of VIII Plan (by 6/97)	
			sq.km.	m	M.cum	m	m	m	km	km	ha	ha	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
I	**Major Irrigation Projects**												
a	**Completed schemes**	NIL											
b	**On going schemes**												
	1 Nagarjunasagar Project (Part)	Krishna	215185	179.83	11560	3413	472.5	979	179	203	92679	92679	
	Sub Total											**92679**	
II	**Medium Irrigation Projects**												
a	**Completed schemes**												
1	Wyra Project	Wyra	367.77	97.6	70.12	1768	402.4	---	16.09	24.14	7038	7038	
2	Palair project (Completed in 1928)	Palair	1686.71	133.94	72.45	2988	709.45	---	23.34	---	6040	6040	
3	Lankasagar Project (1966) (Part)	Kottaleru	203.2	118.2	18.83	2719	146.3	---	12.31	16.41	2976	2752	
4	Kinnerasani Project	Kinnerasani	1333.33	124.05	237.888	---	---	---	---	---	W.S to KTPS		
5	Mukkamamidi Project	Pamaleru	78.14	120.5	4.332	294	96	---	6.6	4.7	1320	1000	
6	Peddavagu Project	Peddavagu	438.08	81.24	16.33	2460	46	---	17.34	17.4	6477	2428	
7	LT Bayyaram	Munneru	572.89	195.4	11.24	2410	197	---	226.32	---	2430	2430	
	Sub Total										**8907**	**4858**	
b	**On going schemes**												
1	Taliperu Project	Taliperu	3183.09	74	20.67	2670	370	2392	63	---	10000	7420	
2	Gundlavagu Project	Gundlavagu	21.83	116.7	2.491	506	51	---	---	6	1045	Nil	
3	Palemvagu Project	Palemvagu	144.52	132.5	72.462	---	60	829	---	14.3	6230	---	
	Sub Total	---	---	---	---	---	---	---	---	---	**17275**	**7420**	

B. STATEMENT OF MAJOR AND MEDIUM PROJECTS CONTEMPLATED

I	**Major Irrigation Projects**												
1	Sriramasagar Project Stage-II (Part)	---	---	---	---	---	---	---	---	---	27889		
2	Inchampalli Project (Part)	---	---	112.77	10.374	---	---	---	---	---	45382		
	Sub Total												
II	**Medium Irrigation Projects**				Nil								
1	Modikuntavagu	---	---	124.05	2.142	---	---	---	---	---	5500		
2	Kinnerasani Irrigation Canal	---	---	124	8.4	---	---	---	---	---	4047		
3	Murreduvagu Anicut Scheme	---	---	81.8	Only diversion		---	---	---	---	2550		
4	Munneru Reservoir Scheme, Mulkanur (v) Garla (M)	---	---	164.5	1.015	---	---	---	---	---	12305		
5	Sileru Diversion Scheme Nalakota (v) Chintoor (M)	---	---	71.65	0.735	---	---	---	---	---	5600		
6	Sokaleru Reservoir Tulasipaka (v)	---	---	128	1.283	---	---	---	---	---	4427		
7	Munneruvagu Reservoir	---	---	---	---	---	---	---	---	---	6883		
8	Cherukupalli Project	---	---	---	---	---	---	---	---	---	3440		
9	Kalikota Project	---	---	---	---	---	---	---	---	---	7487		
	Sub Total										**52239**		

DISTRICT : SRIKAKULAM

A. STATEMENT OF MAJOR AND MEDIUM PROJECTS COMPLETED AND ONGOING

Sl. No	Name of the Project	Name of the Vagu, Stream, River	Catch-ment Area	FRL	Gross Capacity at FRL	DAM			CANALS		Irrigation Potential		Remarks
						Earth Dam	Spillway	Non-Overflow	Left Main Canal	Right Main Canal	Ultimate	Created to end of VIII Plan (by 6/97)	
			sq.km.	m	M.cum	m	m	m	km	km	ha	ha	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
I	**Major Irrigation Projects**												
a	**Completed schemes**												
	NIL					NIL							
	Sub Total												
b	**On going schemes**												
1	Vamasadhara Project Stage I	Vamasadhara	9731	38.1	17.33	---	475.79	---	104.24	---	59990	51750	
2	Vamasadhara Project Stage II	Vamasadhara	Diversion Scheme						---	58	43414	---	
	Flood Flow canal								32				Investment Clearance not given by Planning Commission
	Link canal								2.9				
	High level canal								30				
	Nerodi Barrage	Vamasadhara	7900	71.63	---	---	---	---	---	---			
	Hiiamandalam Reservoir	Vamasadhara	7900	67.06	539.5	7080	20	---	---	---			
	Sub Total										**103404**	**51750**	
II	**Medium Irrigation Projects**												
a	**Completed schemes**												
1	Narayanapuram Anicut	Nagavalli	8553	28.95	Diversion Scheme	---	356.85	---	15.2	50.5	15865	15865	
2	Paidigam Project	Mahendradanaya	111.37	33.23	Diversion Scheme	---	42.7	---	16.81	---	2018	2018	
3	Thotapalli Regulator (part)	Nagavalli	4351.62	---	---	---	131.25	---	37	19.5	11837	11837	
	Sub Total										**29720**	**29720**	
b	**On going schemes**												
	1 Madduvalasa Project	Nagavalli	2536	65	95.51	2159	159.5	---	1.67	58.5	10379	Nil	
	Sub Total										**10379**	0	

B. STATEMENT OF MAJOR AND MEDIUM PROJECTS CONTEMPLATED

I	**Major Irrigation Projects**												
	NIL												
	Sub Total												
II	**Medium Irrigation Projects**												
1	Vonigedda Reservoir Scheme	---	---	86	1.3	---	---	---	---	---	2833	---	
2	Bahuda Reservoir Scheme near Arakubhadra (v), Ichapuram (M)	---	---	16	0.159	---	---	---	---	---	4693	---	
3	Madduvalasa Canal extension scheme ((part of ongoing scheme)	---	---	65	1.806	---	---	---	---	---	5059	---	
4	Reservoir across Mahendrayanaya near Korsavadda (village)	---	---	---	---	---	---	---	---	---	4047	---	
	Sub Total												

DISTRICT : VIZIANAGARAM

A. STATEMENT OF MAJOR AND MEDIUM PROJECTS COMPLETED AND ONGOING

Sl. No	Name of the Project	Name of the Vagu, Stream, River	Catch-ment Area sq.km.	FRL m	Gross Capacity at FRL M.cum	DAM Earth Dam m	DAM Spillway m	DAM Non-Overflow m	CANALS Left Main Canal km	CANALS Right Main Canal km	Irrigation Potential Ultimate ha	Irrigation Potential Created to end of VIII Plan (by 6/97) ha	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
I a	**Major Irrigation Projects Completed schemes** Nil												
b	**On going schemes** Nil												
II a	**Medium Irrigation Projects Completed schemes**												
1	Thotapalli Regulator (part) 1908 (it includes Nagavalli left & right	Nagavalli	4356.87	Diversion Scheme			131.2		37.442	19.87	3138	3138	
2	Denkada Anicut (1968)	Champavathi	1181.04	----	----	3600	----	----	----	4	2062	2062	
3	Thatipudi Reservoir (1968)	Chilagalagadola	334.38	90.525	94.152	548.64	36.576	54.86	12.8	----	5610	5610	
4	Vegavati Anicut (1958)	Nagavalli	256.62	----	----	----	91.44	----	6.943	10.613	1673	1673	
5	Sitanagaram Anicut Scheme(1960)	Suvarnamukhi	759.48	----	----	----	123	----	0.805	12.4	1519	1519	
6	Penddankalam Project (1979)	Suvrnamukhi	1070	79.8	----	3300	108.25	----	----	25	3342	3342	
7	Vottigadda Reservoir (1973)	Vottigadda	284.9	121.61	25.15	2484	58	----	8.855	9.6	7027	7027	
	Sub Total										**24371**	**24371**	
b	**On going schemes**												
1	Vengalaraya Sagaram	Suvrnamukhi	470.42	161	47.75	4.05	60	187.65	0.2	18.7	10000	9300	
2	Andra Reservoir	Champavathi	139.96	146	27.75	1819	----	----	11.5	25	3816	----	
3	Janjhavathi Reservoir	Janjavathi	841.75	146.2	96.3	4435	89.5	48.25	32	30	9972	----	Investment Clearance
	Sub Total										**23788**	**9300**	not given by P.C.

