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GROUNDWATER BALANCE STUDY IN CENTRAL GODAVARI DELTA OF ANDHRA PRADESH

(PART - I)

PROCESSING AND ANALYSIS OF DATA

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KAKINADA
ANDHRA PRADESH

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PREFACE

History shows that the usual practice in ground water development and utilisation has been to treat the problems and initiate action programmes on an individual, piecemeal basis. Those involved often fail to recognise the benefits of complete management of the ground water resource and its integration into the the total water resource system. Each user has its own goals and these may be inconsistant or even in conflict with the goals of other users in the area. For example, a heavy pumpage of ground water for meeting various water requirements will result in lowering of water table and thereby giving rise to the sea water intrusion problem in coastal aquifers, adverse salt balance and land subsidence where draft results in compaction of sediments. On the other hand, if the recharge exceeds withdrawl, the rising water table may necessiate the planning of conjunctive use. Successful management of ground water, therefore, demands full considerations of all implications of aqufier development, water quality, hydrogeochemical aspects and where appropriate coordinated operation of surface and ground water supplies.

The development and management of any ground water basin in a scientific manner involves the ground water balance or hydrological balance analysis as a first step. Ground water balance study enables the assessment of quantity of water available for development and assists in predicting the consequences of artificial changes in the regime of ground water basin. In coastal aquifers having salt water intrusion problems, a fairly accurate estimation on available quantity of fresh water is possible. With water balance data, it is possible to compare individual sources of water in a system over different periods of

time and to establish the degree of their influence on variations in the water regime. Water balance analysis also enables evaluation of one unknown component of water balance equation from all other known components.

Keeping the above objectives in mind, the ground water balance study in Central Godavari Delta has been taken up. Since the study involves a variety of data on various aspects such as location, extent, topography, all forms of water inflow and outflow and their quantities, hydrogeology, water quality and agricultural statistics etc, it is planned to collect, compile, analyse and present all the data in one report. The data thus compiled will be helpful in conducting groundwater balance and other relevant studies in future also. The present report is an endeavour in this direction and forms **Part I of the Ground Water Balance Study in Central Godavari Delta.** The Part II of the study report deals wih the methods of computation of various components of water balance equation and their estimation.

The data for the report have been collected from various Depts. of Govt. of Andhra Pradesh such as Irrigation Dept, Revenue Dept, A P State Ground Water Dept, District Planning Offices and Agriculture Dept. The cooperation rendered by these Depts. during the data collection work is fully acknowledged.

The report has been prepared by **Sri J V Tyagi, Scientist - C** who was assited by **Sri Y Ramji Satyaji Rao, Scientist 'B', Sri T Thomas, SRA and Sri T Vijay, RA,** during the course of field data collection and analysis. Assistance was also provided by Sri S M Saheb, SRA and Sri U V N Rao, RA during the processing of data. The overall guidance was provided by **Dr P V Seethpathi, Scientist 'F'.**

Satish Chandra

(SATISH CHANDRA)

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1.0 INTRODUCTION

1.1 General :

The maximum development of groundwater resource on sustainable basis requires proper planning and management in terms of an entire groundwater basin. When water supply from groundwater reservoir begins with a water well drilled in the basin, people presume that production of water will continue indefinitely with time. As wells become more numerous and rate of extraction increases with time, development of basin reaches and exceeds its natural recharge capability. Continued development thereafter without a management plan could eventually deplete the groundwater resource affecting the water supply adversely. Thus in order to have continuous and beneficial groundwater supply on a long term basis, it is to be ensured that a balance exists between the recharge to and discharge from the basin. Any groundwater basin developed on above basic hydrologic principle can be assumed to function beneficially and indefinitely just as a surface water reservoir. The basic hydrologic equation which permits evaluation of groundwater balance can be stated in its simplest form as below.

$$\text{Recharge} = \text{Discharge} \pm \Delta S$$

Where ΔS is the change in groundwater storage during the period of study. The recharge to groundwater reservoir includes recharge due to precipitation, seepage from streams, lakes, canals and reservoir, subsurface flow, deep percolation from irrigation etc. Evaluation of these components is a pre-requisite for estimating the optimum level of groundwater utilisation in any basin.

1.2 Importance of the Study:

Groundwater balance studies are effected in order to ascertain the quantity of water available for development in a region and this can be done only after identification of the various physical features of the hydrologic system involved, their hydraulic characteristics and their hydraulic inter-relationships. Clearly, after the groundwater system is fully understood, the results can be combined with data regarding the amounts of water transitting the stream network in the relevant region as well as precipitation in it in order to furnish the basis of a water balance analysis. Knowledge of water balance assists the prediction of the consequences of artificial changes in the regime of groundwater basins. For example if indiscriminate groundwater draft is allowed or in other words, the discharge exceeds the recharge, the groundwater levels will decline resulting in crop failures, adverse salt balance, sea water intrusion in coastal aquifers and land subsidence in areas where draft result in compaction of sediments. In coastal aquifers where salt water intrusion is a common phenomenon, the readily usable fresh water storage in the ground water basin can be assessed by accomplishing the groundwater balance. With water balance data, it is possible to compare individual sources of water in a system over different periods of time and to establish the degree of their effect on variations in the water regime. Further, the initial analysis used to compute individual water balance components and the coordination of these components in the hydrologic balance equation make it possible to identify deficiencies in the distribution of observational stations and

discover systematic errors of measurements. Finally, water balance study enables evaluation of one unknown component of water balance from all other known components.

1.3 Scope of the Present Report

Keeping the above aspects in mind, it is planned to prepare the seasonal groundwater balance of Central Godavari Delta in East Godavari District of Andhra Pradesh. Since the study involves a variety of data on various aspects such as location, extent and topography, all forms of water inflow and outflow and their quantities, agricultural statistics, hydrogeology and water quality etc., it is proposed to collect, compile, analyse and present all the data in one report. The data thus, compiled will be helpful for conducting other relevant studies in future also. The present report is an endeavour in this direction and forms PART-I of the Groundwater Balance study in Central Godavari Delta. The data on various aspects have been collected from different Govt. offices and other field agencies for 11 years i.e. from 1980 to 90. Preliminary processing and analysis of data has been carried out and map and charts wherever necessary prepared and presented in the report for further analysis. While different components of recharge, discharge and change in storage as involved in groundwater balance equation have been identified in the present report, their estimation and preparation of groundwater balance will be discussed in Part II of the study report.

1.4 Data Requirements for Groundwater Balance Study

The following data are generally required to evaluate the hydrological equilibrium of a groundwater basin.

1. Map of the basin with all the rivers marked on it,
2. Map showing type and location of raingauges,
3. Map showing location of observation wells,
4. Map showing canal network in the basin,
5. Monthly rainfall data from a well distributed network of raingauges over the basin,
6. Groundwater levels in observation wells spread over the basin,
7. Record of canal discharges at different control points,
8. Length, cross-section and other design details for all canals, distributories and minors and their command areas,
9. Total number of wells and average groundwater draft per well per year,
10. Land use pattern in the basin,
11. Cropping pattern,
12. Unit values of water requirements of different crops,
13. Average river bed gradient and monthly river stages at different points,
14. Location of tanks, reservoirs etc and their monthly water levels,
15. Data on geology and aquifer characteristics,
16. Data on evaporation, temperature, relative humidity, sunshine hours, wind velocity etc.

For all the data which involve time factor, it is required to have information for each time interval of computation and this data is needed for the entire duration for which water balance computations are to be performed.

1.5 Sources of Data :

The Irrigation Dept. of A P State Government controls the irrigation system in the study area and as such the data pertaining to canal system, irrigation water inflow to and outflow from the area, command area and irrigation pattern were collected from Irrigation Dept. The monthly groundwater levels including location of observation wells, chemical quality of water samples, pumping test data and other such relevant information were provided by the A P State Ground Water Dept. The monthly data for various raingauges, stations located in East Godavari and West Godavari Districts were collected from the Office of Chief Planning Officer, of concerned district. The agricultural statistics , e.g. land use pattern, cropping pattern and area irrigated by tubewells along with their numbers have been collected from the Dept. of Agriculture, Govt. of Andhra Pradesh.

2.0 STUDY AREA

2.1 General :

The area selected for groundwater balance study constitutes a part of the delta system of river Godavari in Andhra Pradesh. The River Godavari is one of the largest perenniel rivers of India and flows from west to east across the peninsula. Towards the end of its course, it pierces the Eastern Ghats and flows into the plains between the Ghats and the sea. Upto Dowleswaram in East Godavari Dist. of Andhra Pradesh, the river is known as Akhanda Godavari. Below this point the river bifurcates into two branches, the Gowthami Godavari being the eastern and the Vasista Godavari being the western branch. In between the two branches lies the rich alluvial deposits and is known as Godavari Central Delta. As the western branch of the river, i.e. Vasista again bifurcates in its lower reach at Gannavaram into two branches, the Godavari Central delta is also divided into two parts. Several small islands are also formed due to a number of streamlets of rivers Gowthami and Vasishta.

2.2 Location and Areal Extent:

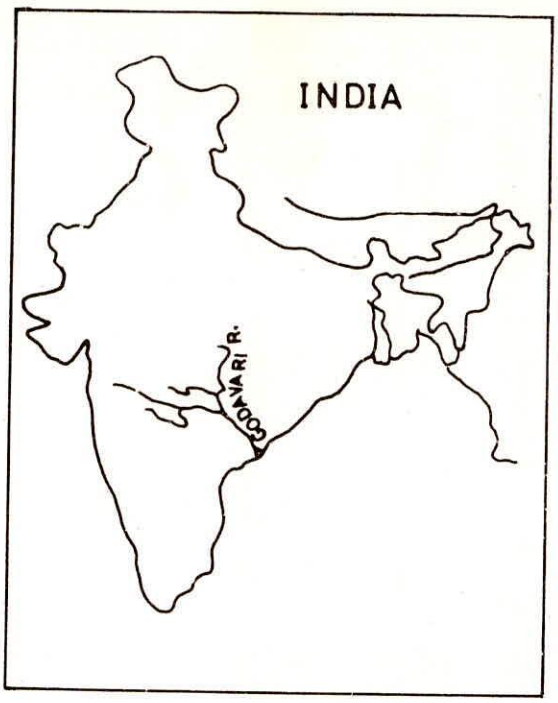
The study area lies in East Godavari Dist. of Andhra Pradesh State and forms a part of Central Godavari Delta with its hydrological boundaries as river Gowthami Godavari in the east, river Vasistha Godavari and its branch Vainateya in the west and Bay of Bengal in the South. With a view to having fairly accurate estimation of various components involved in the hydrologic balance equation, the clear area between the nearest streams of river Gowthami and Vasista has been selected for the study and as such the Island Polavaram and other small islands have also been

omitted. Geographically, the study area is located between 16°25' to 16°55'N latitude and 81°44' to 82°15'E longitude and is shown in Fig.1. The total geographical area under study measures to 825 sq.kms, covering fully or partly the following revenue mandals,

1. Amalapuram
2. Ambajipeta
3. Allavaram
4. Atreyapuram
5. Inavilli
6. Katrenikona
7. Kothapeta
8. Mummidivaram
9. Ravulapalem
10. Uppalaguptam
11. P. Gannavaram

2.3 Climate and Rainfall:

Being the coastal region, the climate of the study area is comparatively equitable. Though it is very warm in April and June with a maximum temperature of about 39°C, it is never oppressive during the rest of the year. The mean minimum temperature during the two coldest months, i.e December and January for the E. G Dist varies from 19°C to 21°C while mean maximum temperature varies from 27°C to 29°C. The mean minimum temp. during April to June varies from 26°C to 29°C with mean maximum temp. range of 35°C to 37°C. The study area has three distinctive monsoon seasons, i.e. Southwest monsoon period from June to Sept, East monsoon period from Oct to Feb. and West monsoon period from March to May. More than half of the annual rainfall is brought by the South West monsoon, while the large portion of the rest occur in October and November. The normal rainfall of the E.G.Dist is 1142mm while at Amalapuram raingauge station which is almost centrally located in the study area the annual normal rainfall is 1228mm.



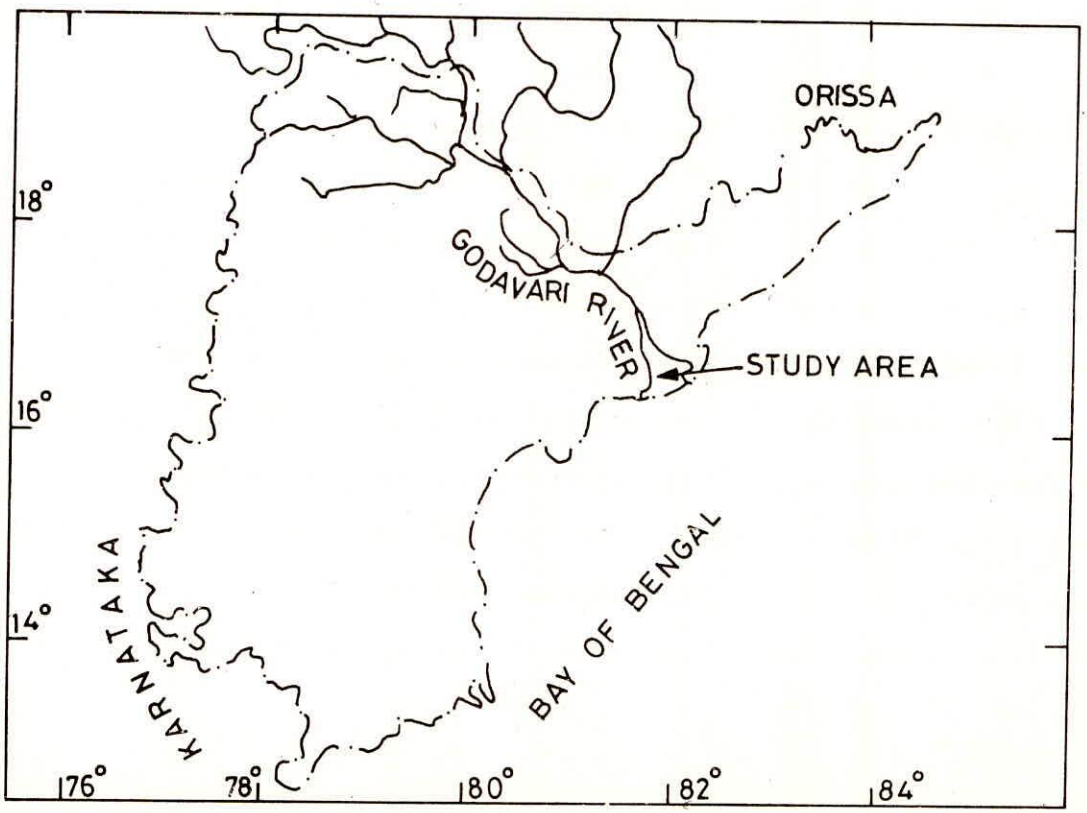


FIG. 1 INDEX MAP

2.4 Topography and Soils:

The study area consists of alluvial plain formed by river Godavari. It has a very gentle land slope of about 1m per km. The coastal line along the study area measures to about 40 km and the general elevations varies from about 2m near the sea to about 13m at upper reach. The topographical map of the area is given in Fig.2. Texturally, a major part of the study area consists of sandy loams and sandy clay loams. The silty soils which are very deep, medium textured with fine loamy sub soils are located all along the river Godavari as a recent river deposits. The very deep, coarse textured soils with sandy sub soils representing the coastal sand are also found along the sea.

2.5 Irrigation and Drainage:

The Godavari delta Irrigation System is one of the oldest and most important irrigation systems in the state of Andhra Pradesh playing a vital role in the rice economy of India over a century. The entire study area is under the command of Godavari Central Canal System and is served by a main canal, three branch canals, one distributary and a large number of irrigation channels. The canal system remain operational for 11 months with one month closure period during April-May. Besides, a good number of tube wells also exist in the study area. The total area under paddy which is the major crop in both the seasons is irrigated by canal water and other important crops like sugarcane and vegetables are partly irrigated by tubewells and partly by canal water. The study area is served by a number of major, medium and minor drains to remove the surplus water from the fields that gets accumulated especially during the southwest monsoon when the

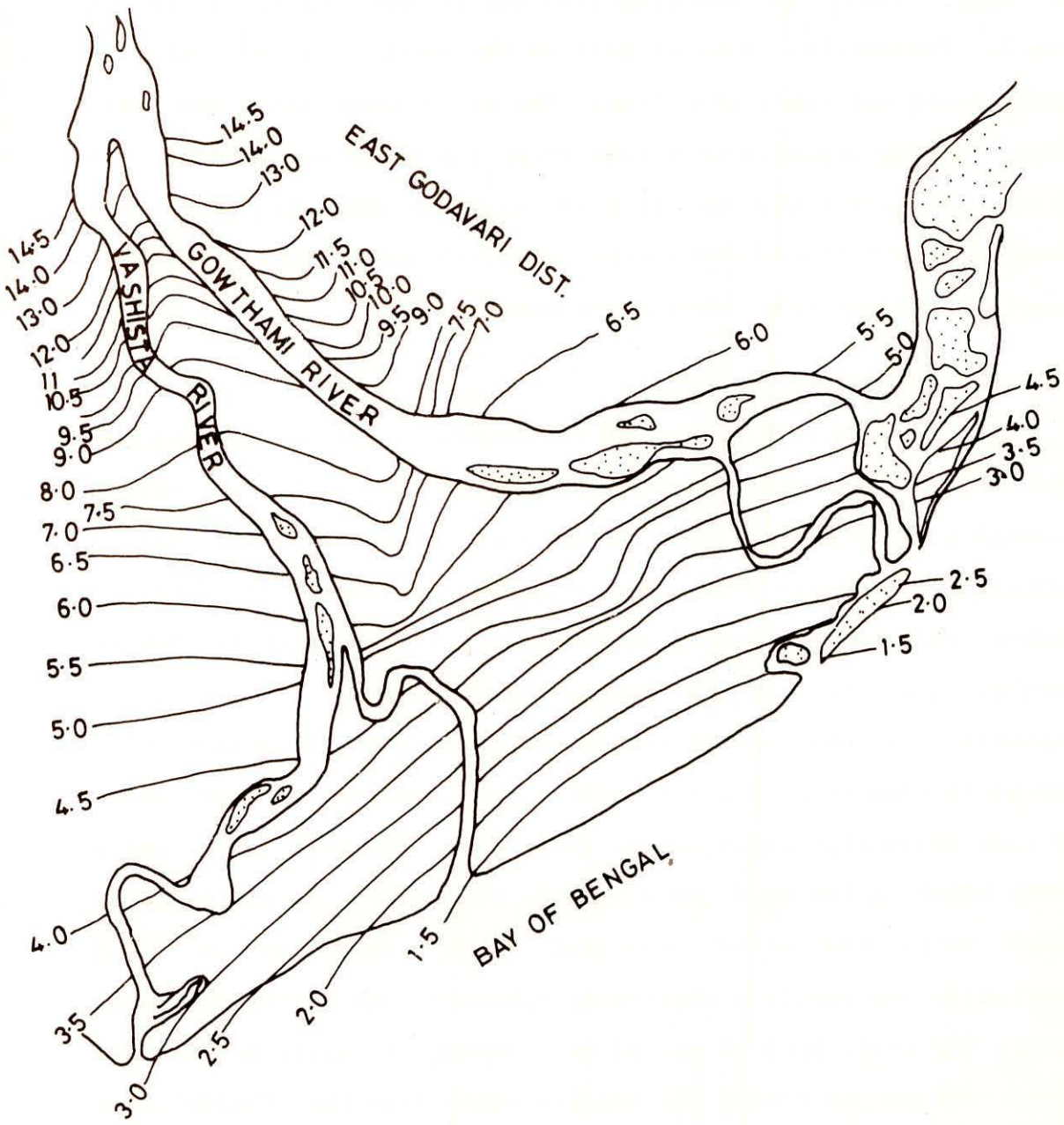


FIG.2 TOPOGRAPHICAL MAP OF STUDY AREA

area is subject to incidence of heavy and wide spread rainfall. The groundfall on an average is about 1/5000 in head reaches and 1/7500 in the lower reaches of the study area. Consequently, the outfall of the drainage from the irrigated area, through the network of surface drains, is rather slow especially in the lower reaches resulting in drainage problems of severe nature.