B. STATEMENT OF MAJOR AND MEDIUM PROJECTS CONTEMPLATED

I	**Major Irrigation Projects**												
1	Thotapalli Reservoir (Scheme on Nagavali River)		----	105	71.05	----	----	----	----	----	----	74463	
	Sub Total												
II	**Medium Irrigation Projects**												
1	Peddagadda Reservoir Scheme	----	----	215	0.949	----	----	----	----	----	----	3179	
2	Tarakaramthirthasagaram Reservoir (Water supply to Vizianagaram town)	----	----	40	2.224	----	----	----	----	----	----	12210	
	Sub Total											15389	

DISTRICT : VISAKHAPATANAM

A. STATEMENT OF MAJOR AND MEDIUM PROJECTS COMPLETED AND ONGOING

Sl. No	Name of the Project	Name of the Vagu, Stream, River	Catch-ment Area sq.km.	FRL m	Gross Capacity at FRL M.cum	DAM			CANALS		Irrigation Potential		Remarks
						Earth Dam m	Spillway m	Non-Overflow m	Left Main Canal km	Right Main Canal km	Ultimate ha	Created to end of VIII Plan (by 6/97) ha	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
I a	**Major Irrigation Projects Completed schemes**	NIL											
	Sub Total												
b	**On going schemes**												
1	Yeleru reservoir schemes	Yeluru	2232	86.56	682.7	2400	147	---	113.3	33.609	39310	---	
	Sub Total										**39310**	**0**	
II a	**Medium Irrigation Projects Completed schemes**												
1	Varaha Reservoir (1975)	Varaha	55.685	140.208	13.167	1210	64.02	---	17.4	---	1815	1815	
2	Gambhiram gedda Reservoir	Gambhiram gedda	93.24	38.405	1.683	247	121.92	---	3.14	---	260	260	
3	Mehadhrigedda Reservoir	Mehadhrige	349.65	18.59	33.102	6020	85.34	---	---	---	---	---	
4	Konam Project	Gadderu	170.94	101.25	24.072	296	36.6	---	8.48	---	5888	5888	
5	Raiwada Project	Sarada	448.83	114	102	5750	146.75	---	15.24	---	6138	5503	
6	Thandava Reservoir (Part)	Thandava	447.88	115.82	140.46	201	57	---	19.8	17.5	13226	13226	
	Sub Total										**19364**	**18729**	
b	**On going schemes**												
1	1 Pedderu Project (Ranipalem (v) Madugula	Pedduru	160	137	9.86	759	81	---	20.5	32	6460	---	Investment Clearance not
	Sub Total										6460		given by P.C.

B. STATEMENT OF MAJOR AND MEDIUM PROJECTS CONTEMPLATED

I	**Major Irrigation Projects**												
1	Polavaram Project	---	---	---	---	---	---	---	---	---	57750	---	
	Sub Total										**57750**		
II	**Medium Irrigation Projects**			NIL									

DISTRICT : EAST GODAVARI

A. STATEMENT OF MAJOR AND MEDIUM PROJECTS COMPLETED AND ONGOING

Sl. No	Name of the Project	Name of the Vagu, Stream, River	Catch-ment Area sq.km.	FRL m	Gross Capacity at FRL M.cum	DAM			CANALS		Irrigation Potential		Remarks
						Earth Dam m	Spillway m	Non-Overflow m	Left Main Canal km	Right Main Canal km	Ultimate ha	Created to end of VIII Plan (by 6/97) ha	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
I	**Major Irrigation Projects**												
a	**Completed schemes**												
1	Godavari Delta (S.A.C.B) system (part)	Godavari	314685	---	---	Barrage consists of 4 arms The lengths G46 are Dowleswaram arm: 1440.05 Ralli arm : 884.45 Madduru arm : 469.66 Vijeswaram arm ; 804.9			Eastern : 254 Western : 199 Central: 370		243911	243911	
	Sub Total										**243911**	**243911**	
b	**On going schemes**												
1	Yeleru reservoir scheme (part)	---	Yeluru	2232	84.56	682.7	2485	147	118.495	53.459	33945	---	
2	Chagalnadu L.I.scheme	Godavari	Lift Irrigation Scheme								14164	---	
3	Gannavaram aqueduct	---	---	---	---	---	---	---	---	---	Stabilisation		
	Sub Total										**292020**	**243911**	
II a	**Medium Irrigation Projects Completed schemes**												
1	Pampa Reservoir (1969)	Pampa	354.52	32	15.97	672	70.71	9.75	---	12.87	4858	4858	
2	Torrigedda pumping scheme	Torrigedda	Lift Irrigation Scheme								5522	5522	
3	Tarakarama Ramavarapu Ava	---	Lift Irrigation Scheme								1975	1975	
	Sub Total										**12355**	**12355**	
b	**On going schemes**												
1	Maddigedda project	Maddigedda	125.3	188	13.735	750	56	---	18.814	---	2430	1094	
2	Thandava Reservoir	Thandava	447.88	115.82	140.46	201	57	---	19.8	17.5	7597	7597	
	Sub Total										**10027**	**8691**	

B. STATEMENT OF MAJOR AND MEDIUM PROJECTS CONTEMPLATED

I	**Major Irrigation Projects**												
1	Polavaram Project (Part)	---	---	---	---	---	---	---	---	---	104100	---	
2	Seethapallivagu Reservoir Musurmilli Reservoir	---	---	---	---	---	---	---	---	---	9700	---	
3	Surampalem Reservoir	---	---	---	---	---	---	---	---	---	9700		
	Sub Total										**123500**		
II	**Medium Irrigation Projects**												
1	Bhupathipalem Reservoir	---	---	---	---	---	---	---	---	---	4897	---	
2	Nelaketa L.I.Scheme	---	---	---	---	---	---	---	---	---	4047	---	
	Sub Total										**8944**		

DISTRICT : WEST GODAVARI

A. STATEMENT OF MAJOR AND MEDIUM PROJECTS COMPLETED AND ONGOING

Sl. No	Name of the Project	Name of the Vagu, Stream, River	Catch-ment Area sq.km.	FRL m	Gross Capacity at FRL M.cum	DAM			CANALS		Irrigation Potential		Remarks
						Earth Dam m	Spillway m	Non-Overflow m	Left Main Canal km	Right Main Canal km	Ultimate ha	Created to end of VIII Plan (by 6/97) ha	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
I a	**Major Irrigation Projects Completed schemes**												
1	Godavari Delta system (part)	Godavari	314685	13.64	---	---	3573	---	453	370	258936	258936	
2	Krishna Delta System (Part) Prakasam Barrage	Krishna	251359	17.4	---	---	1036	---	---	---	22663	22663	
	Sub Total										**281599**	**281599**	
b	**On going schemes**												
1	S.A.C.B.		Stabilisation of Godavari Delta System										
	Sub Total												
II a	**Medium Irrigation Projects Completed schemes**												
1	Bande Kottu Channel (1967)		---	---	---	---	---	---	---	---	1478	1478	
2	Gutala Pumping scheme		---	---	---	---	---	---	---	---	2023	2023	
3	Jalleru project		48.18	217.8	15.32	1790	95.5	18.5	6.09	---	1700	1700	
	Sub Total										**5201**	**5201**	
b	**On going schemes**												
1	Yerrakalava Project	Yerrakalava	1083	81.05	125.38	2730	48		7.59	45	9996	1233	
2	Thammileru Reservoir (part) including Vijayarai Anicut	Thammileru	610.21	108.2	84.49	6365	35		7.08	6.508	3888	3888	Investment clearance not given by P.C.
	Sub Total										**13884**	**5121**	

B. STATEMENT OF MAJOR AND MEDIUM PROJECTS CONTEMPLATED

I	**Major Irrigation Projects**												
1	Polavaram Project (Part)		---	45.72	194.6	---	---	---	---	---	---	104214	
	Sub Total											**104214**	
II	**Medium Irrigation Projects**												
1	Kovvada Kalva Reservoir	---	---	90.5	0.436	---	---	---	---	---	---	4175	
	Sub Total												

DISTRICT : KRISHNA

A. STATEMENT OF MAJOR AND MEDIUM PROJECTS COMPLETED AND ONGOING

Sl. No	Name of the Project	Name of the Vagu, Stream, River	Catch-ment Area	FRL	Gross Capacity at FRL	DAM			CANALS		Irrigation Potential		Remarks
						Earth Dam	Spillway	Non-Overflow	Left Main Canal	Right Main Canal	Ultimate	Created to end of VIII Plan (by 6/97)	
			sq.km.	m	M.cum	m	m	m	km	km	ha	ha	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
I a	**Major Irrigation Projects Completed schemes**												
1	Godavari Delta System (Part) (S.A.C.B)	Godavari	314685	1364	—	---	3573	----	254 199	370	130	130	
2	Krishna Delta System (Part) (Prakasam Barrage)	Krishna	251359	17.4	---	---	1036	----	----	----	266808	266808	
b	**On going schemes**												
1	Nagarjunasagar Project (Part)	Krishna	215185	179.83	11560	3413.76	472.5	977.5	178	203	176180	115000	
	Sub Total										**443118**	**381938**	
II a	**Medium Irrigation Projects Completed schemes**												
1	Munyeru Project	Munyeru	6104.6	67.69	Diversion scheme		553.2	105	50	----	4249	4249	
2	Lankasagar Project (Part)(Khammam Part)	Adivimalayala	207.2	118.26	18.83	2719	146.3	----	10.028	17.62	101	101	
	Sub Total										**4350**	**4350**	
b	**On going schemes**												
1	Thammileru Reservoir (part) including Vijayarai Anicut (part)	Thammileru & Gonela vagu	610.21	108.2	84.95	6365	35	----	7.08	6.51	4162	4162	Investment Clearance not given by P.C.

B. STATEMENT OF MAJOR AND MEDIUM PROJECTS CONTEMPLATED

I	**Major Irrigation Projects**												
1	Polavaram Project (part)			45.72	194.6							25051	
2	Pulichintala Project			53.34	45.77								
II	**Medium Irrigation Projects**	Nil											

DISTRICT : GUNTUR

A. STATEMENT OF MAJOR AND MEDIUM PROJECTS COMPLETED AND ONGOING

Sl. No	Name of the Project	Name of the Vagu, Stream, River	Catch-ment Area sq.km.	FRL m	Gross Capacity at FRL M.cum	DAM			CANALS		Irrigation Potential		Remarks
						Earth Dam m	Spill way m	Non-Overflow m	Left Main Canal km	Right Main Canal km	Ultimate ha	Created to end of VIII Plan (by 6/97) ha	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
I	**Major Irrigation Projects**												
a	**Completed schemes**												
1	Krishna Delta Systems (Part)	Krishna	251359	17.4	---	---	1036	---	---	---	180429	180429	
b	**On going schemes**												
1	Nagarjunasagar Project (Part)	Krishna	215185	179.83	11560	3413.76	472.5	977.5	178	203	284365	269000	
	Sub Total										**464794**	**449429**	
II	**Medium Irrigation Projects**												
a	**Completed schemes**												
1	Pomperu Drainage Scheme	This scheme is mainly meant for discharging drainage water into the sea and to avoid submergence									4120	4120	
2	Vaikuntapuram Pumping Scheme		Pumping Scheme						8.4		130	130	
3	Guntur Channel Scheme	Krishna	Diversion Scheme							47	10926	10926	
4	Duvvaleru	Krishna									520	520	
	Sub Total										**15696**	**15696**	
b	**On going schemes**	NIL											

B. STATEMENT OF MAJOR AND MEDIUM PROJECTS CONTEMPLATED

I	**Major Irrigation Projects**												
1	Pulichintala Project (Part)			53.34	45.77								
II	**Medium Irrigation Projects**	Nil											

DISTRICT : PRAKASAM

A. STATEMENT OF MAJOR AND MEDIUM PROJECTS COMPLETED AND ONGOING

Sl. No	Name of the Project	Name of the Vagu, Stream, River	Catch-ment Area	FRL	Gross Capacity at FRL	DAM			CANALS		Irrigation Potential		Remarks
						Earth Dam	Spillway	Non-Overflow	Left Main Canal	Right Main Canal	Ultimate	Created to end of VIII Plan (by 6/97)	
			sq.km.	m	M.cum	m	m	m	km	km	ha	ha	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
I	**Major Irrigation Projects**												
a	**Completed schemes**												
1	Krishna Delta System (Part) (Prakasam Barrage)	Krishna	251359	17.4	----	----	1036	----	----	----	25900	25900	
	Sub Total										**25900**	**25900**	
b	**On going schemes** Nagarjunasagar Project (Part)	Krishna	215185	179.83	11560	3413.76	472.5	977.5	178	203	191100	180000	
	Sub Total										**191100**	**180000**	
II	**Medium irrigation Projects**												
a	**Completed schemes**												
1	Veeraraghavani Anicut	Manneru	2459	----	----	----	299	----	8.842	----	2270	2270	
2	Paleru Reservoir	Paleru	----	----	----	----	----	----	----	----	590	590	
3	Paleru Bitragunta Channel	Paleru	2100.49	12.95	Diversion Scheme		----	----	----	----	2345	2345	
4	Mopad Reservoir (Completed	Manneru	1677.02	100.15	----	----	----	1670	7.08	----	4401	4401	
5	Markapur tank (Completed	----	Particulars are awited								660	660	
6	Cumbum tank (completed	Gundlakamma	1113.7	203.2	105.34	296	88.4	----	28.4		3202	3202	
7	Karudu Tank	----	Particulars are awited								776	776	
8	Upputeru lower Anicut	Manneru	440	22.1	Diversion Scheme				29.34	----	792	792	
9	Rallapadu Reservoir	Manneru	2201	----	31.33	29.5	----	----	2.818	20.14	5099	5099	
	Sub Total										**20135**	**20135**	
b	**On going schemes**												
1	NIL												

B. STATEMENT OF MAJOR AND MEDIUM PROJECTS CONTEMPLATED

I	**Major Irrigation Projects**												
1	Gundlakamma Reservoir			26.2	3.48							30564	
2	Pulichintala Project (Part)			53.34	45.77						Stabilisation of Krishna delta		
3	Veligonda Project	Investigation works are in progress										177200	
	Sub Total											**207764**	
II	**Medium Irrigation Projects**												
	1 Musi Reservoir Scheme			96.32	2.95							8500	

DISTRICT : NELLORE

A. STATEMENT OF MAJOR AND MEDIUM PROJECTS COMPLETED AND ONGOING

Sl. No	Name of the Project	Name of the Vagu, Stream, River	Catch-ment Area	FRL	Gross Capacity at FRL	DAM			CANALS		Irrigation Potential		Remarks
						Earth Dam	pillway	Non-Overflow	Left Main Canal	Right Main Canal	Ultimate	Created to end of VIII Plan (by 6/97)	
			sq.km.	m	M.cum	m	m	m	km	km	ha	ha	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
I a	**Major Irrigation Projects Completed schemes**												
1	Pennar Delta System	Pennar	---	---	---	---	---	---	---	---	67720	67720	
2	Kanigiri Reservoir	---	---	---	---	---	---	---	---	---	37240	37240	
	Sub Total										**104960**	**104960**	
b	**On going schemes**												
1	Telugu Ganga Project (Part) (Kandaleru Reservoir)	Kandaleru	391.09	82	1290.26	####	55.5	---			100671	---	Investment Clearance not given by P.C.
2	Somasila Project Stage-I	Pennar	48660	100.58	2.21	352	236.21	172.53	---	---	38481	6540	
	Sub Total										**139152**	**6540**	
II	**Medium Irrigation Projects Completed schemes**												
1	Nakkalagandi Reservoir	---	137.27	113.39	4.726	---	243.84	---	8.048	1.61	485	485	
2	Gandipalem Project	Manneru	486.92	147.83	53.24	---	60	60	10.31	6.6	9713	9713	
	Sub Total										**10198**	**10198**	
b	**On going schemes**												
1	Kanupur Canal Scheme	Pennar	50121	Diversion Scheme					56.6	---	25452	7077	

B. STATEMENT OF MAJOR AND MEDIUM PROJECTS CONTEMPLATED

I	**Major Irrigation Projects**												
1	1 G.N.S.S.(Part)		---	---	---	---	---	---	---	---	---	14170	
	Sub Total												
II	**Medium Irrigation Projects**	Nil											

DISTRICT : CUDDAPPAH

A. STATEMENT OF MAJOR AND MEDIUM PROJECTS COMPLETED AND ONGOING

Sl. No	Name of the Project	Name of the Vagu, Stream, River	Catch-ment Area	FRL	Gross Capacity at FRL	DAM			CANALS		Irrigation Potential		Remarks
						Earth Dam	Spillway	Non-Overflow	Left Main Canal	Right Main Canal	Ultimate	Created to end of VIII Plan (by 6/97)	
			sq.km.	m	M.cum	m	m	m	km	km	ha	ha	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
I a	**Major Irrigation Projects Completed schemes**												
1	K.C.Canal (Part)	Thungabhadra	---	---	---	---	---	---	305.8	---	36593	36593	
2	TBPHLC Stage I (Part)	Chitravathi	5436	298	283.17	374	106.75	366	---	196.33	2289	2289	
	Sub Total										**38882**	**38882**	
b	**On going schemes**												
1	T.G.P. (Part)	Local Vagu	57.63	215.5	475.16	5895	50	---	---	---	67581	---	
2	T.B.P.H.L.C. Stage-II	Pennar	19197	20265	281.81	2527	195.1	104.9	34.34	44.44	29090	25543	
3	S.R.B.C. (Part)	Krishna	206301	269.75	108.77	---	201.2	512.06	---	112.73	12829	---	
4	Modernisation of K.C.Canal	---	---	---	---	---	---	---	---	---	Stabilisation		
5	Pulivendula Branch canal	Chitravathi	5431	298	283.17	374	106.75	366	66.47	---	22378	14323	
	Sub Total										**131878**	**39866**	
II a	**Medium Irrigation Projects Completed schemes**												
1	Lower Sagileru	Sagileru	1589.14	157	7.306	1830	76.8	---	22	12.1	5667	4418	
2	Upper Sagileru	Sagileru	663.04	198.3	---	---	121.7	---	14	---	2285	2285	
	Sub Total										**7952**	**6703**	
b	**On going schemes**												
1	Cheyyeru project	Cheyyeru	98.6	203.6	63.46	336	94	---	23.63	---	9105	---	
2	Velligallu Reservoir	Papagini	3429.14	420	131.47	---	---	---	6.32	53.97	11200	---	
3	Buggavanka Reservoir	Buggavanka	205.79	186	14.3	2040	57	90	16.6	4.86	5200	---	
	Sub Total										**25505**		

B. STATEMENT OF MAJOR AND MEDIUM PROJECTS CONTEMPLATED

I	**Major Irrigation Projects**												
1	H.N.S.S.(Part)	---	---	---	---	---	---	---	---	---	15176	---	
2	G.N.S.S.	---	---	---	---	---	---	---	---	---	52632	---	
	Sub Total												
II	**Medium Irrigation Projects**												
	NIL					NIL							
	Sub Total												