2.6 Agriculture:

From agriculture point of view, the alluvial soils are considered to be the most fertile lands and paddy being the major crop of the Godavari delta system, it is known as rice bowl of the Andhra Pradesh. The study area (i.e. part of the delta system) is also predominantly a rice growing area in both kharif and Rabi seasons. Crops like sugarcane, turmeric, vegetables and other seasonal crops like maize, jowar, bajra etc are found in patches only. There are mainly two cropping seasons namely kharif and rabi. The kharif season commences from 1st June when irrigation water is released through the canal system and extends upto November. The Rabi season is from December to April of the succeeding year. The usual cropping pattern in the study area is paddy-paddy-pulses or fodder crop. The net area sown forms about 68 % of total geographical area under study. The gross cropped area is about 95000 ha of which about 75 % is occupied by paddy alone. A large number of coconut trees also exist in the study area and account for about 15 % of total area. The area under other miscellaneous deep rooted trees is almost negligible as compared to the area under coconut trees. There is no forest in the study area.

2.7 Sea Water Intrusion :

The southern boundary of the study area is Bay of Bengal and as such the salt water intrusion problem is observed in the study area. The Total Dissolved Solids (TDS) values of water samples taken from the observation wells near the sea and along the river are very high. Probably the reversal or reduction of groundwater gradient and the seabore effect which goes deep in the rivers during dry periods are the main cause of such high TDS values.

3.0 COLLECTION AND PROCESSING OF DATA

3.1 General:

The collection and organization of data can be expected to account for 50 to 65% of required effort to accomplish a water balance. Depending upon the complexity of the hydrologic system of the study area, a variety of data are required to be collected from various field agencies. The data collected and compiled by these field organisations may represent different level of time periods, i.e. annual, seasonal, monthly, weekly or daily, may be recorded in different units and/or may be organised in inconsistant categories. Preliminary processing, analysis and proper presentation of data is, therefore, essential before the data are subjected to further detailed analysis. For the present groundwater balance study, data from different organisations like, A P State Groundwater Dept, Irrigation Dept, District Planning Office, Agriculture Dept. etc were collected and after preliminary processing are presented in the subsequent paragraphs.

3.2 Rainfall Data:

There exists a good network of raingauage stations in the study area. Monthly rainfall data of 22 stations within and around the study area have been collected for 11 years, i.e 1980 to 1990 from the District Planning Office. A map showing location of these rainguage stations is presented in Fig.3. The rainfall data, thus, collected, were checked for gaps and inconsistant values and wherever necessary adjustments have been made and missing values estimated using the Normal Ratio Method. The monthly rainfall data of 22 stations starting from 1980 to 1990

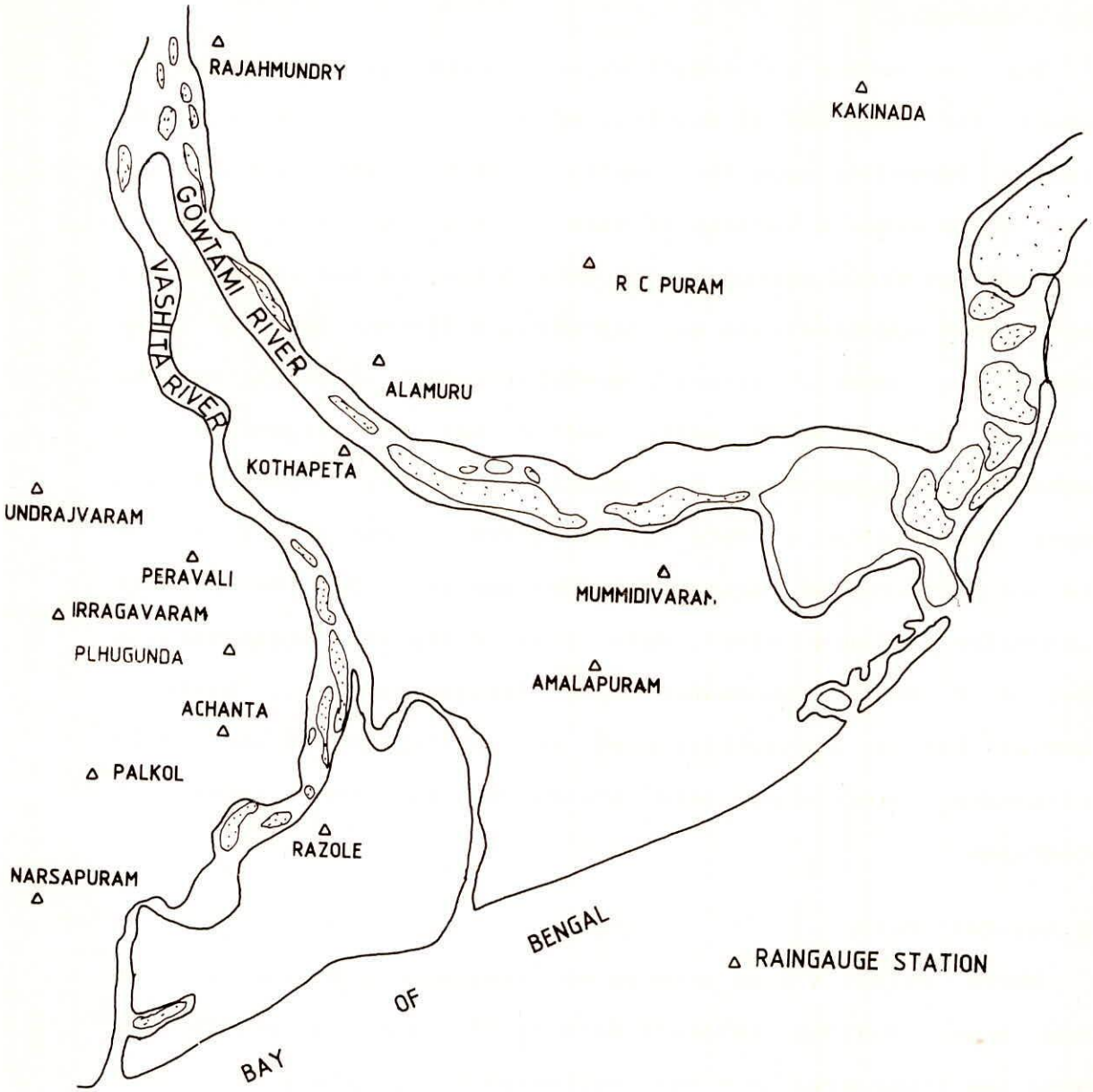


FIG. 3 MAP SHOWING RAINGAUGE STATIONS

are given in Annexure 1. Based on 11 years data, the average annual rainfall for these stations are given in Annexure 2.

The rainfall observations from gauges are point values and as characteristics of the rainfall process exhibits appreciable spatial variation over relatively short distance. Therefore, some procedure is required to estimate the average amount of rainfall over the given basin using the point measurements available at a number of gauges scattered over the area. One of the most popular methods of estimation of average areal precipitation is the Thiessen Polygon Method. The method is used with non uniform stations spacings and gives weights to stations precipitation data according to the area which is closer to that station than to anyother station. The area is found by drawing perpendicular bisectors of the lines joining the nearby stations so that polygons are formed around each station. The polygons thus formed around each station are the boundaries of the effective area assumed to be controlled by this station. The area of the polygons are measured with the help of plannimeter. The weighted average precipitation can be calculated using the following equation :

$$\bar{P} = \frac{\sum_{i=1}^{n} P_i A_i}{\sum_{i=1}^{n} A_i}$$

The Thiessen Polygons have been drawn for the study area using the available raingauge stations and is presented in Fig.4. The list of stations and area under the influence of each of these stations (area of polygons) are presented in Annexure 3. The monthly values of mean areal precipitation over the study area for 11 years are given in Annexure 4.

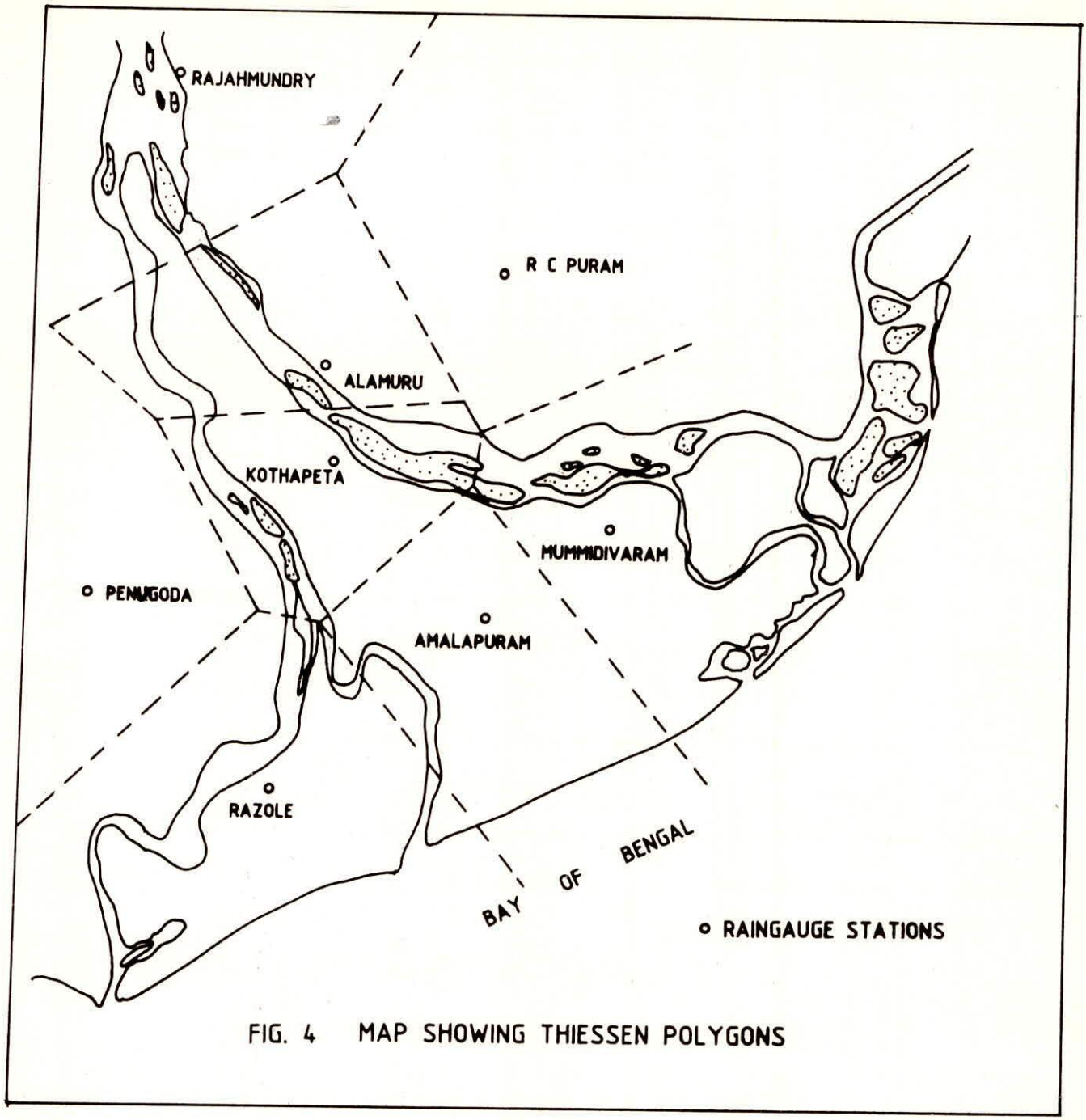


FIG. 4 MAP SHOWING THIESSEN POLYGONS

3.3 Canal Discharge Data:

Data on monthly discharge at the head and other control points on the main canal, branch canals and distributaries, length and cross sections of all canals, wetted perimeter and number of running days for each distributary are required to estimate the seepage losses from the canal system. The irrigation system of the Godavari Central delta comprises of one main canal taking off from the S.A.C. barrage at Dowleswaram, 3 branch canals namely Gannavaram canal, Amalapuram canal and Bank canal, all taking off from Ryalli lock at main canal, one distributary i.e. Benda canal taking off from Amalapuram canal and a number of channels taking off from these branch canals and distributory at different chainages. The entire central delta is under the command of the system. The map showing the network of canals in the study area is presented in Fig.5. Monthly discharge data at the head of main canal, branch canals and other control points wherever channels are taking off from the branch and also flow through escapes have been collected from Irrigation Dept. and are presented alongwith their number of running days in Annexure 5. The cross section and length of the canals, their full supply depth and full supply discharge are given in Annexure 6.

3.4 Stream Flow Data:

Stream gauging data i.e. river stage (on 1st of every month), monthly discharge and river cross sections at few locations are required for estimating the interflows between the aquifer and hydraulically connected rivers. Since the study area is surrounded by two branches of river Godavari, i.e. river Gowthami on east and river Vasistha on south, the river gauging

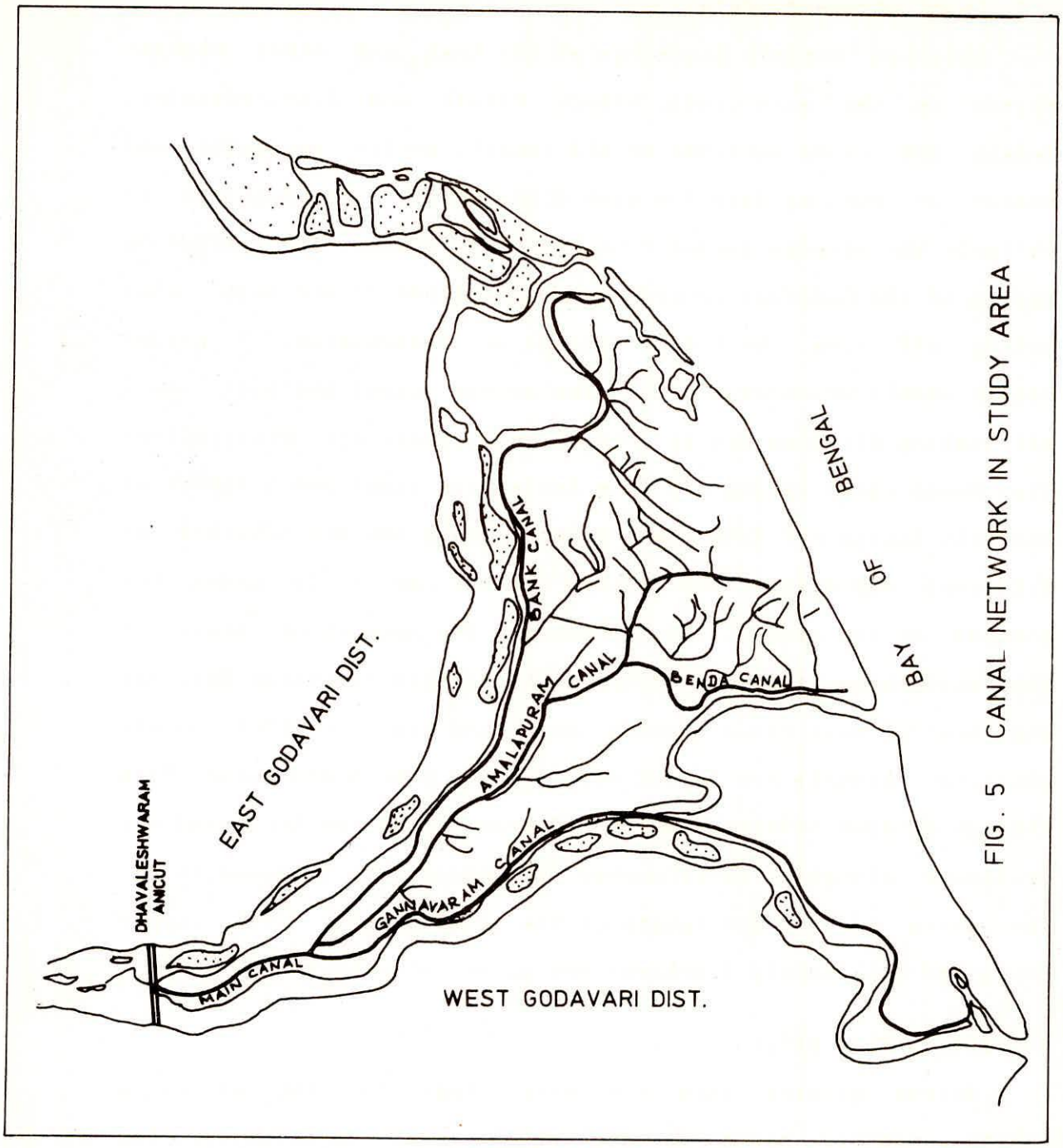


FIG. 5 CANAL NETWORK IN STUDY AREA

data of these two rivers are required for analysis of interflows. But there is no gauging site anywhere on any of these two rivers and as such no data on stage and discharge of these rivers are available. However, the monthly discharge data for river Akhanda Godavari as observed at Dowleswaram gauging station (Barrage site) have been collected and are given in Annexure 7.