DISTRICT : KURNOOL

A. STATEMENT OF MAJOR AND MEDIUM PROJECTS COMPLETED AND ONGOING

Sl. No	Name of the Project	Name of the Vagu, Stream, River	Catch-ment Area	FRL	Gross Capacity at FRL	DAM			CANALS		Irrigation Potential		Remarks
						Earth Dam	Spillway	Non-Overflow	Left Main Canal	Right Main Canal	Ultimate	Created to end of VIII Plan (by 6/97)	
			sq.km.	m	M.cum	m	m	m	km	km	ha	ha	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
I a	**Major Irrigation Projects Completed schemes**												
1	K.C.Canal	Thungabhadra	64711	Crest level of the barrage : + 285.00 m						306	84207	84207	
2	T.B.P.L.L.C	Thungabhadra	27853	497.74	3157.52	150.2	701	1040	---	74	59106	59106	
3	Rajolibanda Diversion Scheme	Thungabhadra	61427	332.23	Diversion Scheme		819.91	---	42.6	100.4	1312	1312	
	Sub Total										**144625**	**144625**	
b	**On going schemes**												
1	Srisailam Right Bank Canal (Part)	Krishna	206301	269.75	10877	---	201.2	512.06	---	---	64060	---	
2	T.G.P. (part)	Galeru	218.4	264.7	480	11.68	70	---	---	---	43709	12718	
3	T.B.P.H.L.C. Stage-II	Thungabhadra	27852	497.74	3157.52	150.2	701	1040	---	---	4747	4707	
4	Modernisation of K.C. Canal	---	---	---	---	---	---	---	---	---	---	---	
5	Modernisation of TBPLLC	---	---	---	---	---	---	---	---	---	---	---	
	Sub Total										**112516**	**17425**	
II a	**Medium Irrigation Projects Completed schemes**												
1	Zurreru Project	Kundur	382.68	263.65	7.051	696.01	35.99	696.01	8.45	---	613	613	
2	Gajuladinne Project	Hundri	1287	377	127.43	4313	87	---	26.5	36	12950	10241	
	Sub Total										**13563**	**10854**	
b	**On going schemes**												
1	Varadaraja swamy Gudi Project	Phapanasi	188.66	370	11.02	565.55	60.55	149.9	1.15	5.26	5351	---	
	Sub Total										**5351**		

B. STATEMENT OF MAJOR AND MEDIUM PROJECTS CONTEMPLATED

I	**Major Irrigation Projects**												
1	Guru Raghavendra Diversion Scheme	---	---	---	---	---	---	---	---	---	8000	---	
	Sugur			329.91	1.18								
	Poola Chinta			329.03	2.31								
	Belgal			324.89	1.5								
2	H.N.S.S. (Part)	---	---	---	---	---	---	---	---	---	32376	---	
	Sub Total												
II	**Medium Irrigation Projects**												
	Nil						Nil						
	Sub Total												

DISTRICT : ANANTAPUR

A. STATEMENT OF MAJOR AND MEDIUM PROJECTS COMPLETED AND ONGOING

Sl. No	Name of the Project	Name of the Vagu, Stream, River	Catch-ment Area sq.km.	FRL m	Gross Capacity at FRL M.cum	DAM Earth Dam m	DAM Spillway m	DAM Non-Overflow m	CANALS Left Main Canal km	CANALS Right Main Canal km	Irrigation Potential Ultimate ha	Irrigation Potential Created to end of VIII Plan (by 6/97) ha	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
I a	**Major Irrigation Projects Completed schemes**												
1	TBPHLC Stage I (Part)	Thungabhadra	6770.23	365.76	17.764	360	---	---	---	---	43334	45700	
	Sub Total										**43334**	**45700**	
b	**On going schemes**												
1	TBPHLC Stage II (Part)	---	---	---	---	---	---	---	---	---	58841	17170	
	Mid Pennar Dam	Pennar	6799	365.76	50	1121	210.3	396.24	96.56	51.9			
	Penna Ahobelam Resrvoir	Pennar	6165	443	3141.5	---	103.54	246.46	---	---			
2	Pulivendula Branch Canal	Chitravathi	5431	---	---	974	92.2	126	66.47	---	1904	1647	
	Sub Total										**104079**	**64517**	
II a	**Medium Irrigation Projects Completed schemes**												
1	Upper Pennar Project	Pennar	5244.75	536.44	51.281	3505.19	129.23	3316	5.79	26.4	4066	4066	
2	Vidyaranaya Swamy Gudi project	Pennar	60.27	---	---	---	102.37	---	---	---	81	81	
3	Chennaraya Swamy Gudi Project	Papagini	1429.67	587.34	4.814	417	50	---	6	7	364	364	
4	Pennar Kumudavati project	Pennar	1131.82	620.06	Diversion Anicut		131.67	---	6.44	14.48	2491	2491	
5	Bhairivanitippa Project	Vedavathi	14392.59	504.44	54.99	2151	187.75	---	25	18	4856	4856	
	Sub Total										**11858**	**11858**	
b	**On going schemes**												
1	Yogi Vemana Reservoir Project (Maddileru project)	Maddileru	1344.18	383	25.42	---	---	---	20.97	19.81	5215	---	
	Sub Total												

B. STATEMENT OF MAJOR AND MEDIUM PROJECTS CONTEMPLATED

I	**Major Irrigation Projects**												
1	H.N.S.S. (Part)	---	---	---	---	---	---	---	---	---	139622	---	
	Sub Total												
II	**Medium Irrigation Projects**												
	Nil						Nil						
	Sub Total												

A. STATEMENT OF MAJOR AND MEDIUM PROJECTS COMPLETED AND ONGOING

Sl. No	Name of the Project	Name of the Vagu, Stream, River	Catch-ment Area	FRL	Gross Capacity at FRL	DAM			CANALS		Irrigation Potential		Remarks
						Earth Dam	Spillway	Non-Overflow	Left Main Canal	Right Main Canal	Ultimate	Created to end of VIII Plan (by 6/97)	
			sq.km.	m	M.cum	m	m	m	km	km	ha	ha	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
I a	**Major Irrigation Projects Completed schemes**												
	NIL					NIL							
	Sub Total										**0**		
b	**On going schemes**												
1	Telugu Ganga Project	Krishna & Pennar		---	---	---	---	---	152	---	21043	---	Investment Clearance
	Sub Total										**21043**		not given by P.C.
II a	**Medium Irrigation Projects Completed schemes**												
1	Suvarnamukhi Anicut scheme	Suvarnamukhi	631.31	---	---	---	---	---	---	---	4128	4128	
2	Araniar Reservoir Projects	Araniar	58.6	85.67	52.49	3.6	27.43	77.41	4.7	4.2	2700	2700	
3	Kalangi Reservoir Project	Kalangi	70	67.67	6.82	3.75	0.221	---	1.27	12	1882	1882	
4	Pincha Reservoir Projects	Cheyyeru	84.77	304.88	9.28	270	68.9	123.78	---	---	1527	1527	
5	Mallimadugu Reservoir Projects	Suvarnamukhi	48.44	111.59	4.98	1334	52	169	---	---	1599	1599	
6	Siddalagandi Reservoir projects	Cheyyuru	27.37	547.4	1	1555	240.5	---	3.4	---	162	162	
7	Bahuda Reservoir Projects	Bahuda	435.12	614.17	10.704	792.5	85.34	---	7.6	1.7	1166	1166	
8	Pedderu Projects	Pennar	1421.24	481.5	15.86	---	590	130	17.37	17.67	1481	1481	
9	Krishnapuram projects	Pennar	435.46	614.17	11.27	792.5	85.34	---	7.6	1.7	2784	2480	
	Sub Total										**17429**	**17125**	
b	**On going schemes**												
	NIL					NIL							
	Sub Total										**0**		

B. STATEMENT OF MAJOR AND MEDIUM PROJECTS CONTEMPLATED

I	**Major Irrigation Projects**												
1	H.N.S.S. (Part)	---	---	---	---	---	---	---	---	---	56.658	---	
2	G.N.S.S. (Part)	---	---	---	---	---	---	---	---	---	64.777	---	
	Sub Total										**121.435**		
II	**Medium Irrigation Projects**												
	NIL					NIL							
	Sub Total												

ANNEXURE - XVII

THE DISTRICT-WISE STATUS OF MINOR IRRIGATION SOURCES

Sl. No.	Name of the District	Schemes under Operation			Schemes under Execution			
		Nos.	Ayacut		Nos.	Ayacut		Est.cost Lakh Rs.
			Ha	acres		Ha	acres	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	Adilabad	334	32227	79600	135	4238	10469	721
2	Ananthapur	364	53077	131100	97	993	2452	1558
3	Chittoor	729	61096	150908	616	15345	37903	1098
4	Cuddapah	308	35591	87909	131	11011	27198	326
5	East Godavari	322	38241	94456	79	217	536	90
6	Guntur	90	8121	20059	111	593	1466	296
7	Karim Nagar	629	64318	158864	94	8235	20341	873
8	Khammam	393	61594	152137	82	2073	5121	787
9	Krishna	324	39292	97050	23	2070	5112	895
10	Kurnool	159	25129	62070	83	975	2407	973
11	Mahabubnagar	654	59648	147331	134	6051	14947	232
12	Medak	628	55238	136437	248	2928	7232	593
13	Nalgonda	795	79610	196637	152	1402	3462	892
14	Nellore	766	12027	297009	90	3492	8626	400
15	Nizambad	501	47827	118132	45	596	1472	428
16	Prakasam	328	41109	101538	98	10624	26241	513
17	Rangareddy	267	32835	81102	102	568	1403	242
18	Srikakulam	1304	124969	308674	246	6369	15731	1191
19	Visakhapatanam	639	77708	191939	69	3821	9438	677
20	Vizianagaram	531	65674	162216	102	7118	17580	398
21	Warangal	786	98851	244162	99	918	2267	535
22	West Godavari	362	38412	94877	74	410	1012	274
	Total	**11213**	**1260812**	**3114207**	**2910**	**90047**	**222416**	**13992**