3.5 Ground water Data:

A complete inventory of the groundwater structures including numbers and draft rates (seasonal & monthly) are required for estimating groundwater withdrawls. Monthly water table levels for a large number of wells distributed over the study area along with their locations on map are also required to study the change in groundwater storage.

The study area is largely dominated by paddy crop and is entirely irrigated through a network of canals. A few number of tube wells & Filter points have been sunk by farmers to irrigate a small area under other minor crops. The information on yearwise number of tube wells and average no. of working hours per day for 6 years as available with the Chief Planning Officer, Kakinada was collected and is given in Annexure 8. The monthly groundwater levels for 11 years i.e. from 1980 to 1990 with some gaps were collected from A P State Groundwater Dept. for 26 selected observation wells spread over within and around the study area and are given in Annexure 9. The map showing location of observation wells are given in Fig.6. Based upon the ground water levels available for 11 years, the average water table contours during pre monsoon and post monsoon periods i.e. during May and October have been drawn and are given in Fig. 7&8.

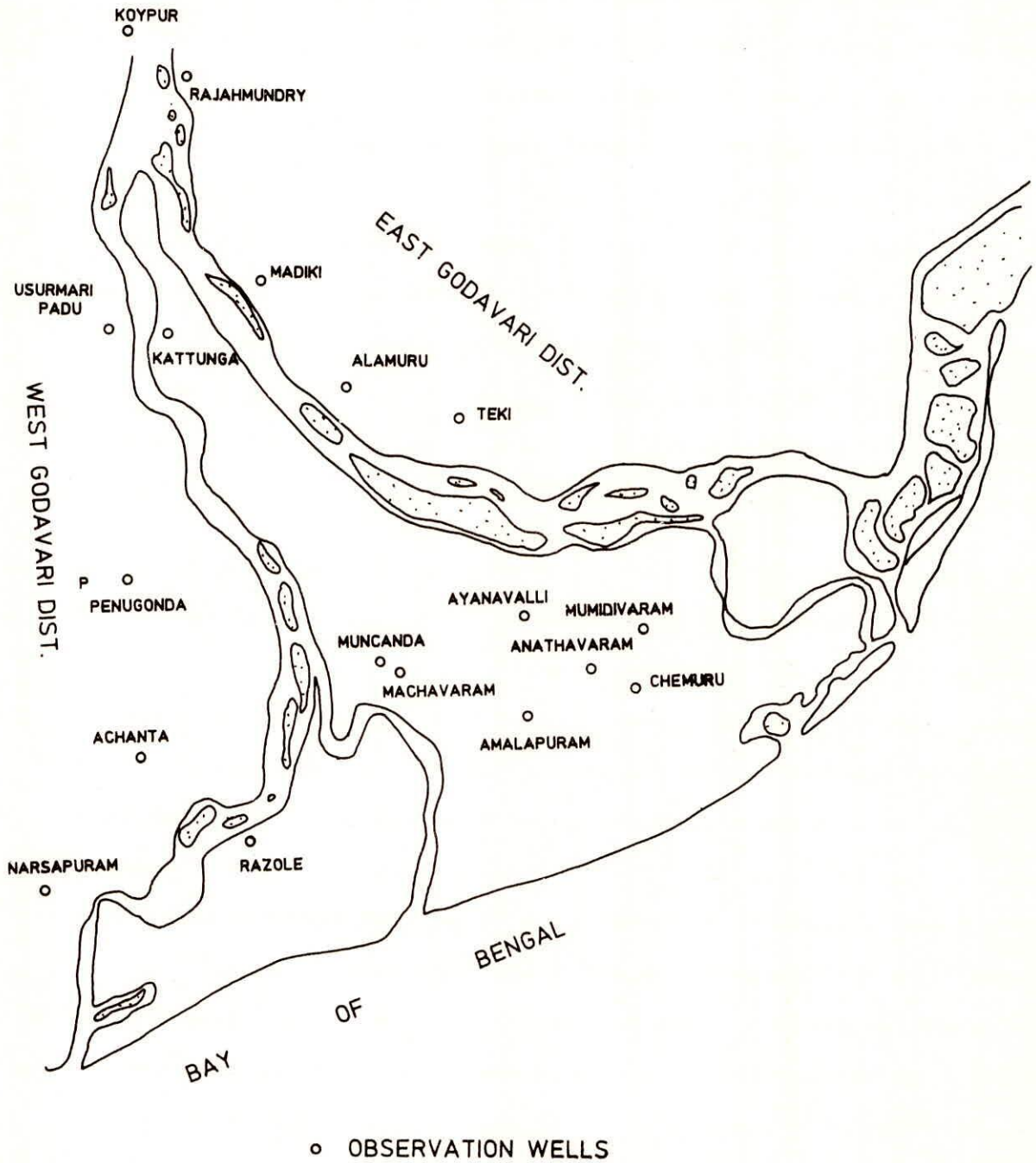


FIG. 6 MAP SHOWING LOCATION OF OBSERVATION WELLS

AVERAGE WATER TABLE CONTOURS
ABOVE M.S.L., DURING MAY (1980-90)

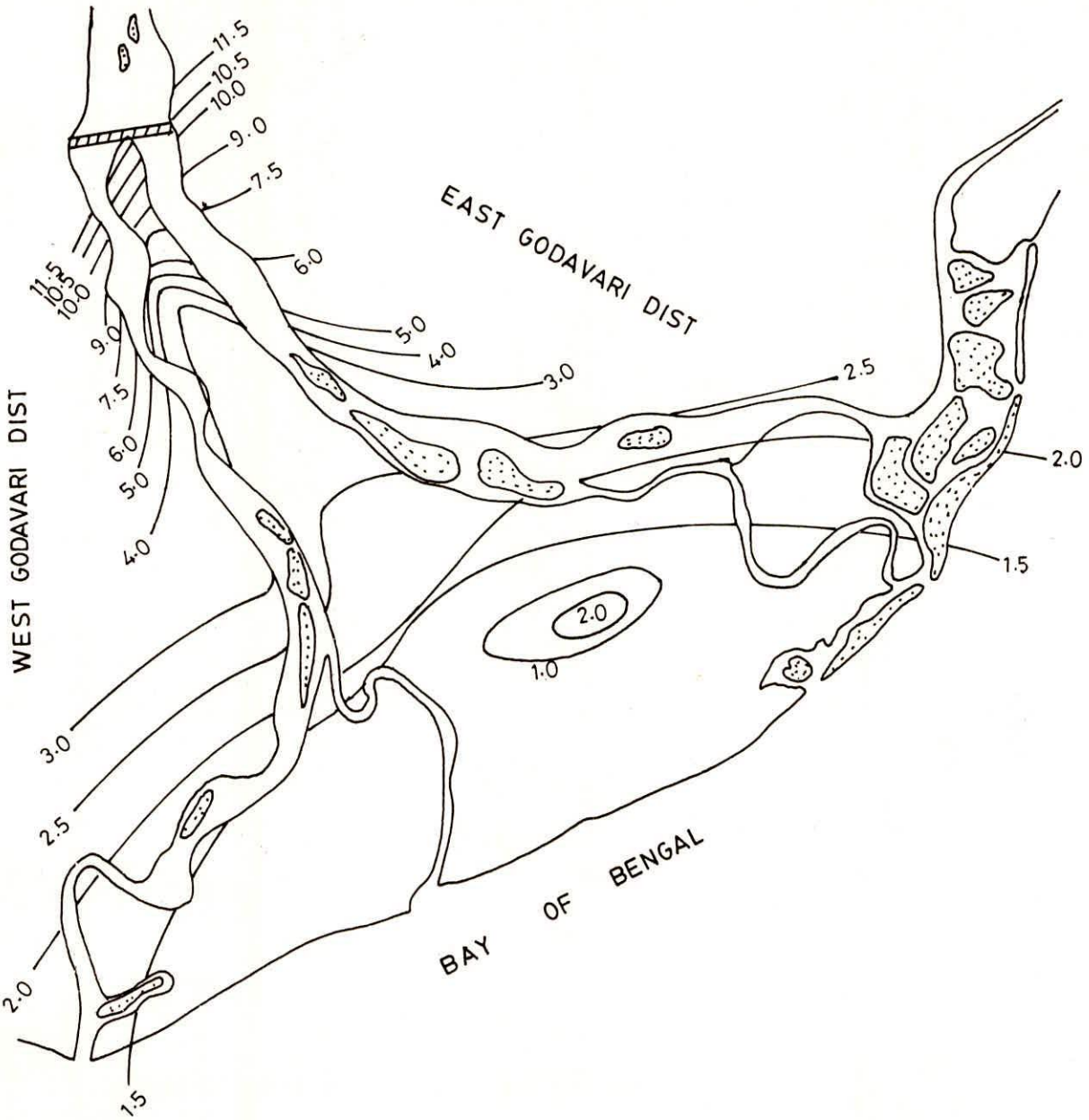


FIG. 7

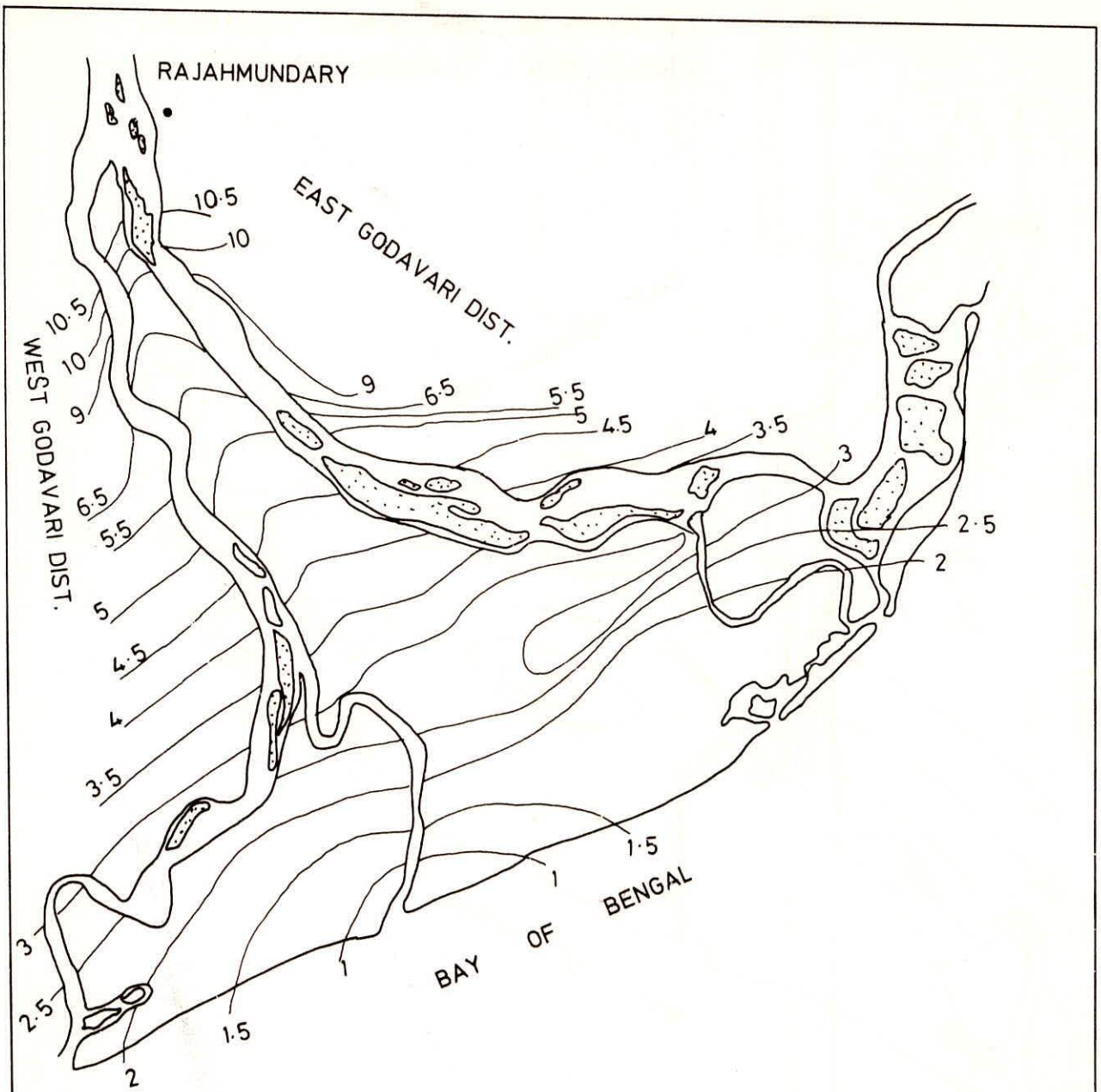


FIG. 8 AVERAGE WATER TABLE CONTOURS ABOVE M.S.L. DURING OCTOBER (1980-90)

From the general trend of the contours, it is observed that the subsurface flow takes place from the rivers to the basin aquifers during both the periods. The water table gradient in the basin aquifers is also found towards the sea.

3.6 Water Quality Data

The water quality data for pre monsoon and post monsoon periods for 11 years i.e. 1980-90 for above observation wells have also been collected from A P State Ground Water Dept. and are presented in Annexure 10. With a view to demarcate the groundwater zones having high TDS values, the contours of TDS values during pre monsoon and post monsoon periods i.e. during May and October for each year have also been drawn and are presented in figs. 9 to 14. From the areal distribution of water quality, it is observed that though the TDS values in study area ranges from about 400 to as high as 3700, the average range lies between 600 to 1200. To be very specific, the high TDS values are found near the coastal line and along the rivers.

3.7 Geology and Aquifer Data:

The well log data, aquifer material, depth of aquifer, specific yield, and transmissibility data at sufficient points over the entire study area are required to study the change in ground water storage. But in the study area, only one pumping test has been conducted in Uppalaguptam Mandal by the A P State Groundwater Dept. and coefficient of transmissivity and specific yield are available. The well log data for one well in Mandapeta mandal which is about 8 kms. from the study area are also available with State Groundwater Dept. The available information for these two stations have been collected and are given in Annexure 11 & 12.