Source: Chief Engineer, Minor Irrigation, Irrigation & CAD Dept, Govt. of Andhra Pradesh

ANNEXURE - XVIII

GROWTH IN WELL POPULATION IN ANDHRA PRADESH

Sl.No.	Years	Tube wells/ Filter points	Dug wells with				Total No. of Wells	Gross area irrigated under wells ha.
			Oil Engines	Electric Motors	Mhotes	Total		
1	1971-72	34188	93101	103284	459150	655535	689723	803515
2	1972-73	35610	119959	154327	426737	701023	736633	838208
3	1973-74	44670	107831	160086	464370	732287	776957	948174
4	1974-75	49767	117989	178697	479355	776041	825808	1017723
5	1975-76	52580	129772	202242	460182	792196	844776	875393
6	1976-77	57618	198470	238750	356383	793603	851221	920161
7	1977-78	61555	176774	227691	409847	814312	875867	1001098
8	1978-79	64568	179886	240958	424662	845506	910074	1080995
9	1979-80	70471	220478	262065	430131	912674	983145	1102726
10	1980-81	72531	243491	289138	407677	940306	1012837	1124288
11	1981-82	74260	246439	309658	403123	959220	1033480	1159685
12	1982-83	79226	244481	330298	401465	976244	1055470	1197193
13	1983-84	82221	237994	358197	390137	986328	1068549	1212053
14	1984-85	77194	233866	478779	581954	1294599	1371793	1148589
15	1985-86	60212	208316	484377	486860	1179553	1239765	1161624
16	1986-87	89169	222079	557966	492800	1272845	1362014	1165606
17	1987-88	115904	293759	637827	400989	1332575	1448479	1321471
18	1988-89	130533	264023	608885	356920	1229828	1360361	1539438
19	1989-90	130533	264023	608885	356920	1229828	1360361	1646654
20	1990-91	130892	264627	632209	358403	1255239	1386131	1761000
21	1991-92	131352	265105	637931	361255	1264291	1395643	1929000
22	1992-93	201651	143564	818374	218351	1180289	1381940	1904490
23	1993-94	254879	147064	850997	196677	1194738	1449617	1912000

Source: Bureau of Economics and Statistics, Hyderabad.

ANNEXURE - XIX

ANDHRA PRADESH FARMERS' MANAGEMENT OF IRRIGATION SYSTEMS ACT

The following Act of the Andhra Pradesh Legislative Assembly received the assent of the Governor on the 7th April, 1997 and the said assent is hereby first published on the 9th April, 1997 in the Andhra Pradesh Gazette for general information:-

ACT No. 11 of 1997

AN ACT TO PROVIDE FOR FARMERS' PARTICIPATION IN THE MANAGEMENT OF IRRIGATION SYSTEMS AND FOR MATTERS CONNECTED THEREWITH OR INCIDENTAL THERETO.

Whereas the State of Andhra Pradesh is essentially an agricultural State depending on an efficient and equitable supply and distribution of water which is a National Wealth, ensuring optimum utilisation by farmers for improvement of agricultural production is the immediate need;

And whereas; scientific and systematic development and maintenance of irrigation infrastructure is considered best possible through farmers' organisations;

And whereas; such farmers' organisations have to be given an effective role in the management and maintenance of the irrigation system for effective and reliable supply and distribution of water.

Be it enacted by the Legislative Assembly of the State of Andhra Pradesh in the Forty-eighth year of the Republic of India as follows:

CHAPTER–1 : PRELIMINARY

Short title, extent and commencement

1. (1) This Act may be called the Andhra Pradesh Farmers' Management of Irrigation Systems Act, 1997.

(2) It extends to the whole of the State of Andhra Pradesh.

(3) It shall come into force on such date as the Government may, by notification in the Andhra Pradesh Gazette, appoint and they may appoint different dates for different areas and for different provisions.

Definitions

2. (1) In this Act, unless the context otherwise requires:-

(a) 'area of operation' in relation to farmers' organisation means a contiguous block of land in the command area of an irrigation system as may be notified for the purposes of this Act.

(b) 'ayacut road' means a road within the area of operation of a farmers' organisation for the purposes of irrigation and agriculture but does not include a road vested in a Gram Panchayat, Mandal Parishad, Zilla Parishad, Municipality, Municipal Corporation or Roads and Buildings Department of the Government.

(c) 'command area' means an area irrigated or capable of being irrigated either by gravitational flow or by lift irrigation or by any other method from a government or the corporation source and includes every such

area whether it is called 'ayacut' or by any other name under any law for the time being in force.

(d) 'competent authority' means the authority appointed under Section 21.

Act 12 of 1997

(e) 'corporation' means the Andhra Pradesh Water Resources Development Corporation constituted under the Andhra Pradesh Water Resources Development Corporation act; 1997;

(f) 'distributory system' means and includes'-

(i) all main canals, branch canals, distributories and minor canals constructed for the supply and distribution of water for irrigation;

(ii) all works, structures and appliances connected with the distribution of water for irrigation; and

(iii) all field channels and other related channels and structures under a pipe outlet.

(g) 'District Collector means the Collector of the district in which the irrigation system is situated and includes any officer specially notified by the Government to perform all or any of the functions of the District Collector under this Act;

(h) 'drainage system in relation to an irrigation system includes:-

(i) channels either natural or artificial, for the discharge of waste or surplus water and all works connected therewith or ancillary thereto:

(ii) escape channels from an irrigation or distribution system and other works connected therewith, but does not include works for removal of sewage;

(iii) all collecting drains and main drains to drain off surplus water from field drains; and

(iv) all field drains and related structures under pipe outlets.

(i) 'farmers' organisation' wherever it occurs, shall mean and include-

(i) water users' association at the primary level consisting of all the water users, as constituted under section 3;

(ii) distributory committee at the secondary level, as constituted under section 5; and

(iii) project committee at the project level, as constituted under section 7;

(j) 'field channel' ncludes a channel existing or to be constructed by the Government or by the land holders or by any agency to receive and distribute water from a pipe outlet.

(k) 'field drain' includes a channel excavated and maintained by the land holder or by any other agency, to discharge waste or surplus water from the land holding under a pipe outlet; and includes drains, escape channels and other similar works existing or to be constructed.

(l) 'Financial year' means a year commencing from the 1st April of the relevant year to the 31st March of the ensuing year.

(m) 'financing agency', means any commercial bank, or any co-operative society or any other bank or organisation established or incorporated under any law, for the time being in force, which lends money for the development of the area of operation of the farmers' organisation.

(n) 'Government' means the State Government of Andhra Pradesh.

(o) 'hydraulic basis' means the basis for identifying a viable irrigated area served by one or more hydraulic structures such as head works, distributories, minors, pipe outlets and the like.

(p) 'irrigation system' means such major, medium and minor irrigation system for harnessing water for irrigation and other allied uses from Government / or Corporation source and includes reservoirs, open head channels, diversion systems, anicuts, lift irrigation schemes, tanks, wells and the like;

Explanation:

1) 'Major Irrigation System' means irrigation system under Major Irrigation Project having irrigable command area of more than 10,000 hectares.
2) 'Medium Irrigation System' means irrigation system under Medium Irrigation Project having irrigable command area of more than 2,000 hectares and upto 10,000 hectares.
3) 'Minor Irrigation System' means irrigation system under minor irrigation project having irrigable command area upto 2,000 hectares.

Act 26 of 1971

(q) 'land holder' means an owner and or a tenant recorded as such in the record of rights – under the Andhra Pradesh Record of Rights in Land Act 1971 in respect of land in the notified ayacut area of an irrigation system.

(r) 'maintenance' means execution of such works on the irrigation system as are necessary to ensure that the physical system designed to the standards operates for proper distribution of water to the land holders in the area of operation.

(s) 'notification' means a notification published in the Andhra Pradesh Gazette, and the expression 'notified' shall be construed accordingly.

(t) 'operational plan' means a schedule of irrigation deliveries with details of the mode and duration of supplies drawn up for regulation of irrigation in the command area of an irrigation system

(u) 'Prescribed' means prescribed by the Government by rules made under this Act.

(v) 'Warabandi means a system of distribution of water allocation to water users by turn, according to an approved schedule indicating the day, duration and the time of supply.

(w) 'Water allocation' in relation to an irrigation system means distribution of water determined from time to time by a farmers' organisation in its area of operation.

(x) "Water user' means and includes any individual or body corporate or a society using water for agriculture, domestic, power, non-domestic, commercial, industrial or any other purpose from a government or the corporation source of irrigation.

Act 15 of 1984

(2) The words and expressions used in this act, but not defined, shall have the same meaning assigned to them in the Andhra Pradesh Irrigation Utilisation and Command Area Development Act, 1984.

CHAPTER–II : FARMERS' ORGANISATION

Delineation of water users' area and constitution of an association.

3. (1) The District Collector may, by notification and in accordance with the rules

made under this Act, in this behalf, delineate every command area under each of the irrigation systems on a hydraulic basis which may be administratively viable; and declare it to be a water users' area for the purpose of this Act;

Provided that in respect of the command area under the minor and lift irrigation systems, the entire command area may, as far as possible, form a single water users' area.

(2) Every water users' area shall be divided into territorial constituencies, which shall not be less than four but not more than ten, as may be prescribed.

(3) There shall be a water users' association called by its local distinct name for every water users' area delineated under sub-section (1).

(4) Every water users' association shall consist of the following members, namely

i.) All the water users who are land holders in a water users area;

Provided that where both the owner and the tenant are land holders in respect of the same land, the tenant;

ii.) All other water users co-opted in a water users' area;

iii.) Members specified in clause (i) and (ii) shall constitute the general body for a water users' association;

iv.) A person eligible to become a member of more than one territorial constituency of a water users' association under clause (i) shall be entitled to be a member of only one territorial constituency and he shall exercise his option thereof as prescribed;

v.) Members specified in clause (1) shall alone have the right to vote.

Election of President and Members of the Managing Committee of Water Users' Association.

(1) There shall be a Managing Committee for every water users' association.

(2) The District Collector shall make arrangements for the election of President of the managing committee of the water users' association by direct election by the method of secret ballot in the manner prescribed.

(3) The District Collector shall also cause arrangements for the election of a managing committee consisting of one member from each of the territorial constituencies of a water users' area, by the method of secret ballot in the manner prescribed.

(4) If at an election held under sub-sections (2) and (3), the president or the members of the territorial constituencies of water users' association are not elected, fresh elections shall be held in the manner prescribed;

Provided that the Government for the reasons to be recorded in writing may, from time to time, postpone elections.

(5) The President and the members of the managing committee shall, if not recalled earlier, be in office for a period of three years, from the date of the first meeting.

(6) The managing committee shall exercise the powers and perform the function of the water users' association.

Delineation of Distributory area and constitution of the Distributory Committee.

5. (1) The Government may, by notification and in accordance with the rules made in this behalf, delineate every command area of the irrigation system, comprising of one or more water users' associations, and declare it to be a distributory area for the purpose of this Act.

(2) There shall be a distributory committee called by its local distinct name for every distributory area declared as such under sub-section (1).

(3) All the Presidents of the water users' association in the distributory area, so long as they hold such office, shall constitute the general body of the committee.

Election of President and Constitution of Managing Committee

6. (1) There shall be a managing committee for every distributory committee.

(2) The District Collector shall cause arrangements, in the manner prescribed, for the election by the method of secret ballot of the President and members of the managing committee who shall not be more than five from among the members of the general body of the distributory committee. Provided that the Government may, for the reasons to be recorded in writing, from time to time postpone elections.

(3) If, at an election held under sub-section (2), the President and the members of the managing committee are not elected, fresh elections shall be held in the prescribed manner.

(4) The term of office of the President and the members of the managing committee shall, if not recalled earlier, be coterminous with the term of the general body specified in sub-section (3) of section 5.

(5) The managing committee shall exercise the powers and perform the functions of the distributory committee.

Delineation of Project area and constitution of Project Committee.

7. (1) The Government may by notification and in accordance with the rules made under this act in this behalf, delineate every command area or part thereof, of an irrigation system and declare it to be a project area for the purposes of this Act.

(2) There shall be a project committee called by its distinct name for every project area declared under subs-ection (1).

(3) All the Presidents of the distributory committees in the project area, so long as they hold such office, shall constitute the general body for the project committee.

Election of Chairman and constitution of the Managing Committee

8. (1) There shall be a managing committee for every project committee.

(2) The District Collector shall cause arrangements in the manner prescribed for election by the method of secret ballot of chairman and managing committee consisting of not more than nine members from among the members of the general body of the project committee;

Provided that the Government for the reasons to be recorded in writing may, from time to time, postpone elections.

(3) If, at an election held under sub-section (2), the chairman and the members of the managing committee are not elected, fresh elections shall be held in the prescribed manner.

(4) The term of office of the chairman and the members of the managing committee shall, if not recalled earlier, be coterminous with the term of general body specified in sub-section (3) of section 7.

(5) The managing committee shall exercise the powers and perform the functions of the project committee.

Apex Committee

9 (1) The Government may, by notification, constitute an Apex Committee with such number of members as may be considered necessary.

(2) The Committee, constituted under sub-section (1) may exercise such powers and functions as may be necessary to –

a) Lay down the policies for implementation of the provisions of this act; and

b) give such directions to any farmers' Organisation, as may be considered necessary, in exercising their powers and performing their functions in accordance with the provisions of this Act.

Procedure for recall

10. (1) A motion for recall of a chairman or president or member of a managing committee, as the case may be, of a farmers' organisation may be made by giving a written notice as may be prescribed, signed by not less than one-third of the total number of members of the farmers' organisation, who are entitled to vote.

Provided that no notice of motion under this section shall be made within one year of the date of assumption of office by the person against whom the motion is sought to be moved.

(2) If the motion is carried with the support of majority of the members present and voting at a meeting of the general body specially convened for the purpose, the District Collector or the Government as the case may be, shall by order remove him from office and the resulting vacancy shall be filled in the same manner as a casual vacancy.

Constitution of sub-committees in farmers' organisation

11. The managing committee of a farmers' organisation may constitute sub-committees to carry out all or any of the functions vested in each organisation under this Act.

Farmers' Organisation to be a Body Corporate.

12. Every farmers' organisation shall be a body corporate with a distinct name having perpetual succession and a common seal and subject to the provisions of this Act vested with the capacity of entering into contracts and of doing all things necessary, proper or expedient for the purposes for which it is constituted and it shall sue or to sued in its corporate name represented by the chairman or the president, as the case may be:

Provided that no farmers' organisation shall have the power to alienate in any manner, any property vested in it.

Changes in Farmers' Organisation

13. The Government may in the interest of a farmers' organisation in the command area by notification and in accordance with the rules made in this behalf –

a) form a new farmers' organisation by separating the area from any farmers' organisation;

b) increase the area of any farmers' organisation;

c) diminish the area of any farmers' organisation;

d) alter the boundaries of any farmers' organisation; or

e) cancel a notification issued under this Act for rectifying any mistake:

Provided that no such separation, increase, diminution, alteration and cancellation shall be effected unless a reasonable opportunity is given to the organisation likely to be effected.

Disqualifications of Candidates or Members

14. (1) No village servant and no officer or servant of the Government of India or any State Government or of a local authority or an employee of any institution receiving aid from the funds of the Government shall be qualified for being chosen as or for being a chairman, or president or a member of a managing committee.

Explanation: For the purpose of this section the expression 'village servant' means in relation to –

i.) The Andhra Area, any person who holds any of the village offices of neeruganti, neeradi, vetti, kawalkar, toti, talayari, tandalagar, sathsindhi or any such village office by whatever designation it may be locally known;

ii.) The Telangana Area, any person who holds any of the village offices of neeradi, kawalkar, sathsindhi or any such village office by whatever designation it may be locally known.

(2) No person who has been convicted by a criminal court for any offence involving moral turpitude committed under any law for the time being in force shall be qualified for being chosen in or for being a chairman or President or a member of a managing committee.

(3) A person shall be disqualified for being chosen as a chairman or a president or a member of the managing committee if on the date fixed for scrutiny of nominations for election, or on the date of nomination he is-

a) of unsound mind and stands so declared by a competent court;

b) an applicant to be adjudicated as an insolvent or an undischarged insolvent; or

c) a defaulter of land revenue or water tax or charges payable either to the Government or to the farmers' organisation.

d) interested in a subsisting contract made with, or any work being done for, the Gram Panchayat, Mandal Parishad, Zilla Parishad or any State or Central Government or the farmers' organisation :

Provided that a person shall not be deemed to have any interest in such contract or work by reason only of his having share or interest in –

i.) a company as a mere share-holder but not as a director.

ii.) any lease, sale or purchase of immovable property or any agreement for the same; or

iii.) any agreement for the loan of money or any security for the payment of money only; or

iv.) any newspaper in which any advertisement relating to the affairs of the farmers' organisation is inserted.

Explanation: For the removal of doubts it is hereby declared that where a contract is fully performed it shall not be deemed to be subsisting merely on the ground that the Gram Panchayat, Mandal Parishad, Zilla Parishad, the farmers' organisation, the State or Central Government has not performed its part of the contractual obligations.

(4) A chairman or a president or a member of managing committee shall also become disqualified to continue in office if he, -

a) is convicted in a criminal case involving moral turpitude; or

b) absents for three consecutive meetings without reasonable cause:

Provided that such disqualification under item (b) shall not apply in the case of women who are in an advanced stage of pregnancy and for a period of three months after delivery, and shall cease to hold the office forthwith.

(5) A person having more than two children shall be disqualified for election or for continuing as a Chairman or a President or a member of the Managing Committee:

Provided that the birth within one year from the date of commencement of this Act, hereinafter in this section referred to as the date of such commencement, of an additional child shall not be taken into consideration for the purposes of this section:

Provided further that a person having more than two children (excluding the child if any born within one year from the date of such commencement) shall not be disqualified under this section for so long as the number of children he had on the date of such commencement does not increase.