CONTOURS OF TDS VALUES
DURING MAY 1992,
(PRE-MONSOON)

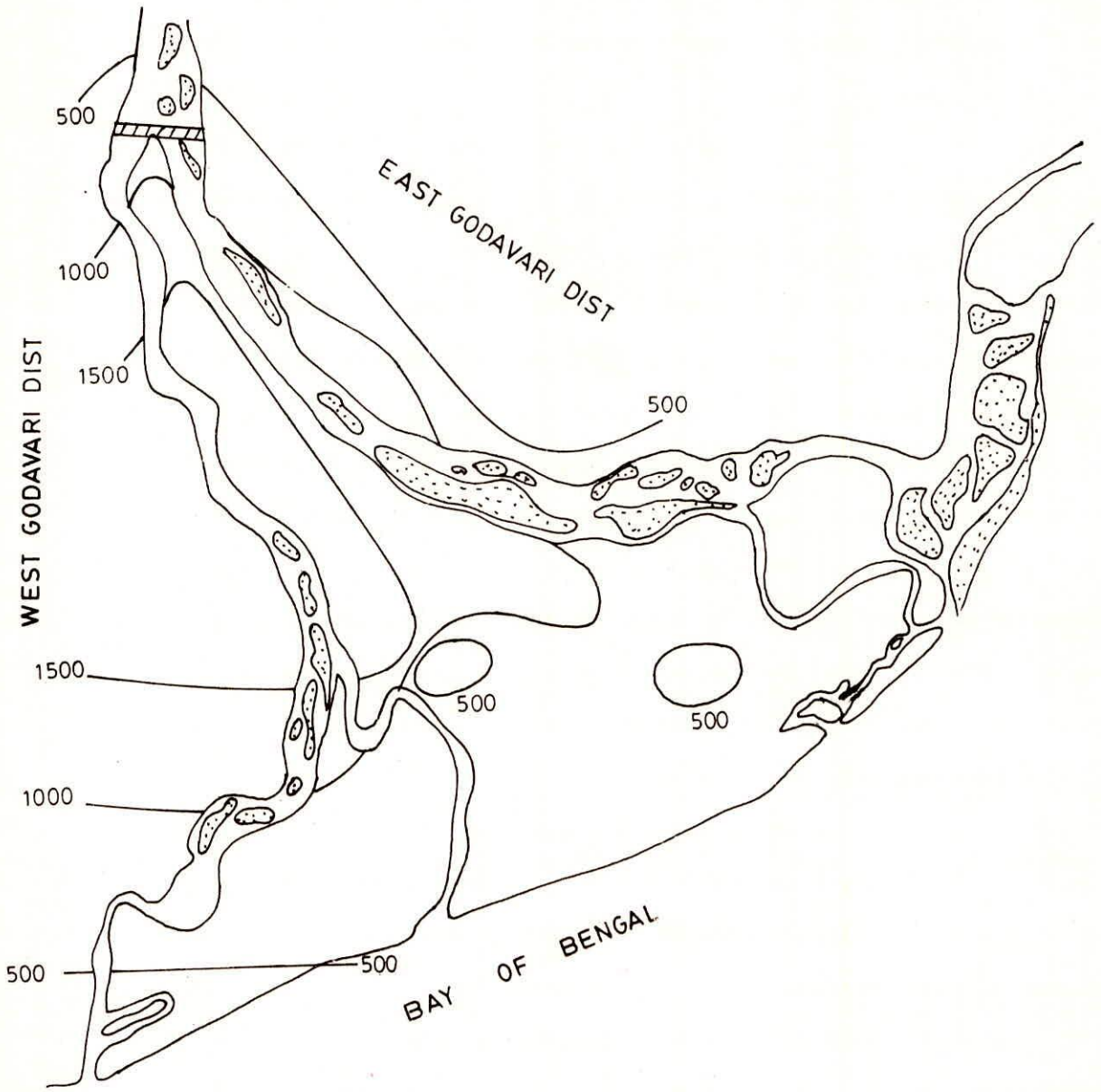


FIG. 9

CONTOURS OF T D S VALUES
DURING OCTOBER 1982,
(POST-MONSOON)

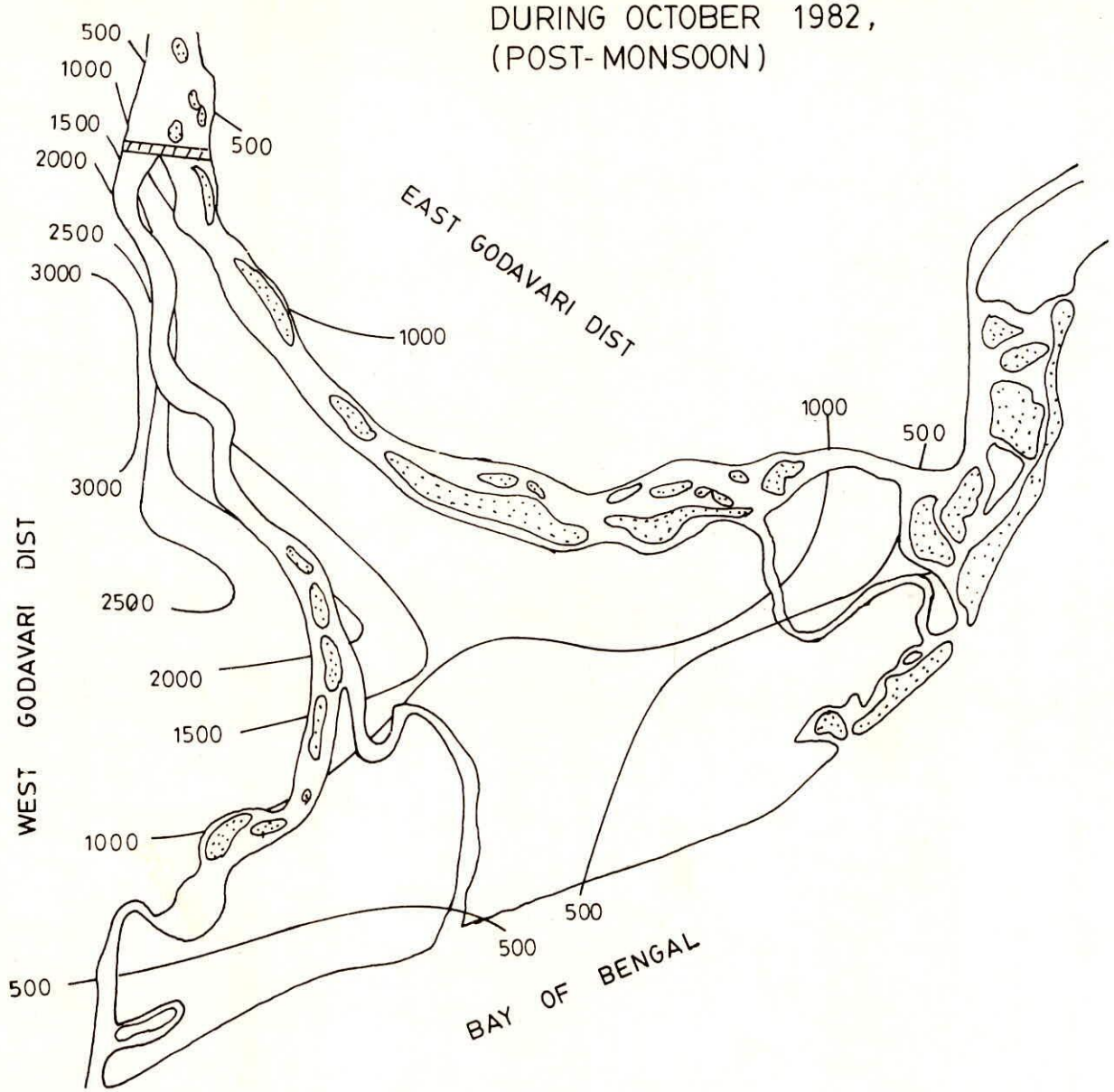


FIG. 10

CONTOURS MAP OF TDS VALUES
DURING MAY 1986 ,
(PRE-MONSOON)

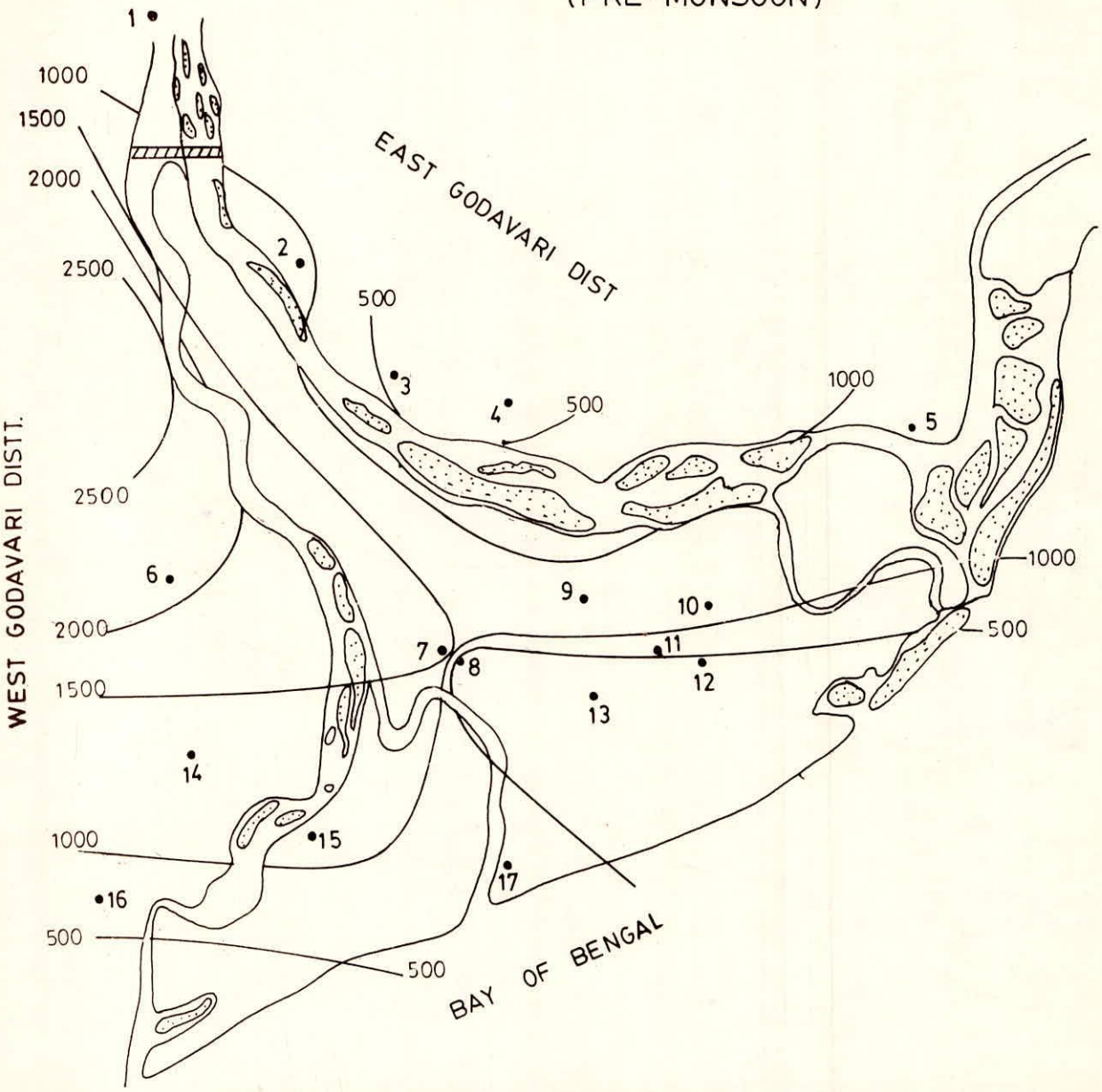


FIG. 11

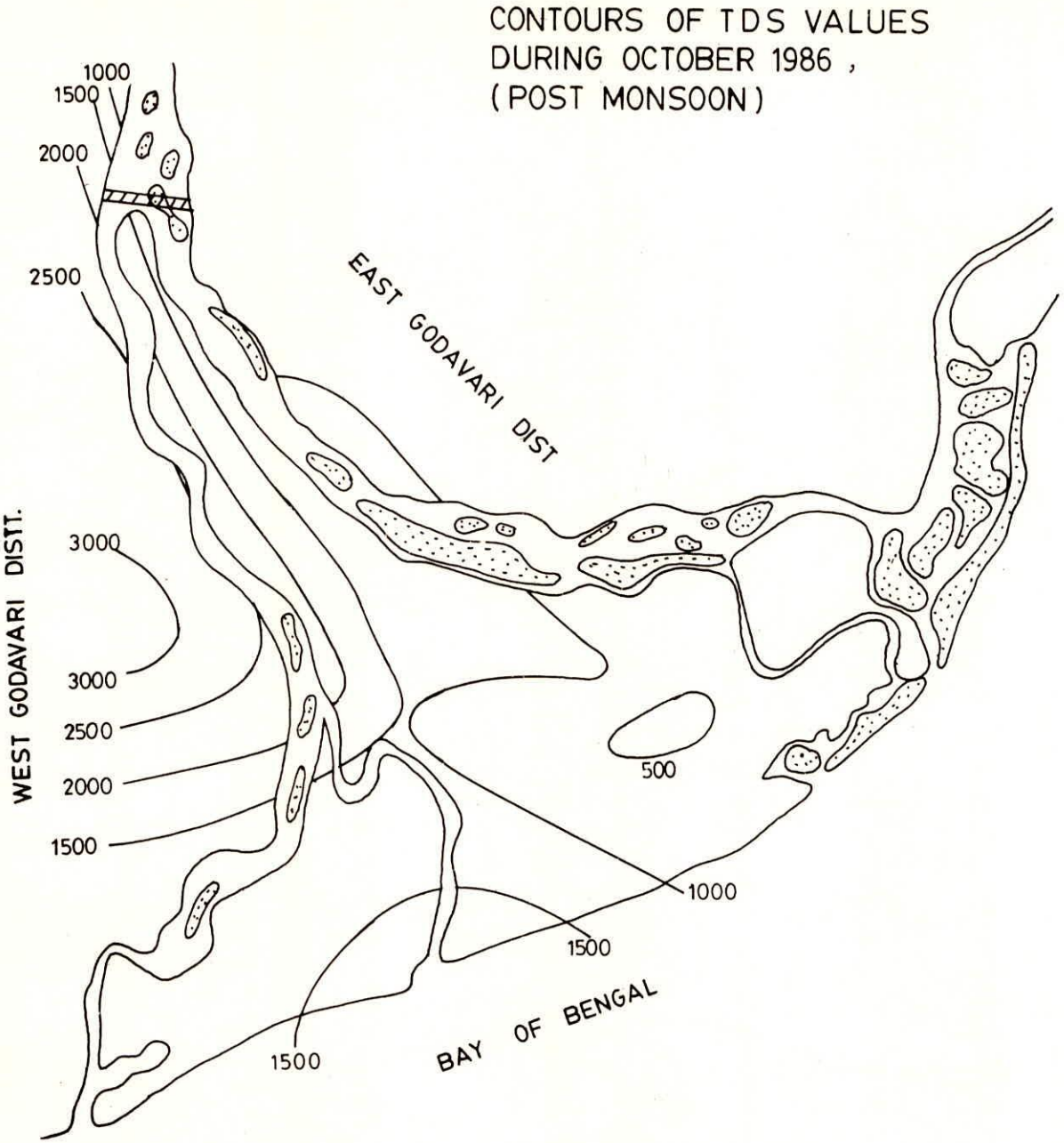
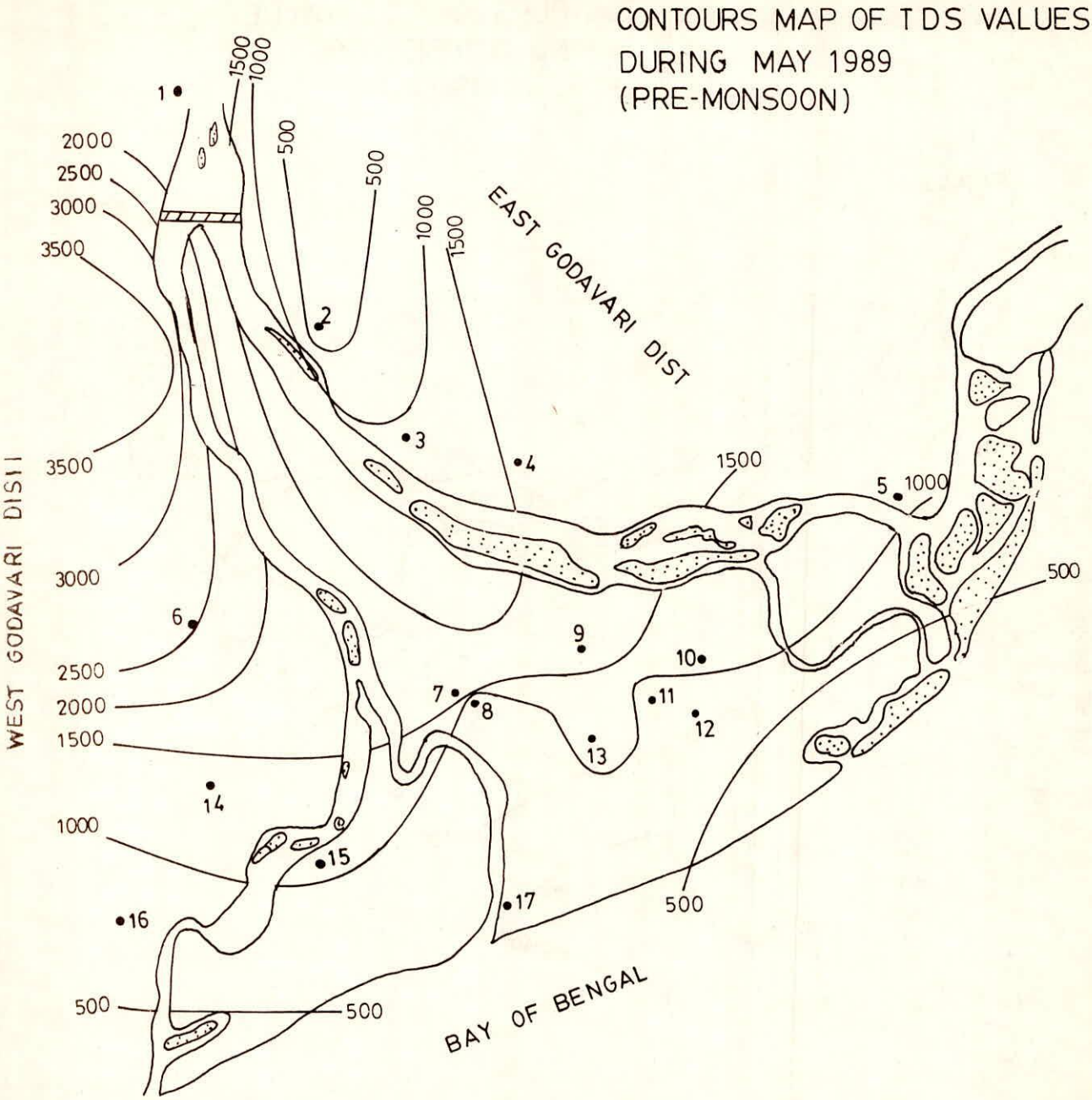

CONTOURS OF TDS VALUES
DURING OCTOBER 1986 ,
(POST MONSOON)
1000
1500
2000
2500
EAST GODAVARI DIST
WEST GODAVARI DISTT.
3000
3000
2500
2000
1500
500
1000
1500
1500
BAY OF BENGAL

FIG. 12


CONTOURS MAP OF TDS VALUES
DURING MAY 1989
(PRE-MONSOON)
EAST GODAVARI DIST
WEST GODAVARI DISTT
BAY OF BENGAL
1
2
3
4
5
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7
8
9
10
11
12
13
14
15
16
17
1500
1000
500
2000
2500
3000
3500

FIG. 13

CONTOURS MAP OF TDS VALUES
DURING OCTOBER 1989
(POST-MONSOON)