Filling up of Vacancies

15. (1) A vacancy arising either due to disqualification under sub-section (4) of section 14 or due to death or resignation or by any reason, such vacancy shall be filled up by nomination in the following manner:-

a) a vacancy in the water users' association shall be filled, by nomination by the managing committee of the distributory committee in the manner prescribed.

b) a vacancy in the distributory committee shall be filled by nomination by the managing committee of the project committee in the manner prescribed; and

c) a vacancy in the project committee shall be filled, by nomination either by the apex Committee or by the Government, as the case may be, in the manner prescribed.

(2) The District Collector shall take necessary steps to conduct elections to fill up any vacancy caused within a period of one month from the date of occurrence of such vacancy.

(3) The term of office of a member or a President or a Chairman of the farmers' organisation, elected under sub-section (2), shall expire at the time at which it would have expired, if he had been elected at the ordinary election.

CHAPTER–III : OBJECTS AND FUNCTIONS OF THE FARMERS' ORGANISATIONS

Objects

16. The objects of the farmers' organisation shall be to promote and secure distribution of water among its users, adequate maintenance of the irrigation system, efficient and economical utilisation of water to optimise agricultural production, to protect the environment, and to ensure ecological balance by involving the farmers, inculcating a sense of ownership of the irrigation system in accordance with the water budget and the operational plan.

Functions of Water Users' Association.

17. The water users' association shall perform the following functions, namely:-

a) To prepare and implement a warabandi schedule for each irrigation season, consistent with the operational plan, based upon the entitlement, area, soil and cropping pattern as approved by the distributory committee, or as the case may be, the project committee;

b) To prepare a plan for the maintenance of irrigation system in the area of its operation at the end of each crop season and carry out the maintenance works of both distributory system and minor and field drains in its area of operation with the funds of the association from time to time.

c) To regulate the use of water among the various pipe outlets under its area of operation according to the warabandi schedule of the system;

d) To promote economy in the use of water allocated;

e) To assist the revenue department in the preparation of demand and collection of water rates;

f) To maintain a register of landholders as published by the revenue department;

g) To prepare and maintain a register of co-opted members;

h) To prepare and maintain an inventory of the irrigation system within the area of operation;

i) To monitor flow of water for irrigation.

j) To resolve the disputes, if any, between the members and water users in its area of operation.

k) To raise resources;

l) To maintain accounts;

m) To cause annual audit of its accounts;

n) To assist in the conduct of elections to the managing committee;

o) To maintain other records as may be prescribed;

p) To abide by the decisions of the distributory and project committees;

q) To conduct general body meetings, as may be prescribed.

r) To encourage avenue plantation on canal bunds and tank bunds by leasing such bunds; and

s) To conduct regular water budgeting and also to conduct periodical social audit, as may be prescribed.

Functions of Distributory Committee

18. The distributory committee shall perform the following functions; namely:-

a) To prepare an operational plan based on its entitlement, area, soil, cropping pattern at the beginning of each irrigation season, consistent with the operational plan prepared by the project committee;

b) To prepare a plan for the maintenance of both distributories and medium drains within its area of operation at the end of each crop seasons and execute the maintenance works with the funds of the committee from time to time.

c) To regulate the use of water among the various water users' associations under its area of operation;

d) To resolve disputes, if any between the water users' associations in its area of operation;

e) To maintain a register of water users association in its area of operation;

f) Maintain an inventory of the irrigation system in the area of its operation, including drains;

g) To promote economy in the use of water allocated;

h) To maintain accounts

i) To cause annual audit;

j) To maintain other records as may be prescribed;

k) To monitor the flow of water for irrigation;

l) To conduct general body meetings as may be prescribed;

m) To abide by the decisions of the project committee;

n) To cause regular water budgeting and also the periodical social audit as may be prescribed;

o) To assist in the conduct of elections to the managing committee; and

p) To encourage avenue plantations in its area of operation;

Functions of Project Committee

19 The Project committee shall perform the following functions; namely :-

a) To approve an operational plan based on its entitlement, area, soil, cropping pattern as prepared by the competent authority in respect of the entire project area at the beginning of each irrigation season;

b) To approve a plan for the maintenance of irrigation system including the major drains within its area of operation at the end of each crop season and execute the maintenance works with the funds of the committee from time to time;

c) To maintain a list of the distributory committees and water users' association in its area of operation;

d) To maintain an inventory of the distributory and drainage systems in its area of operation;

e) To resolve disputes if any, between the distributory committees;

f) To promote economy in the use of water;

g) To maintain accounts;

h) To cause annual audit to its accounts.

i) To maintain other records as may be prescribed

j) To conduct general body meetings as may be prescribed;

k) To cause regular water budgeting and also the periodical social audit as may be prescribed; and

l) To encourage avenue plantation in its area of operation.

Power to levy and collect fee

20 A farmers' organisation may, for carrying out the purposes of this act and for achieving the objects of the organisation and performing its functions, levy and collect such fees as may be prescribed from time to time.

Appointment of competent authority and his functions

21 (1) The Government may by notification appoint such officer from the irrigation and Command Area Development Department, or any other Department or Corporation including Irrigation Development Corporation, as they consider necessary, to be the competent authority to every farmers' organisation for the purpose of this Act.

(2) The competent authority appointed under sub-section (1) shall be responsible to the respective farmers' organisation in the implementation and execution of all decisions taken by the farmers' organisation.

CHAPTER – IV : RESOURCES

Resources of Farmers' Organisation

22. The funds of the farmers' organisation shall comprise of the following, namely:-

i.) Grants received from the Government as a share of the Water tax collected in the area of operation of the farmers' organisation;

ii.) Such other funds as may be granted by the State and Central Government for the development of the area of operation;

iii.) Resources raised from any financing agency for undertaking any economic development activities in its area of operation;

iv.) Income from the properties and assets attached to the irrigation system within its area of operation;

v.) Fees collected by the farmers' organisation for the services rendered in better management of the irrigation system; and

vi.) Amounts received from any other source.

CHAPER – V : OFFENCES AND PENALTIES

Offences and Penalties

23. Whoever without any lawful authority does any of the following acts, namely:-

a) Damages, alters, enlarges, or obstructs any irrigation system;

b) Interferes with, increases, or diminishes the water supply in, or the flow of water from, through, over or under any irrigation system;

c) Being responsible for the maintenance of the irrigation system neglects to take proper precautions for the prevention of wastage of the water thereof or interferes with the authorised distribution of water there from or uses water in an unauthorised manner, or in such manner as to cause damage to the adjacent landholdings;

d) Corrupts or fouls, water of any irrigation system so as to render it less fit for the purposes for which it is ordinarily used;

e) Obstructs or removes any level marks or water gauge or any other mark or sign fixed by the authority of a public servant; and

f) Opens, shuts, or obstructs or attempts to open, shut or obstruct any sluice or outlet or any other similar contrivance in any irrigation system, shall, on conviction, be punished with imprisonment which may extend to two years or with fine which may extend to five thousand rupees or with both.

Punishment under other laws not barred

24 Nothing in this Act shall prevent any person from being prosecuted and punished under any other law for the time being in force for any act or omission made punishable by or under this Act.

Provided that no person shall be prosecuted and punished for the same offence more than once.

Composition of offences

25 (1) A farmers' organisation may accept from any person who committed or in respect of whom a reasonable belief can be inferred that he has committed an offence punishable under this Act or the rules made thereunder, a sum of money not exceeding rupees one thousand by way of composition for such offence.

(2) On payment of such sum of money, the said person, if in custody, shall be discharged and no further proceedings shall be taken against him in regard to the offence, so compounded.

CHAPTER – VI : SETTLEMENT OF DISPUTES

Settlement of disputes

26 (1) Any dispute or difference touching the constitution, management, powers or functions of a farmers' organisation arising between members; shall be determined by the managing committee of the farmers' organisation.

(2) Any such dispute or difference arising between a member and the managing committee of a water users' association or between two or more water users'

associations shall be determined by the managing committee of the distributory committee.

(3) Any such dispute or difference arising between a member and the managing committee of a distributory committee or between two or more distributory committees shall be determined by the managing committee of the project committee.

(4) Any such dispute or difference arising between a member and the managing committee of a project committee or between two or more project committees shall be determined by the apex committee, whose decision shall be final.

(5) Every dispute or difference under this section shall be disposed of within fifteen days from the date of reference of the dispute or difference.

Appeals

27 (1) A party to a dispute or difference aggrieved by any decision made or order passed by the managing committee of a water users' association may appeal to the managing committee of the distributory committee, whose decision thereon shall be final.

(2) Any party to a dispute or difference aggrieved by any decision made or order passed by the managing committee of a distributory committee may appeal to a project committee, whose decision thereon shall be final

(3) Any party to a dispute or difference aggrieved by any decision made or order passed by the managing committee of a project committee may appeal to the apex committee, whose decision thereon shall be final.

(4) Any appeal under sub-section (1) or sub-section (2) or sub-section (3) shall be preferred within 15 days of communication of the decision or the order to the person aggrieved.

(5) Every appeal under this section shall be disposed of within 15 days from the date of filing of the appeal.

CHAPTER – VII : MISCELLANEOUS

Records

28. (1) Every farmers' organisation shall keep at its office the following accounts, records and documents, namely :-

a) An up -to –date copy of this Act

b) a map of the area of operation of the farmers' organisation along with map of the structures and distributory networks prepared in consultation with the irrigation department;

c) a statement of the assets and liabilities;

d) minutes book;

e) books of account showing receipt and payments;

f) books of account of all purchases and sales of goods by the farmers' organisations;

g) register of measurement books, level field books, work orders and the like;

h) copies of audit reports and enquiry reports;

i) all such other accounts, records and documents as may be prescribed from time to time.