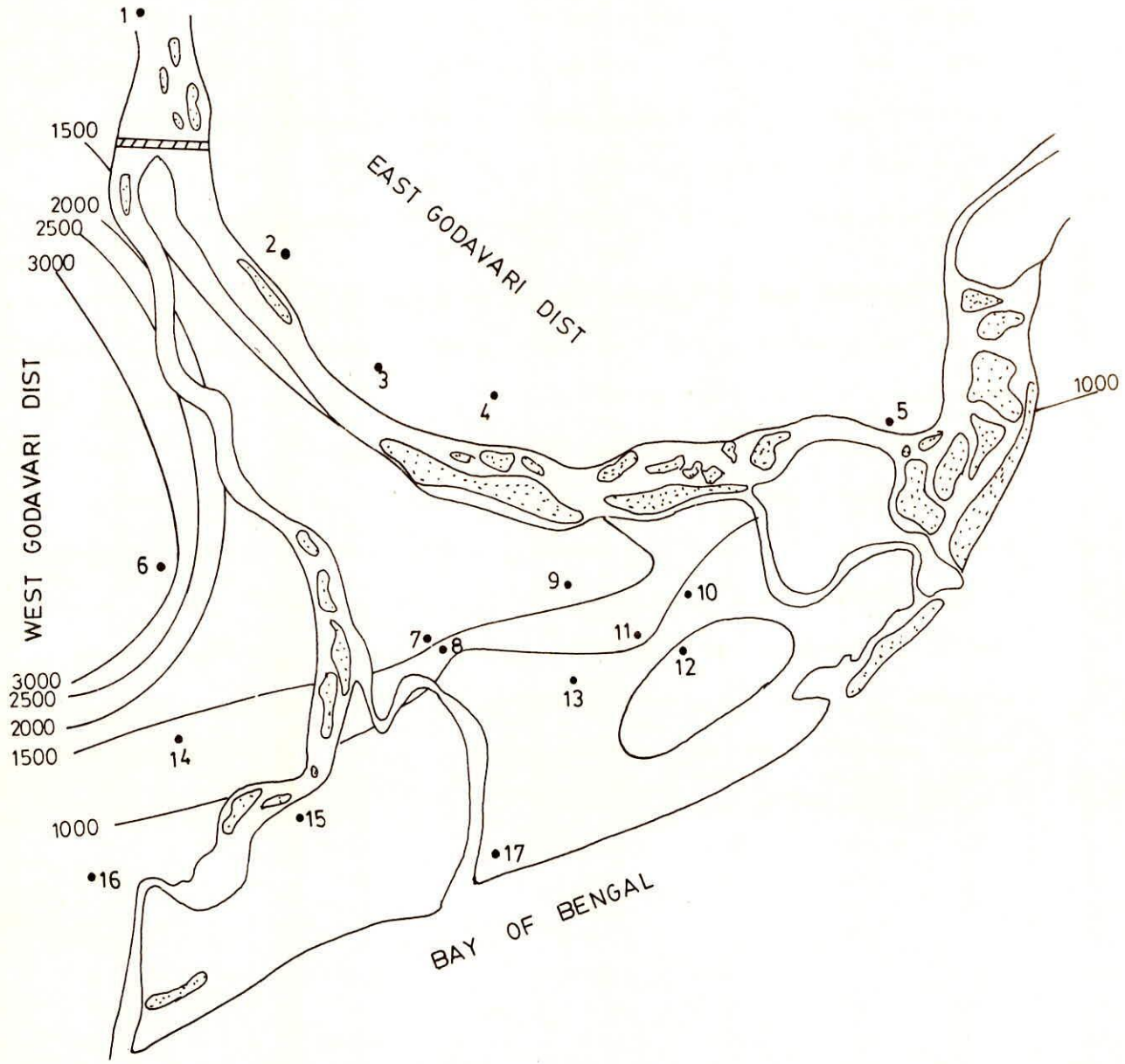

FIG. 14

3.8 Land Use and Cropping Pattern Data:

Land use data is required for estimating the evapotranspiration losses from the water table through deep rooted trees. Similarly, cropping pattern data also plays an important role in estimating the consumptive uses in the study area and also for estimating the spatial and temporal distributions of the ground water withdrawls and canal releases. Potential evapotranspiration rate and monthly pan evaporation rates applicable to the study area are also required.

The land use and cropping pattern data for Central Godavari delta as available for few years were collected from the Chief Planning Office, East Godavari Dist, Kakinada. The figures for the selected area of 825 sq kms under study were worked out on proportionate basis and are given in Annexure 13 & 14. Paddy is the main crop in both the seasons and accounts for 80% of gross cropped area. The entire paddy crop is irrigated by canal water. The area irrigated by different sources during different cropping seasons is presented in Annexure 15. The monthly potential evapotranspiration and pan evaporation rates for the study area are not available.

4.0 COMPONENTS OF WATER BALANCE EQUATION FOR A GROUNDWATER BASIN

4.1 General:

The water balance or hydrologic balance is a statement of the conservation of matter applied to a groundwater basin. All waters entering an area during any given period of time must either go into storage within its boundaries, be consumed or flow out during that period. This basic concept of water balance can be expressed as below :

$$I = O \pm \Delta s$$

Where, I = Inflow to the system
O = Outflow , and
ΔS = Change in ground water storage

Clearly the items in the equation can include a number of factors which are listed below:

1. Inflow:

A) Natural Recharge:
   i) Recharge due to rainfall
   ii) Recharge from rivers (influent seepage)
   iii) Inflow from other basins
   iv) Recharge from tanks & reservoirs

B) Artificial Recharge:
   i) Induced recharge from rivers
   ii) Recharge due to seepage from irrigation channels
   iii) Recharge from deep percolation of irrigation water from fields
   iv) Recharge by injection

2. Outflow

A) Natural outflow:
   i) Evapotranspiration
   ii) Regeneration in river or effluent seepage to rivers
   iii) Outflow to other basins

B) Artificial Outflow:
   i) Pumpage through open wells, and tube wells

Considering the above components the groundwater balance equation can be rewritten as

$$R_i + R_e + R_r + R_t + I_g + S_i = T_p + E_t + O_g + S_e + \Delta S$$

Where,

R_i = recharge from rainfall

R_c = Recharge from canal seepage

R_r = Recharge due to deep percolation from field irrigation

$= R_{rs} + R_{rg}$

R_{rs} = Recharge from surface water irrigation

R_{rg} = recharge from groundwater irrigation

R_t = recharge from reservoirs & tanks

I_g = subsurface inflow from other basin

S_i = influent seepage from rivers

T_p = withdrawl from ground water

E_t = evapotranspiration losses
$= E_{tf} + E_{tw}$

E_{tf} = evapotranspiration losses from forested areas

E_{tw} = evapotranspiration losses water logged areas

O_g = subsurface outflow from the basin

S_e = effluent seepage to rivers

ΔS = change in ground water storage (positive for increase and negative for decrease)

The above expression considers only one aquifer system and thus does not account for the interflows between the aquifers in a multi-aquifer system. However, if sufficient data related to water table and piezometric head fluctuations and conductivity of intervening layers are available, the additional terms for these interflows can be included in the equation. Each item of the equation represents a discharge or volume of water per unit of

time. For the purpose of study any consistant units of volume and time can be adopted. The water year extending from 1st June to 30th April is preferable to the calender year. Theoretically, the hydrologic equation must balance but it rarely happens in practice as there may be some inaccuracies in the estimation of various parameters. However, the amount of unbalance should not exceed the limits of accuracy of the basic data. If the amount of unbalance (n) is given as a residual term of the water balance equation and includes the errors in the determination of the components and the values of components which are not taken into account the equation may be written in the following form.

$$R_i + R_e + R_r + R_t + I_g + S_i - E_t - T_p - O_g - S_e - \Delta S - N = 0$$

In order to avoid huge errors, all the components of water balance equation must be estimated independently and adjustments, if required, should be made in items subject to large errors.

4.2 Description of Groundwater Balance Components

The above form of ground water balance equation includes occurrence of all types of water but there may be situations in which it is possible to eliminate certain items from the equation because either they are negligible or they do not effect the solution. In the present study also, the components which do not play significant role have been dropped and only relevant components are described below.

4.2.1 Recharge from Rainfall (R_i):

Recharge from rainfall is the most important parameter among a variety of inputs used in the groundwater balance equation. The

increase in groundwater storage takes place mainly due to recharge of aquifers through deep percolation of rain water. The natural phenomena of rainfall recharge is very complex to study and analyse and any work on the estimation of recharge of aquifers by rainfall needs a clear understanding of the physical processes of the soil, vegetation and atmospheric system. The rainfall after being affected by vegetation interception reaches the land surface where it fills up the surface depressions and also infiltrates into the soil surface. Infiltration is the term applied to the process of water entry into the soil through the soil surface, vertically as well as horizontally. A portion of the infiltration reaches the groundwater storage and is called ground water recharge. This recharge which is fraction of total rainfall depends upon several factors such as soil characteristics, topography, vegetal cover, land use, soil moisture condition, depth of water table, intensity, duration and seasonal distribution of rainfall and other meteorological factors. The recharge from rainfall, therefore, varies in space and time.

4.2.2 Recharge from Canal Seepage (R_e):

The process of water movement from a canal into and through the bed and wall material is referred to as canal seepage. The seepage losses from canal after percolating deep joins the groundwater table. The recharge from seepage depends on the infiltration capacity of the canal bed and sides, subsurface lithology, extent of wetted perimeter, length of canal, discharge, sediment load, physical and chemical properties of water and relative position of water level in canal with respect

to the ground water table. Recharge rates may decline over the years due to water logging, clogging of pores of the bed material or cementation by calcareous precipitation.

4.2.3 Recharge from Field Irrigation (R_f):

When irrigation water is applied to the field crops, a part of it is lost in meeting the consumptive use of crops and the balance infiltrates into the soil and recharges the groundwater aquifer. The infiltration from applied irrigation water, derived both from groundwater and surface water sources constitutes one of the major components of groundwater recharge especially in areas under wet crops like paddy, in view of continuous submergence of soil for long duration. However, in dry crops, where water applied is much less and the soil is saturated for a short duration, the recharge may be insignificant as the maximum part of water applied is abstracted by crops for meeting the consumptive use.

4.2.4 Sub-surface Inflow and Outflow (I_g & O_g):

A ground water basin may also experience flow from or towards the aquifers. If the water table level in the basin aquifers is lower than that of the adjacent basin aquifers, there may be recharge or inflow to the basin. If the water table positions are vice-versa, the flow direction will change forming discharge component. The amount of this flow depends mainly on hydraulic gradient and the transmissivity of the aquifers at the boundary of the basin. Since the hydraulic gradient and the transmissivity may vary from place to place, the net amount of flow should be estimated for different sections seperately by

using the transmissivity of the aquifer and the average hydraulic gradient for that section. The length of the section, across which ground water inflow/outflow occurs, is determined from water table contour maps, the length being measured parallel to the contour.

4.2.5 Effluent and Influent Seepage (S_e & S_i):

Rivers, streams in a basin also affects the groundwater regime in the basin aquifers. The interaction between a river and an aquifer may be of two types- 1) the flow from the aquifer to support river flow, and 2) the flow from river to the aquifer. Depending upon whether water is entering the stream or going out of the stream, the stream is called as effluent or influent respectively. The direction of flow is governed by the hydraulic gradient of the water table in respect to the river stage and the amount of flow depends upon the both hydraulic gradient as well as the transmissivity of the aquifer system. For estimation of the total flow, it is desirable to divide the entire river system into a number of small reaches, each reach having atleast one observation well, and then computations be made for each segment. Adding the flow through all segments will give total flow.

4.2.6 Draft from Ground water (T_p):

Draft implies the extraction of ground water through shallow tube wells, deep tube wells and dug wells. In order to meet various demands of water, ground water is extracted from the aquifers through different types of water lifting devices. Draft from individual well may vary widely depending upon the yield, type of well, source of lifting, depth of water level, type of

water use etc. An inventory of wells and a sample survey of groundwater draft from various types of wells are, therefore, pre-requisites for computation of ground water use.

4.2.7 Evapotranspiration Losses (E_t):

Evapotranspiration, in its simplest form is the loss of water into the atmosphere through evaporation from all surfaces containing water, including evaporation from free water surfaces, soil and man made surfaces and transpiration from plants. The water requirement for evapotranspiration process is met partly by rain water, applied irrigation water and directly from ground water reservoir. In the present context of ground water balance study, only that amount of water which is directly extracted from ground water storage through evapotranspiration process is relevant and needs to be computed. When the water table is very close to the ground surface, the evaporation from soil and transpiration from plants will be at the maximum possible rate i.e. at potential rate. The potential evapotranspiration losses from the ground water reservoir, thus, may be of two types, 1)in a water logged tract due to rise in water table (E_{tw}) and 2) in a forested or other tree vegetation area which has the roots extending to the water table or upto the capillary zone (E_{tf}). For the purpose of estimating these evapotranspiration losses from an area, the total water logged area with type of vegetation and the area under deep rooted trees needs to be worked out. The unit value of evapotranspiration for the type of vegetation cover times area will give total evapotranspiration losses.

4.2.8 Change in Ground water Storage (ΔS):

As a result of deep percolation losses of rainfall, irrigation water and seepage from surface water bodies, the ground water reservoir experiences an increase in its storage volume. Similarly, there may be a decrease in ground water storage due to outflow of ground water in non-monsoon or dry periods resulting from pumping or subsurface drainage of aquifers. The cumulative effect in terms of net increase or decrease in ground water storage over a given period of time thus depends upon the total recharge to or discharge from the ground water storage during the given period. The change in ground water storage between the beginning and end of the non monsoon season indicates the total quantity of water withdrawn from ground water storage, while the change between beginning and end of monsoon season indicates the volume of water gone to the reservoir. The change in ground water storage is exhibited by the change in water table levels in the aquifers. The water levels are highest immediately after monsoon in the month of October or November and lowest just before rainfall in the month of May or June. To monitor the water table levels, a number of observation wells with a suitable grid are installed in the basin. Water levels in these wells should be measured under conditions as near static as possible, preferably after the season of heavy draft and again after the season of recharge. A few control wells should be equipped with automatic water level recorders or have their water levels measured monthly to facilitate detailed study of ground water fluctuations.

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ANNEXURE - I

MONTHLY RAINFALL DATA OF GODAVARI DELTA (mm)

A) EAST GODAVARI DISTRICT (A P)

RAMACHANDRA PURAM

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
1980	0.0	0.0	0.0	0.0	1.0	324.6	129.5	245.7	67.2	236.4	140.2	18.8
1981	34.8	0.0	0.0	0.0	4.6	132.5	321.6	165.0	395.2	95.4	19.0	0.0
1982	0.0	0.0	0.0	0.0	6.6	117.8	158.6	240.4	102.4	126.4	64.0	0.0
1983	0.0	17.6	0.0	0.0	84.0	172.2	212.8	524.6	353.4	210.4	3.6	28.2
1984	0.0	15.8	0.0	37.6	44.0	110.4	153.0	36.6	116.8	104.1	57.2	0.8
1985	44.6	0.0	0.0	3.6	39.6	88.4	255.4	244.6	41.0	334.8	24.0	22.4
1986	51.6	6.8	0.0	4.0	36.4	81.6	143.4	312.0	63.1	147.2	150.6	0.0
1987	38.0	0.0	0.0	0.0	79.2	75.4	79.2	83.9	161.3	272.0	176.2	42.0
1988	0.0	0.0	0.0	17.6	25.4	17.6	12.6	206.4	262.2	402.0	6.2	0.0
1989	0.0	0.0	59.0	0.0	0.0	200.6	578.8	325.4	161.3	3.0	0.0	0.0
1990	0.0	70.0	56.2	41.4	661.0	108.4	82.8	198.2	78.2	264.4	25.0	2.0

ALAMURU

1980	0.0	0.0	0.0	0.0	1.0	324.6	129.5	245.7	67.2	236.4	140.2	18.8
1981	16.6	0.0	0.0	6.8	46.8	119.6	280.4	116.0	216.2	91.2	13. 2	0.0
1982	0.0	0.0	0.0	11.6	39.6	73.0	127.8	301.0	132.3	167.2	67.2	0.0
1983	0.0	41.0	0.0	0.0	62.8	161.0	135.6	486.4	308.4	116.2	16.0	33.6
1984	0.0	9.4	0.0	6.4	47.9	66.3	171.8	42.7	161.0	149.6	48.2	0.0
1985	40.2	0.0	0.0	5.6	24.0	97.4	182.8	197.8	106.8	256.2	43.0	39.2
1986	54.8	2.8	0.0	0.0	45.2	53.4	119.8	427.9	75.0	89.2	123.6	0.0
1987	46.2	0.0	0.0	14.8	31.4	55.2	112.4	99.4	175.5	223.7	130.4	22.4
1988	0.0	0.0	0.0	16.6	37.4	24.0	11.8	284.2	191.2	31.2	11.6	0.0
1989	0.0	0.0	56.3	0.0	0.0	106.8	419.2	445.4	175.5	0.0	0.0	0.0
1990	0.0	103.6	95.2	27.2	579.6	88.0	182.0	158.0	91.6	240.0	0.0	0.0

KAKINADA

1980	0.0	0.0	0.0	0.0	17.2	265.4	144.7	259.7	163.2	162.2	122.2	6.2
1981	33.4	0.0	0.0	5.0	27.8	133.4	284.1	131.4	229.0	118.8	62.0	4.2
1982	0.0	0.0	0.0	32.0	9.9	95.5	137.4	187.2	165.2	137.0	114.0	0.0
1983	0.0	8.0	0.0	0.0	49.4	321.2	202.2	326.7	401.8	260.2	0.0	17.0
1984	0.0	14.8	0.0	9.6	83.4	81.3	116.1	45.4	88.5	156.0	62.9	0.0
1985	51.9	0.0	0.0	0.0	0.0	119.8	233.2	244.5	141.5	400.9	40.6	14.1
1986	39.2	0.0	0.0	10.2	73.8	170.1	33.7	299.2	132.7	129.8	125.4	8.0
1987	19.0	0.0	18.0	4.2	16.4	36.6	117.9	124.3	159.3	387.5	216.8	16.4
1988	0.0	8.2	0.0	19.1	59.6	11.6	12.1	235.0	249.8	78.2	10.0	0.0
1989	3.2	0.0	19.6	0.0	12.6	156.8	451.8	168.4	159.3	11.4	3.4	8.2
1990	0.0	64.8	49.4	14.2	732.4	134.4	88.8	154.8	80.6	101.4	28.0	0.0

AMALAPURAM

1980	0.0	0.0	0.0	0.0	14.2	362.4	135.5	246.4	96.3	396.0	103.8	20.7
1981	33.1	0.0	0.3	5.1	31.9	67.4	324.6	95.3	296.0	183.2	14.8	5.8
1982	0.0	0.0	0.0	1.4	10.0	108.5	89.4	220.6	95.8	157.4	119.2	0.0
1983	0.0	23.1	0.0	0.0	28.2	144.4	143.2	247.7	350.0	228.5	3.3	22.2
1984	0.0	23.2	0.0	1.2	32.0	87.4	301.3	99.1	109.9	116.3	125.4	0.0
1985	41.9	0.0	0.0	0.0	5.2	85.0	259.0	117.0	93.8	361.2	18.7	45.2
1986	52.2	16.4	0.0	0.0	4.4	70.2	128.7	512.2	87.7	161.8	116.9	7.2
1987	0.0	0.0	11.4	51.1	23.4	25.1	84.0	112.6	195.1	318.2	173.7	33.3
1988	0.0	0.0	0.0	10.8	40.2	33.4	11.9	268.6	222.8	31.2	17.4	0.0
1989	0.0	0.0	35.6	0.0	12.2	147.9	376.0	461.0	195.1	81.1	1.4	0.0
1990	0.0	147.9	61.4	48.4	530.5	169.2	174.5	197.5	193.0	334.0	114.2	1.4

MUMMIDIVARAM

1980	0.0	0.0	0.0	0.0	0.0	345.0	83.3	194.6	105.4	381.4	136.5	15.8
1981	51.5	0.0	0.0	5.5	32.0	97.9	333.0	111.5	467.0	94.5	7.8	18.3
1982	0.0	0.0	0.0	0.0	18.2	65.1	116.3	200.5	119.8	154.1	136.1	0.0
1983	0.0	5.0	0.0	0.0	12.9	185.2	121.6	418.8	424.8	300.0	10.0	41.8
1984	0.0	12.5	0.0	16.5	67.6	101.0	302.1	51.8	196.3	117.0	124.9	3.0
1985	40.8	0.0	0.0	0.0	0.0	106.8	336.2	162.7	73.9	319.0	78.5	26.4
1986	44.5	44.3	0.0	19.2	26.8	67.3	75.9	347.4	87.5	212.8	174.3	7.2
1987	22.5	0.0	3.0	34.4	8.4	49.0	95.8	143.2	205.1	394.7	194.4	55.7
1988	0.0	0.0	0.0	12.4	12.0	71.3	10.9	313.2	318.4	47.1	15.6	2.5
1989	0.0	0.0	36.0	0.0	38.3	191.1	429.8	477.0	205.1	94.3	2.5	5.5
1990	0.0	83.9	52.7	13.5	641.2	0.0	142.2	179.4	215.0	324.5	95.9	38.0

RAZOLE

1980	0.0	0.0	0.0	0.0	15.0	321.0	234.8	332.5	49.8	336.7	96.7	18.4
1981	41.0	0.0	0.0	0.0	21.0	81.6	266.9	95.2	219.2	156.4	27.8	0.0
1982	0.0	0.0	0.0	2.2	4.4	41.6	99.0	234.9	88.9	171.9	56.2	0.0
1983	0.0	31.1	0.0	0.0	51.5	239.8	152.7	282.8	344.7	211.6	13.2	8.2
1984	0.0	19.1	0.0	1.0	10.0	67.5	255.0	63.3	163.7	207.7	28.4	2.6
1985	43.3	0.0	0.0	0.0	16.2	79.3	217.2	126.6	133.2	244.5	34.8	73.6
1986	44.6	0.0	0.0	29.8	0.0	92.5	63.5	589.3	61.9	136.6	110.2	0.0
1987	0.0	0.0	36.0	47.4	4.4	39.7	179.2	232.0	182.2	217.6	295.3	28.2
1988	0.0	0.0	0.0	8.5	35.8	64.3	12.2	283.0	214.5	41.0	22.7	31.8
1989	0.0	0.0	109.4	0.0	0.0	81.0	330.7	462.5	182.2	59.6	0.0	0.0
1990	0.0	161.0	136.2	50.0	532.0	156.8	139.0	158.6	67.0	436.0	85.0	0.0

KOTHAPETA

1980	0.0	0.0	0.0	0.0	9.0	345.4	153.6	397.2	57.6	306.7	115.0	16.4
1981	18.6	0.0	4.0	12.2	0.0	79.8	249.6	70.4	355.5	73.4	0.0	0.0
1982	0.0	0.0	0.0	20.0	36.4	114.6	112.8	244.4	211.1	201.6	42.8	0.0
1983	0.0	25.2	0.0	0.0	85.2	115.5	212.9	384.7	383.8	223.2	5.0	42.2
1984	0.0	14.6	0.0	10.0	35.7	65.8	116.2	40.1	186.6	128.5	60.7	0.0
1985	32.5	0.0	0.0	13.4	37.8	195.3	416.3	144.8	110.5	269.1	18.5	20.4
1986	40.0	25.0	0.0	10.0	6.5	45.5	70.0	331.4	64.0	110.6	92.3	0.0
1987	0.0	0.0	2.5	9.6	45.0	49.4	83.1	141.8	198.0	216.8	116.4	17.4
1988	0.0	0.0	0.0	14.9	54.6	35.6	11.1	158.3	259.6	33.8	13.5	0.0
1989	0.0	0.0	21.5	0.0	0.0	47.0	412.3	276.1	198.1	21.8	0.0	0.0
1990	0.0	71.6	107.2	0.0	435.0	100.8	114.4	230.2	119.8	260.8	24.4	0.0

PITHAPURAM

1980	0.0	0.0	0.0	0.0	33.7	319.0	90.8	175.1	68.8	219.6	78.6	8.6
1981	6.8	0.0	12.2	0.0	151.6	147.3	214.2	159.0	218.8	104.0	56.6	0.0
1982	0.0	0.0	0.0	21.6	49.6	66.8	133.0	190.8	59.6	176.4	33.2	0.0
1983	0.0	43.6	0.0	0.0	68.2	136.2	69.6	272.4	352.0	268.8	15.6	4.0
1984	17.0	3.6	0.0	19.0	82.4	102.5	149.2	108.0	250.4	95.2	0.0	2.2
1985	24.4	0.0	0.0	0.0	54.0	94.2	177.0	163.6	96.9	263.6	26.2	0.0
1986	42.0	0.0	0.0	10.4	125.0	71.2	122.0	290.4	230.4	63.4	117.4	22.0
1987	16.8	0.0	0.0	21.2	54.4	44.4	139.2	161.4	158.2	292.4	159.0	22.2
1988	0.0	0.0	0.0	24.2	94.2	24.4	11.0	261.4	258.2	90.8	0.0	0.0
1989	0.0	0.0	44.4	3.8	20.6	133.2	320.6	198.2	158.2	18.6	0.0	0.0
1990	0.0	92.2	56.8	0.0	490.8	87.1	125.1	159.9	102.4	158.2	65.6	0.0

B) WEST GODAVARI DISTRICT (A P)

KOVVUR

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
1981	1.6	0.0	15.0	0.0	153.0	78.6	232.8	148.0	233.4	116.4	0.00	0.00
1982	0.0	0.0	0.0	68.0	21.8	92.8	150.0	241.3	196.4	147.0	4.0	0.0
1983	0.0	0.0	0.0	0.0	107.0	102.2	180.0	460.8	283.4	375.8	0.0	2.0
1984	12.0	4.2	32.0	70.4	49.6	76.4	216.8	92.6	136.2	110.4	32.0	0.0
1985	37.0	24.0	0.0	0.0	35.0	115.2	342.0	213.8	104.2	306.8	3.0	13.6
1986	20.0	7.0	0.0	92.4	33.4	97.4	223.3	451.0	67.6	106.4	51.0	0.0
1987	20.0	0.0	24.6	5.0	78.4	56.6	83.9	294.3	228.2	268.1	198.0	15.0
1988	0.0	0.0	0.0	100.2	145.4	17.9	455.0	219.9	186.2	61.6	0.0	0.0
1989	0.0	0.0	103.0	1.8	7.4	196.2	377.6	402.8	83.0	77.0	9.8	0.0
1990	64.0	88.0	85.8	0.0	500.8	96.6	151.2	217.6	160.8	165.3	0.0	6.6

NARASAPURAM

1981	18.3	1.4	0.0	0.0	16.0	54.1	397.7	106.3	302.0	162.4	14.1	5.0
1982	0.0	0.0	0.0	2.3	34.4	37.9	94.4	170.5	185.4	151.5	81.3	0.0
1983	0.0	34.0	0.0	0.0	44.1	178.9	131.5	304.0	385.0	191.8	0.0	3.2
1984	0.0	6.8	0.0	0.0	16.9	48.8	343.9	63.8	229.8	134.6	27.9	2.0
1985	45.2	0.0	0.0	0.0	8.0	105.4	225.2	198.0	346.0	476.8	38.6	94.0
1986	42.0	5.0	0.0	29.0	21.2	125.6	95.6	576.8	187.0	278.4	138.7	0.0
1987	0.0	0.0	85.0	6.0	36.0	24.0	124.6	162.9	93.4	260.2	270.4	45.8
1988	0.0	0.4	0.0	38.6	130.8	87.4	396.8	232.0	219.8	78.2	17.2	11.4
1989	3.0	0.0	59.8	0.0	2.4	125.6	423.4	461.4	250.8	75.4	17.0	0.0
1990	10.4	192.2	106.2	0.0	449.0	85.6	186.6	232.0	170.4	392.2	42.4	35.0

PENUGONDA

1981	16.0	0.0	6.6	0.0	21.0	73.9	248.0	115.1	173.7	151.3	4.0	0.0
1982	2.5	0.0	0.0	0.0	7.2	50.0	93.7	249.4	198.2	176.0	8.0	0.0
1983	0.0	0.0	0.0	0.0	4.2	39.5	41.0	248.5	174.0	147.0	0.0	3.5
1984	0.0	5.5	0.0	0.0	0.0	39.0	153.0	13.0	151.7	97.8	74.0	0.0
1985	27.5	0.0	0.0	0.0	8.0	110.4	212.5	171.1	115.7	215.1	4.0	10.1
1986	9.2	0.0	0.0	41.0	46.0	74.8	85.8	490.6	108.0	43.0	20.0	0.0
1987	45.0	0.0	0.0	0.0	9.0	4.0	153.4	219.3	182.1	243.	142.0	22.0
1988	0.0	0.0	0.0	81.0	60.0	160.6	455.5	229.0	219.	36.0	0.0	3.0
1989	0.0	0.0	42.0	0.0	0.0	137.6	46 .8	452.4	165.2	7.6	2.8	0.0
1990	26.0	68.4	90.0	28.4	.2	61.4	109.8	201.0	111.4	246.0	33.0	20.0

POLAVARAM

1981	0.0	0.0	19.4	26.6	44.8	134.6	349.4	253.0	293.0	14.0	8.0	5.0
1982	0.0	0.0	0.0	71.0	65.0	183.0	150.4	272.6	129.0	144.2	0.0	0.0
1983	10.2	0.0	0.0	0.0	120.6	85.0	225.7	516.8	679.1	411.7	4.0	44.0
1984	0.0	52.0	0.0	14.0	39.0	156.0	151.6	118.4	150.4	175.4	0.0	5.0
1985	45.4	0.0	0.0	117.9	0.0	81.2	160.2	253.0	30.6	190.2	4.4	8.3
1986	10.0	0.0	3.0	48.0	67.0	46.6	80.5	462.1	132.0	172.0	10.0	0.0
1987	38.0	0.0	30.0	0.0	71.0	70.0	155.6	333.4	196.8	253.0	168.0	14.0
1988	0.0	0.0	0.0	171.0	179.0	2.0	638.0	166.0	237.0	79.2	0.0	0.0
1989	0.0	0.0	54.6	0.0	3.2	222.3	346.6	457.8	130.2	28.4	0.0	0.0
1990	0.0	193.4	69.4	10.4	603.4	78.4	140.6	323.2	122.2	217.0	49.2	10.4

GOPALAPURAM

1981	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1982	0.0	0.0	0.0	0.0	0.0	333.6	228.4	506.2	237.0	302.2	0.0	0.0
1983	0.0	0.0	0.0	0.0	72.8	123.0	208.2	578.0	300.1	363.8	0.0	47.4
1984	0.0	36.6	0.0	50.8	36.2	77.6	233.6	108.0	78.6	94.0	20.2	33.8
1985	38.6	7.6	0.0	8.8	33.6	108.4	245.0	206.8	28.6	165.6	1.8	15.8
1986	17.6	0.0	0.0	2.6	50.4	67.4	88.7	555.6	25.8	123.6	28.0	0.0
1987	0.0	0.0	10.2	6.4	58.4	75.4	137.2	144.8	117.8	140.5	141.3	20.5
1988	0.0	80.5	0.0	80.2	69.5	31.1	511.9	284.8	223.5	74.1	0.0	1.0
1989	0.0	0.0	43.8	9.6	6.3	213.4	370.6	346.6	170.6	49.8	0.0	0.0
1990	26.4	39.0	106.8	6.0	419.6	69.6	111.4	220.0	181.6	229.2	12.0	30.0

PALAKOL

1981	STATION NOT EXISTING											
1982	0.0	0.0	0.0	0.0	0.0	105.0	115.0	369.0	177.0	272.0	28.0	0.0
1983	0.0	15.0	0.0	0.0	47.0	380.0	254.0	453.0	505.0	235.0	13.0	14.0
1984	0.0	18.0	0.0	0.0	18.6	92.0	370.0	91.0	306.0	337.0	35.0	0.0
1985	67.0	0.0	0.0	0.0	5.6	241.8	410.2	227.8	273.6	393.8	37.2	126.8
1986	64.8	8.0	0.0	75.4	58.4	53.2	104.2	280.2	135.2	123.8	129.6	0.0
1987	0.0	0.0	31.4	20.2	25.0	60.6	218.0	169.1	181.2	419.2	351.0	60.8
1988	0.0	0.0	0.0	78.4	57.4	91.4	481.5	272.3	175.9	76.4	7.8	34.2
1989	0.0	0.0	61.4	0.0	0.0	112.2	420.9	458.8	199.0	43.2	7.6	0.0
1990	15.2	118.2	116.6	9.6	419.2	88.2	105.6	87.6	187.6	314.8	26.6	13.2

UNDRAJAVARAM

1981	TO 87	STATION	NOT	EXISTING								
1988	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.4	10.8	0.0
1989	0.0	0.0	91.4	0.0	6.6	136.0	525.8	388.2	250.0	47.0	5.6	0.0
1990	21.0	36.4	89.2	6.6	462.6	42.6	52.4	202.0	57.4	277.4	16.4	0.0

IRAGAVARAM

1981	TO 87	STATION	NOT	EXISTING								
1988	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.2	4.8	0.0
1989	0.0	0.0	55.2	0.0	0.0	126.8	501.8	418.4	191.6	50.0	2.8	0.0
1990	30.4	29.8	96.0	29.6	601.2	44.6	93.6	254.8	84.6	272.6	21.6	11.6

PERAVALI

1981	TO 87	STATION	NOT	EXISTING								
1988	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.8	10.0	1.0
1989	0.0	0.0	90.4	0.0	3.0	137.4	499.0	433.6	269.4	33.4	17.0	0.0
1990	38.0	27.8	63.8	12.6	545.2	40.0	51.2	140.6	65.6	270.6	34.6	0.0

ELAMANCHILI

1981	TO 87 STATION NOT EXISTING											
1988	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	45.8	23.4	11.4
1989	0.0	0.0	52.2	0.0	0.0	89.8	307.8	402.8	227.1	72.0	12.4	0.0
1990	12.4	156.3	76.3	18.4	377.8	83.4	83.4	161.7	122.1	228.8	30.0	0.0

ACHANTA

1981	TO 87 STATION NOT EXISTING											
1988	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.8	6.0	1.4
1989	0.0	0.0	57.0	0.0	3.0	106.2	350.4	436.8	142.5	38.9	0.0	0.0
1990	33.0	91.5	71.8	76.0	470.8	133.2	102.0	151.2	76.6	283.0	44.8	0.0

MOGALTUR

1981	TO 87 STATION NOT EXISTING											
1988	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	93.0	10.0	19.0
1989	0.0	0.0	28.0	0.0	0.0	92.0	244.7	468.9	283.4	162.5	25.4	0.0
1990	0.0	331.1	106.2	0.0	368.8	158.6	111.0	267.6	83.8	396.2	27.6	0.0

NIDADAVOLU

1981	TO 1988 STATION NOT EXISTING											
1989	0.0	0.0	0.0	0.0	10.2	179.4	559.4	337.0	128.4	53.5	15.6	0.0
1990	86.4	26.7	72.6	25.4	607.6	129.8	83.2	124.2	95.6	202.8	54.4	0.0

TALLAPUDI

1981 TO 1988 STATION NOT EXISTING												
1989	0.0	0.0	36.0	13.0	2.2	228.7	261.2	326.6	101.4	38.6	20.0	0.0
1990	3.2	29.4	48.8	10.4	543.4	77.4	100.2	236.6	100.0	189.4	11.2	6.6