2. The books of accounts and other records shall be open for information to the members of the farmers' organisation.

Audit

29 Every farmers' organisation shall get its accounts audited in the manner prescribed.

Recovery of dues

30 All the amounts payable or due to a farmers' organisation shall be recovered as arrears of land revenue.

Meetings

31 The meetings of the farmers' organisation and the managing committees thereof, at such intervals, the procedure, the presidency and the Quorum thereof and the cessation of membership thereof shall be, as may be prescribed.

Registration:

32 1) A member of managing committee of a farmers' organisation may resign his office by a letter sent by registered post or tendered in person to the chairman or president of the managing committee concerned.

2) The president of the managing committee of a water users' association may resign his office by a letter sent by registered post or tendered in person to the President of the distributory committee concerned.

3) The president of the managing committee of a distributory committee may resign his office by a letter sent by registered post or tendered in person to the chairman of the project committee concerned.

4) The chairman of the managing committee of a project committee may resign his office by a letter sent by registered post or tendered in person to the chairman of the apex committee.

5) Such resignation as above mentioned shall take effect from the date of its acceptance or on the expiry of 30 days from the date of its receipt whichever is earlier.

Appointment of a Commissioner

33 (1) The Government may by notification appoint a Commissioner to exercise general control and superintendence over the competent authorities and the District Collector in performance of their functions under this Act or the rules made thereunder.

(2) The powers to be exercised and the functions to be performed by the Commissioner shall be such as may be prescribed.

Transitional Arrangements

34. The Government may by notification appoint an officer or officers to exercise the powers and perform the functions of a farmers' organisation and the managing committee thereof till such time such farmers' organisation is duly constituted or reconstituted and such managing committee assumes office under the provisions of this Act.

Authentication of orders and documents of the Farmers' Organisation

35. All permissions, orders, decisions, notices and other documents of the farmers' organisation shall be authenticated by the signature of the chairman or president of the farmers' organisation or any other member of the managing, committee authorised by the managing committee in this behalf.

Acts not to be invalidated by informality or vacancy etc.

36. No act or proceedings of the managing committee of a farmers' organisation shall be invalid by reason only of the existence of any vacancy in, or defect in the constitution of, the said committee.

Deposit and Administration of the funds

37. 1) The farmers' organisation shall keep their funds in a Nationalised Bank or a Co-operative Bank namely a Primary Agricultural Co-operative Society or the District Co-operative Central Bank or the Andhra Pradesh State Co-operative Central Bank.

2) The funds shall be applied towards meeting of the expenses incurred by the managing committee of the concerned farmers' organisation in the administration of this Act and for no other purpose.

Sinking Fund

38. 1) The managing Committee of the farmers' organisation shall maintain a sinking fund for the repayment of moneys borrowed and shall pay every year into the sinking fund such sum as may be sufficient for repayment within the period fixed of all moneys so borrowed.

2) The sinking fund or any part thereof shall be applied in or towards, the discharge of the loan for which such fund was created, and until such loan is wholly discharged, it shall not be applied for any other purpose.

Budget

39 The managing committee of a farmers' organisation shall prepare in such form in every financial year a budget in respect of the financial year next, showing the estimated receipts and expenditure of the committee and shall place before the general body of the farmers' organisation for its approval as may be prescribed.

Protection of acts done in good faith

40 No suit, prosecution or other legal proceedings shall be instituted against any person for anything which is, in good faith done or intended to be done under this Act or under the rules made thereunder.

41. Power to remove difficulties:

1) If any difficulty arises in giving effect to the provisions of this Act or as to the first constitution or reconstitution of any farmers' organisation after the commencement of this Act, the Government, as the occasion may require, by order published in the Andhra Pradesh Gazette, do anything which appears to them necessary for removing the difficulty.

2) All orders made under sub-section (1) shall as soon as may be, after they are made, be placed on the table of the legislative assembly of the state and shall be subject to such modifications by way of amendments or repeal as the Legislative Assembly may make either in the same session or in the next session.

Savings

42. 1) Nothing contained in this Act shall affect the rights or properties vested in a Gram Panchayat, Mandal Parishad, Zilla Parishad, Municipality or Municipal Corporation under any law for the time being in force.

2) Nothing contained in this Act shall apply to the minor water bodies in the Scheduled Areas in the State of Andhra Pradesh.

Power to make rules

43. 1) The State Government may, by notification in the Official Gazette, make rules to carryout the purposes of this Act.

2) Every rule made under this Act shall immediately after it is made, be laid before the Legislative Assembly of the State, if it is in session and if it is not in session, in the session immediately following for a total period of fourteen days which may be comprised in one session or in two successive sessions, and if, before the expiration of the session in which it is so laid or the session immediately following, the Legislative Assembly agrees in making any modification in the rule or in the annulment of the rule, the rule shall, from the date on which the modification or annulment is notified, have effect only in such modified form or shall stand annulled as the case may be, so however, that any such modification or annulment shall be without prejudice to the validity of anything previously done under that rule.

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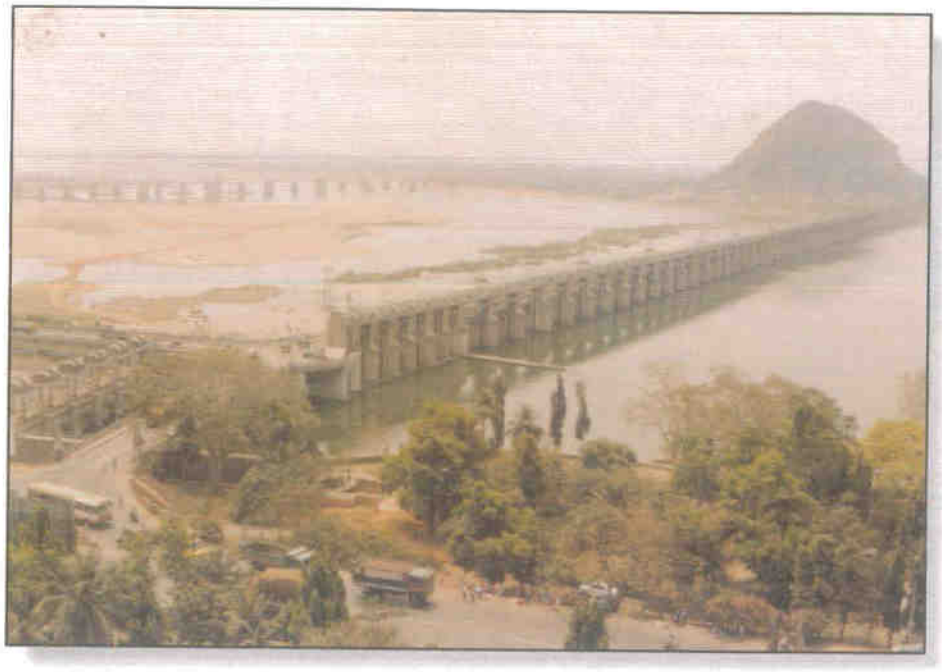
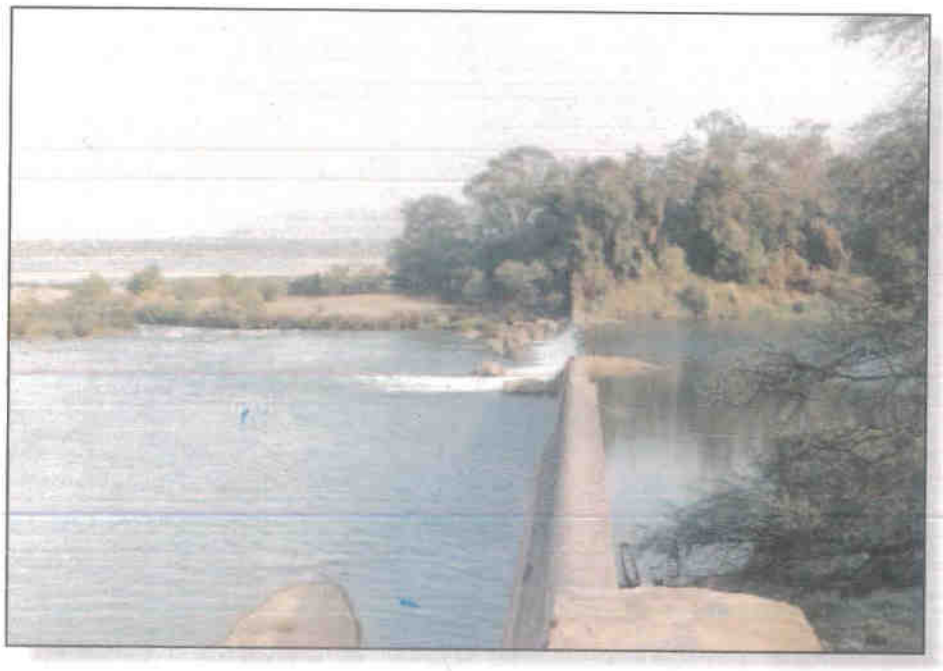


Prakasam Barrage at Vijaywada



Top view of Branch Anicut at Dummagudem

A view of Tungabhadra Dam (Bellary Dt.)

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