ANNEXURE - 2

NORMAL ANNUAL RAINFALL FOR RAINGAUGE STATIONS (mm) IN GODAVARI DELTA AREA

S.No	Name of the Raingauge Station	Normal Rainfall (mm)
1	Rajahmundry	1054.2
2	Alamuru	1136.9
3	Kakinada	1095.1
4	Amalapuram	1227.9
5	Mummidivaram	1296.7
6	Razole	1193.3
7	Kothapeta	1145.5
8	Pithapuram	996.9
9	Kovvur	1057.9
10	Narasapuram	904.0
11	Penugonda	564.0
12	Polavaram	1171.5
13	Gopalapuram	1109.0
14	Palakol	1303.6
15	Undrajavaram	--
16	Iragavaram	--
17	Peravali	--
18	Elamanchili	--
19	Achanta	--
20	Mogaltur	--
21	Nidadavolu	1041.9
22	Tallapudi	1095.0

ANNEXURE - 3

LIST OF EFFECTIVE RAINGAUGE STATIONS AND AREA OF POLYGONS

S.No.	Raingauge Station	Area of Polygon (Sq Kms)
1	Rajahmundry	19.5
2	Alamuru	71.5
3	Kothapeta	143.0
4	Amalapuram	351.0
5	Mummidivaram	226.0
6	Razole	14.0
	Total	825.0

ANNEXURE 4

MONTHLY MEAN AREAL PRECIPITATION OVER THE STUDY AREA (mm)

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JUL	AUG	SEP	OCT	NOV	DEC
1980	--	--	--	--	9.4	346.4	124.7	267.3	87.96	352.02	116.03	17.61
1981	33.05	--	0.91	9.34	29.31	84.3	306.37	100.42	340.66	129.22	10.05	7.48
1982	--	--	--	6.1	20.5	92.79	--	226.72	128.68	165.35	102.38	--
1983	--	20.0	--	--	39.34	152.91	151.47	343.42	370.8	238.54	60.62	31.29
1984	0.57	16.89	0.57	8.59	43.56	84.85	254.6	69.29	152.03	122.65	102.75	0.87
1985	38.85	--	--	2.81	12.38	11.58	300.74	144.86	93.41	320.52	37.03	35.03
1986	47.78	23.69	--	8.92	15.12	63.95	102.15	428.77	82.00	159.68	127.56	5.08
1987	10.42	--	8.04	35.11	25.18	39.72	91.63	130.90	197.28	312.28	167.75	35.22
1988	--	--	--	12.85	36.09	43.39	23.93	263.05	254.80	37.05	15.41	1.22
1989	--	--	37.07	--	17.53	139.28	401.54	432.19	196.00	66.65	1.28	1.51
1990	--	112.18	71.5	27.5	549.07	102.41	154.10	194.91	174.70	306.00	80.55	11.05

ANNEXURE - 5(A)

INDEX TO CONTROL POINTS OF GANNAVARAM CANAL

S.NO.	Name of the Locks and Head Sluice
1	BOBBARLANKA LOCK
2	Amalapuram Channel
3	Atreyapuram Channel
4	Uchili Pumping Channel
5	L.S.S Channel
6	R.S.S. Channel
7	Lolla Highlevel Channel
8	Lolla Side Channel
9	RYALI GANNAVARAM LOCK
10	L.Polavaram
11	R.C.Pur Surplus Weir
12	R.C.Pur Side Channel
13	Eathakota Channel
14	Burugucheruvu Channel
15	Gopalapuram Side Channel
16	GOPALAPURAM LOCK
17	Bellempudi Surplus Weir
18	Bodapativari Channel
19	Burugu Channel
20	Hospital Channel
21	Yenugupalli Channel
22	GANNAVARAM AQUEDUCT
23	Mondepulanka West Channel
24	Mondepulanaka East Side Channel
25	MONDEPULANKA LOCK

P.GANNAVARAM SUB DIVISION

Monthly Discharges in Gannavaram Canal (Cumec-day)

DISCHARGE (Q) AND NO. OF RUNNING DAYS (D) YEAR : 1981

DISCHARGE IN CUMEC-DAY

S.NO	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D
1	1812	31	1648	28	1570	31	849	15											1493	31	1828	30	1806	31
2	33		30		C		17												34		33		34	
3	23		23		C		11												23		23		23	
4	19		19		C		9												15		19		19	
5	9		8		9		6												7		6		6	
6	21		19		25		19												20		17		10	
7	30		29		32		23												33		25		14	
8	11		11		12		8												16		12		5	
9	431		404		410		187		<---------- Not Available ----------										424		322		533	
10	2		2		2		1												2		1		2	
11	C		C		C		C												C		C		C	
12	1		1		2		1												2		2		2	
13	6		5		6		2												5		4		5	
14	7		6		7		3												5		4		5	
15	12		10		10		6												15		12		17	
16	414		377		363		185												347		313		487	
17	C		C		C		C												C		C		C	
18	3		2		3		4												2		2		5	
19	6		5		6		3												4		4		5	
20	8		10		11		3												6		9		8	
21	23		17		14		6												10		10		18	
22	NA		NA		NA		NA												NA		NA		NA	
23	3		4		14		4												5		3		5	
24	6		6		10		6												5		3		5	
25	391	31	339	28	302	31	165												309	31	246	30	427	31

DISCHARGE (Q) AND NO.OF RUNNING DAYS (D) YEAR : 1982

DISCHARGE IN CUMEC-DAY

S.NO	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D
1	NA	31	NA	28	NA	31	NA	15	NA	14	NA	30	NA	20					NA	19	NA	30	NA	31
2	34		31		34		17		15		33		30						34		34		33	
3	24		21		24		11		11		30		22						24		24		23	
4	19		17		19		9		9		19		19						19		12		18	
5	8		7		6		5		4		5		7						11		8		19	
6	13		14		30		19		13		16		14						40		19		19	
7	21		18		23		14		13		23		16						18		25		31	
8	10		7		9		5		5		8		11						11		6		11	
9	502		473		433		233		220		411		580						501		455		523	
10	2		2		2		1		1		2		2		<---Not Available --->				2		2		2	
11	C		C		C		C		C		C		C						C		C		C	
12	2		2		2		1		1		2		2						2		2		3	
13	6		4		5		3		2		5		6						4		4		9	
14	5		5		7		3		1		5		6						4		6		10	
15	18		17		13		7		9		17		18						7		10		12	
16	478		428		394		199		229		386		535						464		373		485	
17	C		C		C		C		C		C		C						C		C		C	
18	5		4		3		2		2		3		3						3		3		4	
19	4		3		3		4		2		3		7						5		3		4	
20	8		8		6		5		4		6		9						6		4		6	
21	15		15		15		NA		7		12		17						16		14		12	
22	C		C		C		NA		NA		NA		NA						NA		NA		NA	
23	4		4		5		3		3		5		7						10		7		4	
24	6		5		8		3		4		6		7						11		6		3	
25	425	31	368	28	312	31	169	15	187	14	329	30	450	20					363	19	291	30	422	31

DISCHARGE (Q) AND NO.OF RUNNING DAYS (D) YEAR : 1983

DISCHARGE IN CUMEC-DAY

S.NO	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D
1	NA	31	NA	28	NA	26			NA	10	NA	20												
2	34		30		13				C		10													
3	24		21		11				C		9													
4	19		17		15		C		C		11													
5	6		5		8		A		1		3													
6	16		14		26		N		4		6													
7	3		22		18		A		5		10													
8	11		10		9		L		1		4													
9	486		444		293				140		159													
10	3		4		2				1		1													
11	C		C		C		C		C		C													
12	3		2		1		L		1		1													
13	6		4		3		O		2		2													
14	9		5		4		S		2		4													
15	17		8		9		E		5		21													
16	441		387		289		D		132		151	<----------Data Not Available---------->												
17	C		C		C				C		C													
18	3		3		3				1		1													
19	5		4		3				1		1													
20	6		7		6				2		3													
21	11		10		9				5		4													
22	NA		NA		NA				NA		NA													
23	3		3		5				1		2													
24	3		3		5				1		2													
25	383	31	373	28	235	26			116	10	149	20												

DISCHARGE (Q) AND NO.OF RUNNING DAYS (D) YEAR : 1984

DISCHARGE IN CUMEC-DAY

S.NO	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D
1	NA	12	NA	29	NA	15			NA	15	NA	30	NA	25										
2	13		32		17				NA		33		28											
3	9		22		11				NA		23		19											
4	7		18		9		C		NA		19		15											
5	4		11		5		A		3		7		8											
6	16		38		19		N		10		19		25											
7	19		45		23		A		13		28		31											
8	4		15		8		L		2		12		12											
9	235		530		319				257		509		497											
10	1		2		1		C		2		2		2											
11	C		C		C		L		C		C		C											
12	1		2		1		O		2		2		2											
13	2		4		2		S		4		7		4											
14	2		6		3		E		4		6		6											
15	6		12		7		D		7		15		20											
16	220		497		276				224		429		445	<-------- Data not Available---------->										
17	C		C		C				C		C		C											
18	2		3.		2				3		3		3											
19	2		3		3				4		3		3											
20	3		7		3				4		6		6											
21	7		12		8				8		11		9											
22	NA		NA		NA				NA		NA		NA											
23	2		5		5				NA		NA		NA											
24	3		6		4				NA		NA		NA											
25	189	12	439	29	249	15			186	15	375	30	398	25										

NOTE : DATA FOR 1985 NOT AVAILABLE

DISCHARGE IN CUMEC-DAY -YEAR 1986

S.NO	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D
1									C		1324	30	2720	31	775	10	1326	22	1566	31	581	20	1174	19
2									C		33		44		10		26		27		17		21	
3									C		23		28		7		18		19		14		14	
4									C		29		17		5		12		18		8		12	
5									C		6		9		3		36		8		5		4	
6									C		12		35		9		17		22		18		11	
7									C		18		41		11		18		23		10		15	
8									C		6		15		4		7		7		3		3	
9									389	19	445		747		142		390		478		254		285	
10									6	18	1		2		1		2		1		1		1	
11									C		C		C		C		C		C		C		C	
12									2	18	1		2		1		1		2		1		2	
13									3	18	3		7		2		5		7		4		2	
14									3	18	4		11		3		4		7		3		3	
15									9	18	9		16		4		9		21		8		11	
16	<------NOT AVAILABLE ---------->								336	22	337		696		176		321		343		163		281	
17									C		C		C		C		C		C		C		C	
18									3	22	2		3		1		1		3		2		1	
19									3	22	3		5		1		1		3		2		2	
20									4	22	3		5		1		2		3		2		2	
21									8	22	5		11		3		4		5		3		3	
22									NA		NA		NA		NA		NA		NA		NA		NA	
23									C		C		C		C		C		C		C		C	
24									C		C		C		C		C		C		C		C	
25									312	22	289	30	544	31	130	10	289	22	288	31	160	20	205	19

DISCHARGE (Q) AND NO.OF RUNNING DAYS (D) YEAR : 1987

DISCHARGE IN CUMEC-DAY

S.NO	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D
1	2203	31	2019	28	1091	17																		
2	34		31		20																			
3	24		21		14																			
4	19		17		11																			
5	12		8		4																			
6	36		22		13		C																	
7	45		31		10		A																	
8	14		12		4		N																	
9	670		546		289		A																	
10	3		2		1		L																	
11	C		C		C																			
12	3		2		2		C																	
13	6		5		3		L																	
14	6		6		4		O		<---------- DATA NOT AVAILABLE---------->															
15	21		17		9		S																	
16	525		477		263		E																	
17	C		C		C		D																	
18	3		4		2																			
19	3		6		2																			
20	4		6		3																			
21	9		8		4																			
22	NA		NA		NA																			
23	C		C		C																			
24	C		C		C																			
25	409	31	374	28	207	17																		

DISCHARGE (Q) AND NO.OF RUNNING DAYS (D) YEAR : 1988

DISCHARGE IN CUMEC-DAY

S.NO	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D
1											681	15	1406	31	1359	31	1664	30	1696	31	1923	30	2443	31
2											7		32		33		33		33		32		34	
3											5		22		22		23		23		22		24	
4											4		18		13		9		13		12		19	
5											2		7		3		3		8		10		11	
6											8		34		15		14		27		38		40	
7											9		27		19		15		20		25		31	
8								C			3		7		6		5		8		8		13	
9								A			206		390		384		493		434		414		567	
10								N			1		3		3		3		3		3		3	
11								A			C		C		C		C		C		C		C	
12	<------NOT AVAILABLE ---------->							L			1		3		3		3		2		3		3	
13											3		5		7		9		3		5		7	
14								C			2		6		7		9		4		6		7	
15								L			5		19		23		23		14		14		28	
16								O			196		385		274		394		382		377		526	
17								S			C		C		C		C		C		C		C	
18								E			2		5		4		4		3		4		5	
19								D			2		4		3		3		3		3		5	
20											2		5		5		5		4		5		6	
21											4		8		9		8		5		5		11	
22											NA		NA		NA		NA		NA		NA		NA	
23											2		3		C		C		2		2		4	
24											2		2		C		C		2		3		6	
25											160	15	393	31	229	31	320	30	304	31	323	30	409	31

DISCHARGE (Q) AND NO.OF RUNNING DAYS (D) YEAR : 1989

	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D
1	NA	31	NA	28	NA	31			NA	31	NA	30	NA	31	NA	31	NA	30	NA	31	NA	30		
2	29		22		34				C		33		38		34		33		34		30			
3	21		18		24				C		24		26		24		23		24		21			
4	16		15		19				C		11		11		19		19		18		15		N	
5	13		5		7		C		6		9		10		8		6		7		7		O	
6	38		13		19		A		21		21		40		37		15		24		24		T	
7	30		18		25		N		22		25		29		24		NA		33		27			
8	10		7		10		A		7		12		11		13		10		9		7		A	
9	548		446		414		L		294		461		487		305		351		405		424		V	
10	3		3		2				2		2		2		3		2		2		3		A	
11	C		C		C		C		C		3		C		C		C		C		C		I	
12	3		2		2		L		2		3		2		3		2		2		3		L	
13	6		8		4		O		3		5		4		5		5		5		8		A	
14	6		8		4		S		3		5		4		5		5		5		8		B	
15	18		14		13		E		7		14		15		12		16		15		16		L	
16	527		412		409		D		285		370		544		318		300		301		368		E	
17	C		C		C				C		C		C		C		C		C		C			
18	3		3		3				2		3		3		2		4		4		4			
19	4		4		4				2		3		4		1		3		4		3			
20	5		5		5				3		4		5		3		5		4		4			
21	9		10		6				4		9		11		6		6		4		6			
22	NA		NA		NA				NA		NA		NA		NA		NA		NA		NA			
23	4		4		6				4		5		5		2		2		3		3			
24	4		3		4				3		5		4		2		2		2		3			
25	381	31	340	28	278	31			227	22	294		405		266		301		284		316			

DISCHARGE (Q) AND NO.OF RUNNING DAYS (D)

YEAR 1990

DISCHARGE IN CUMEC-DAY

S.NO	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D
1													1312	20	NA	31	NA	30	NA	31	NA	30	NA	31
2													22		32		31		24		33		29	
3													15		22		21		17		23		20	
4													12		12		17		13		18		17	
5													7		11		6		5		8		11	
6													26		27		NA		9		10		24	
7													23		26		22		9		30		28	
8													8		12		12		8		5		14	
9													323		481		453		333		356		437	
10													2		2		2		1		2		3	
11													C		C		C		C		2		C	
12													2		2		2		1		3		3	
13													5		6		8		2		5		7	
14													5		6		8		2		8		8	
15													14		19		21		6		6		25	
16	<------DATA NOT AVAILABLE---------->												279		437		393		287		213		247	
17													C		C		C		C		C		C	
18													5		8		4		11		8		7	
19													4		8		5		13		10		8	
20													5		7		8		15		12		6	
21													11		16		12		27		14		24	
22													NA		NA		NA		NA		NA		NA	
23													C		5		C		3		3		C	
24													C		3		C		2		3		C	
25													237	20	373	31	423	30	303	31	198	30	169	31

ANNEXURE 5(B)

INDEX TO CONTROL POINTS OF AMALAPURAM CANAL

S.NO.	Name of the Lock/Channel
1	Bobbarlanka Head Sluice
2	Lolla Lock
3	Wadapalem Lock
4	Vilasa Channel
5	Chintallanka Lock
6	Thanelanka Channel
7	Kothalanka Channel
8	Annampalli Aqueduct
9	Guttina Deevi Channel
10	Polavaram Channel
11	Kesanakurru Channel
12	Tillakuppa Channel
13	Annampalli Lock
14	Wadaparru Channel
15	Indapuram Channel
16	Kundaleswaram Weir
17	N.K.Palli Channel
18	Geddanapalli Channel
19	Dontikurru Channel
20	Kandikuppa Channel
21	Pallamkurru No.1 Channel
22	Pallamkurru No.2 Channel
23	Ryali Gannavaram canal
24	Gopalapuram Lock
	AMALAPURAM CANAL
25	Ryali Amalapuram canal
26	Ambajipeta Channel
27	Palivela Lock
28	Nedunuru Channel
29	K.Pedapudi Channel
30	Mukkamala West side Channel
31	Mukkamala Lock
32	Nadipudi Lock
33	Amalapuram Channel
34	Reddipalli Channel
35	Cheyyeru Channel
36	Samanasa Channel
37	Chintalapudi Lock
38	Challapalli (Z) Channel
39	S.Yanam New Channel
40	S.Yanam Old Channel
	BENDA CANAL
41	Indupalli weir
42	Allavaram Channel
43	Kowsika Channel
44	Benda No.1 Channel
45	Benda No.2 Channel
	SURPLUS WEIRS
46	Mukkamala S/W (Amalapuram Canal)
47	Allavaram S/W (Benda canal)
48	Challapalli S/W (Amalapuram canal)
49	Kundaleswaram S/W (Bank Canal)

MONTHLY DISCHARGES IN AMALAPURAM CANAL (IN CUMEC-DAY)

DISCHARGE (Q) AND NO. OF RUNNING DAYS (D) YEAR :1981

DISCHARGE IN CUMEC-DAY

S.NO	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D
1	239	4	1648	28			849	15	546	9														
2	76		528				239		140															
3	86		596				242		144															
4	12		75				29		23															
5	61		447				192		108															
6	2		13				6		2															
7	20		140				51		30															
8	5		31				12		7															
9	8		59		N		20		10															
10	6		35		O		11		9															
11	4		22		T		8		5															
12	31		226				117		42															
13	3		21		A		8		2															
14	6		47		V		22		7															
15	16		99		A		52		16															
16	6		35		I		17		9															
17	1		3		L		2		2															
18	1		9		A		5		2															
19	2		13		B		7		2															
20	1		8		L		4		2	<----------DATA NOT AVAILABLE ---------->														
21	1		12		E		7		1															
22	60		388				200		131															
23	59		364				189		118															
24	59		415				224		124															
25	7		46				23		27															
26	51		371				179		102															
27	2		13				8		4															
28	2		14				2		3															
29	1		2				1		1															
30	44		345				152		94															
31	41		319				131		105															
32	4		21				12		10															
33	4		27				9		9															
34	C		C				3		2															
35	7		60				21		19															
36	2		14				6		3															
37	2		16				6		4															
38	1		7				2		2															
39	16		120				64		29															
40	7		46				25		10															
41	9		57				31		13															
42	6		45				20		11															
43	4		26				13		6															
44	C		C				C		C															
45	C		C				C		C															
46	C		C				C		C															
47	C		C				C		C															
48	C		C				C		C															

DISCHARGE (Q) AND NO. OF RUNNING DAYS (D) YEAR :1982

DISCHARGE IN CUMEC-DAY

S.NO	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D
1																			607	12	1472	30	2220	31
2																			209		537		795	
3																			187		528		754	
4																			19		51		103	
5																			140		391		573	
6																			5		13		14	
7																			38		111		155	
8																			10		27		38	
9																			16		49		74	
10																			10		25		45	
11																			6		24		30	
12																			126		245		293	
13																			5		19		24	
14																			14		52		59	
15																			26		102		129	
16																			9		37		49	
17																			1		3		4	
18																			2		9		9	
19																			3		13		15	
20																			2		7		8	
21	<----------DATA NOT AVAILABLE----------																		4		16		20	
22																			156		447		538	
23																			134		360		498	
24																			199		449		654	
25																			25		42		74	
26																			159		304		529	
27																			7		13		22	
28																			8		8		13	
29																			1		2		3	
30																			165		258		404	
31																			153		211		418	
32																			11		22		31	
33																			8		19		34	
34																			5		7		10	
35																			55		55		78	
36																			6		11		11	
37																			9		17		20	
38																			3		8		13	
39																			73		102		155	
40																			17		38		53	
41																			19		54		67	
42																			19		44		50	
43																			12		27		33	
44																								
45																								
46																								
47																								
48																								

DISCHARGE (Q) AND NO. OF RUNNING DAYS (D) YEAR :1983

DISCHARGE IN CUMEC-DAY

S.NO	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D
1	1990	31	1768	28	1677	31	703	15	971	15	1128	30	2150	31	1486	31	958	30	575	16				
2	743		664		562		212		287		338		655	31	403		210		217	31				
3	723		645		576		232		284		296		397	20	525		285		255					
4	98		84		61		24		40		44		57	19	47		27		25					
5	551		506		474		179		236		368		305	19	425	31	224		216					
6	13		9		10		5		1		6		7	21	4	12	9		5					
7	161		155		129		53	15	60		87	30	136	31	120	31	57		63					
8	38		346		33		8	13	18		23	27	45		30		12		12					
9	77		71		57		19	13	20		37	30	57		48		19		23					
10	44		43		35		12	13	19		25		37		35		13		18					
11	26		24		22		7	13	11	15	14		19		19		13		8					
12	296		253		307		99	15	116	8	150		332		270		231		176					
13	31		27		22		7	11	10	10	14		27		21		15		12					
14	73		59		54		17	11	23	10	37		67		56		45		33					
15	132		108		144		40	11	52	11	75		144		109		72		90					
16	72		46		62		15	11	21	14	31		58		42		28		27					
17	3	18	4		4		2	11	2	14	3		6		5		3		4					
18	10	31	8		9		4	11	5	15	7		12		9		6		6					
19	15		14		15		5	10	7		10		14		13		9		10					
20	9		7		9		3	10	4		7		12		9		6		7					
21	21		18		25		5	10	8		12		21		21		15		13		<--- NOT AVAILABLE-->			
22	503		430		367		202	15	233		285		537		287		303		243					
23	473		404		344		191		223		255		510		348		230		166					
24	674		593		573		239		296		316		709		390		343		303					
25	75		59		63		30		29		35		88		49		26		23					
26	528		468		416		151		264		252		585		336		290		235					
27	21		16		18		5		13		16		21		16		9		7					
28	12		10		15		5		9		12		20		14		11		10					
29	3		3		3		1		5		3		4		3		3		3					
30	402		370		315		131		198		176		421	31	265		238		191					
31	420		366		264		110		203		165		266	21	235		233		163					
32	38		29		23		13		18		18		25	24	17		8		10					
33	34		31		17		7		15		15	30	23	24	24		25		15					
34	12		10		7		3		4		3	17	7	24	7		5		3					
35	75		79		79		22		38		54	30	92	24	78		80	30	74	31				
36	14		11		12		4		7		11	27	14	23	5		4	20	7	27				
37	10		21		15		7		8		13	30	12	23	11		12	30	16	31				
38	10		9		8		5		4		7		6	24	4		6		6	31				
39	155		145		132		51		74		66		85	24	84	31	87		67	31				
40	53		47		38		21	15	21		20		32	24	28	19	32		22	19				
41	69		59		39		19	12	27		31		49	27	44	31	43		37	23				
42	50		45		46		18	12	23		42		37	25	43	31	41		39	31				
43	39	31	27	28	30	31	9	10	12	15	18	30	26	25	29	31	29	30	27	31				
44	C		C		36	9	C		C		C		C		C		C		C					
45	C		C		C		C		C		C		C		C		C		C					
46	C		C		C		C		C		C		C		C		C		C					
47	C		C		C		C		C		C		C		C		C		C					
48	C		C		C		C		C		C		C		C		C		C					

DISCHARGE (Q) AND NO. OF RUNNING DAYS (D) YEAR :1984

DISCHARGE IN CUMEC-DAY

S.NO	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D
1											1277	20	2393	31	2344	31	2105	30	1656	31	1600	30	2528	31
2											416		679		702		606		455		449		711	
3											386		663		703		629		485		484		726	
4											52		81		95		103		55		44		112	
5											334		563		612		513		400		400		569	
6											6		11		11		13		7		93		60	
7											88		154		160		145		130		112		162	
8											20		34		42		37		40		23		32	
9											38		63		56		56		61		43		59	
10											25		43		48		37		45		40		52	
11											17		17		25		19		21		C		25	
12											191		353		328		318		333		30		374	
13											17		41		29		30		17		24		23	
14											39		86		67		64		38		46		69	
15											89		143		132		120		60		61		126	
6											29		41		40		48		23		27		40	
17											4		6		8		7		6		3		5	
18											7		14		12		9		7		7		10	
19											8		15		12		7		7		6		13	
20											7		15		13		12		14		7		9	
21											18		34		30		22		20		22		30	
22											347		610		652		509		367		367		674	
23											282		527		579		447		302		286		621	
24											378		670		635		553		359		447		645	
25	< --------NOT AVAILABLE ----------									>	36		70		80		58		42		53		66	
26											230		473		506		469		337		319		541	
27											10		23		24		16		11		10		19	
28											9		23		23		18		12		9		11	
29											2		4		5		4		3		3		4	
30											202		396		413		373		288		283		414	
31											182		367		401		364		270		281		361	
32											15		29		33		31		18		19		34	
33											11		23		29		29		19		24		37	
34											4		8		9		8		5		5		10	
35											39		98		84		93		78		72		77	
36											9		21		18		16		14		16		17	
37											7		19		18		17		14		17		18	
38											4		9		21		8		7		10		8	
39											56		135		130		139		91		89		134	
40											21		49		41		42		32		38		51	
41											27		59		49		51		34		35		50	
42											21		44		39		29		26		28		42	
43											16	20	30	31	28	31	17	30	6	31	16	31	43	31

YEAR 1985

DISCHARGE (Q) AND NO. OF RUNNING DAYS (D)

DISCHARGE IN CUMEC-DAY

S.NO	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D
1	2123	31	1588	24	1707	31	1263	15	900	15	1840	30	2183	31	2098	31	2371	30	1179	31	1828	30	2317	31
2	570		458		512		260		265		511		643		688		751		357		557		771	
3	198		436		442		199		244		460		627		635		722		333		521		756	
4	405		69		78		42		46		59		100		81		101		35		71		93	
5	11		397		396		188		186	15	355		449		468		553	30	262		423		590	
6	134		3		C		C		1	1	17		7	10	5	11	11	20	9		12		11	
7	23		112		112		60		28	7	105		128		116		145	30	70		114		154	
8	50		22		17		9		21	5	24		28		26		29		14		25		28	
9	45		56		50		25		8	5	37		56		49		57		29		46		64	
10	17		31		34		19		5	5	32		41		36		45		22		42		52	
11	249		18		17		9		1	3	17		24		28		29		13		24		23	
12	14		187		232		90		62	8	197		289		290		342		205		304		327	
13	29		14		13		7		6	10	11		28		24		22		8		16		24	
14	73		39		45		23		16	10	38		61		66		60		41		51		66	
15	25		81		121		47		44	11	81		124		116		127		84		105		138	
16	C		24		37		9		13	15	40		44		44		39		17		25		38	
17	5		4		C		1		2		4		12		5		7		4		3		6	
18	6		5		9		2		2		5		16		8		8		4		4		8	
19	12		5		8		3		3		4		24		6		7		5		7		9	
20	C		5		8		2		3		6		21		10		10		6		6		11	
21	C		21		24		9		7		18		28		21		24		13		18		28	
22	439		398		441		205		237		435		579		500		612		289		406		582	
23	422		387		392		184		219		403		495		484		601		261		380		568	
24	518		418		486		202		276		476		571		630		665		312		475		629	
25	41		43		45		20		15		49		62		52		60		28		77		76	
26	437		371		366		177		182		341		483		503		546		222		518		493	
27	20		11		10		7		5		17		18		17		16		9		43		17	
28	11		8		8		5		3		12		30		18		17		7		11		15	
29	3		2		3		1		2		3		5		3		3		2		3		4	
30	351		286		277		121		157		244		350		386		442		207		281		389	
31	290		283		264		118		131		252		340		353		446		180	31	278		381	
32	22		23		24		11		11		28		30		32		35		7	12	29		33	
33	33		20		17		9		7		16		24		29		34		26	12	15		26	
34	9		6		7		2		6		6		14		7		13		6	12	7		15	
35	53		74		68		27		46		66		83		98		109		66	12	53		71	
36	16		15		15		10		8		10		18		19		22		5	16	19		23	
37	22		14		16		9		9		15		18		11		19		5	16	18		19	
38	8		8		9		5		11		10		14		130		13		3	14	12		18	
39	115		95		102		36		46		73		109		50		135		76	31	90		104	
40	46		37		32		14		18		26		38		50		52		22	15	47		48	
41	44		38		55		22		23		35	30	46		60		65		24	15	51		45	
42	39		33		49		14		16		15	10	40		29		46		9	6	36		36	
43	24		18		32		13		11		18	10	26	31	C		34		22	23	28	30	18	31
44	43		C		C		C		C		C		17	3	C	31	C		3	1	3	1	7	2
45	C		C		C		C		C		C		2	1	1	1	C		20	5	C		C	
46	C		C		C		C		C		C		7	2	1	1	C	30	C		C		C	
47	C		C		C		C		C		C		4	1	4	2	10	1	11	2	26	3	15	3
48	C	31	C	24	C	31	C	15	C	15	2	12	3	23	5	2	6	1	3	2	4	2	4	3

DISCHARGE (Q) AND NO. OF RUNNING DAYS (D) YEAR :1986

DISCHARGE IN CUMEC-DAY

S.NO	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D
1	2028	31	1666	28	1786	27			1111	23	1393	30	2704	31	1772	31	1729	30	1656	31	1254	27	2033	26
2	638		522		575				489		504		903		643		603		586		393		606	
3	601		493		531				422		451		816		658		584		518		326		618	
4	85		68		63				46		56		107		105		76		68		40		72	
5	466	31	371		395				295		346		604		507		405		384		211		421	
6	10	22	C		10				10		11		19		36		13		11		8		15	
7	136	31	118		112				103		108		165		125		122		127		98		102	
8	32		24		27				22		22		35		30		29		33		21		24	
9	57		42		44				44		45		72		47		44		49		32		41	
10	41		37		33				30		34		53		37		37		43		36		33	
11	23		19		18				15		19		28		29		21		23		18		19	
12	280		209		251				161		191		310		359		215		287		200		234	
13	19		15		15		C		14		10		19		17		20		18		12		24	
14	50		40		52		A		35	23	33		58		51		44		44		37		48	
15	118		91		112		N		84	20	103		136		176		39		103		81		117	
16	27		26		24		A		28	23	34		49		59		29		32		17		41	
17	7		4		5		L		1		6		6		8		5		6		4		8	
18	8		7		7				6		8		8		11		6		6		4		14	
19	7		5		8		C		7		8		10		13		8		8		6		10	
20	10		8		7		L		6		7		9		3		8		8		4		12	
21	18		19		20		O		13		15		20		36	31	16	30	12		8		22	
22	514		482		467		S		428		424		750		471	24	475	25	522		365		527	
23	485		439		355		E		360		337		698		369	31	415	30	366		248		500	
24	568		493		515		D		504		477		768		564		567		559		407		595	
25	56		50		45				38		49		88		55		54		42		35		61	
26	462		370	28	390	27			368		267		683		431		140		397		274		423	
27	17		11	24	11	23			16		16		37		33		20		15		11		18	
28	14		10	24	14	27			12		12		22		20		13		11		11		15	
29	3		2	24	2				2		3		8		3	31	3		3		3	27	3	
30	399		305	28	352				126		187		495		269	20	274		321		186	25	333	
31	373		282		338				271		174		495		240	16	272		298		171	21	308	
32	30		24		30				24		23	30	46		19	20	26		25		17	29	34	
33	31		20		29	27			23	23	16	27	45		33	23	27	30	39		25	21	32	
34	11		7		7	25			5	18	3	18	7		4	16	5	23	6		4	21	6	
35	73		68		97	27			123	23	73	18	129	31	63	23	73	27	78	31	54	23	77	
36	18		13		15				16		13	25	22	26	18	19	15	23	19	25	8	14	17	
37	19		15		18				12		11	30	16	26	11	21	12	26	13	23	5	14	12	
38	10		8		6				47		9		12	31	7	22	7	25	6	23	4	13	7	
39	123		98		112				95		51		184		88	25	98	25	134		82	25	124	
40	45		35		41				31		21		51		42	23	33	27	49		28	17	31	
41	54		35	28	48	27			37		26		63		54	23	40	25	44		26	17	43	
42	47		26	18	38	24			31		C		49		36	23	40	24	43		23	17	37	25
43	31		15	17	23	25			15		14		29		23	21	21	26	26		18	31	18	13
44	C		C		C				C		C		C		C		C		C		C		C	
45	C		C		C				C		C		C		C		C		C		C		C	
46	C		C		C				C		C		C		C		C		C		C		C	
47	C		C		C				C		C		C		C		C		C		C		C	
48	6	31	4	28	1	27			4	23	6	30	6	31	4	21	9	30	4	23	3	20	3	22

DISCHARGE (Q) AND NO. OF RUNNING DAYS (D) YEAR :1987

DISCHARGE IN CUMEC-DAY

S.NO	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D
1	2440	31	1885	28	1719	31			648		1856	30	4584	31	4718	31	4547	30	1135	21	545	23	1914	31
2	765		624		535				233		581		973		924		886		287	21	145	15	625	
3	733		515		276				189		568		927		879		877		329		150	30	521	
4	89		90		43				24		61		132		122		119		49		20	30	80	
5	515		378		233				151		423		631		667		639		254		163	30	478	
6	15		17		190				4		15		16		15		12		7		4	24	11	
7	143		129		279				50		133		164		166		163		80		42	30	151	
8	31		28		36				11		31		33		38		37		17		14		30	
9	60		49		45				12		37		70		72		65		30		10		58	
10	46		39		24		C		13		31		54		58		52		28		23		44	
11	27		21		61		A		7		17		29		29		29		14		17	30	26	
12	333		219		145		N		94		209		325		375		366		197		87	28	261	
13	31		19		16		A		5		19		25		52		27		15		24	30	19	
14	76		42		50		L		18		42		55		71		68		40		24		48	
15	146		99		105				43		86		150		152		149		118		31		121	
16	46		34		42		C		19		28		56		76		74		29		18	30	42	
17	8		4		24		L		3		5		5		6		6		6		3	24	6	
18	11		5		16		O		3		6		13		13		14		11		4	22	11	
19	13		8		9		S		4		22		14		15		18		9		8	22	13	
20	8		6		3		E		4		5		9		9		13		8		3	30	8	
21	26		20		17		D		9		19		50		31		32		18		6	30	20	
22	698		530		273				193		489		726		736		698		445		171	18	492	
23	537		464		261				169		196		679		720		700		363		199	26	427	
24	743		549		316				205		629		635		652		616		409		179	15	503	
25	69		60		23				23		58		79		78		61		34		19	30	64	
26	502		426		180				181		326		559		598		551		240		147		395	
27	17		19		6				6		28		24		16		16		10		5		24	
28	15		17		5				5		15		21		16		15		7		4		16	
29	3		3		1				1		3		4		2		2		1		1		5	
30	402		332		133				133		219		425		487		470		266		133		285	
31	402		317		133				133		216		422		486		472		272		86	30	273	
32	30		27		12				12		26		38		42		41		24		16	22	40	
33	44		26		14				14		20		36		40		41		30		9	20	36	
34	7		5		1				1		3		7		9		9		7		2	18	C	
35	84		83		48				48		67		82		124		108		52		17	30	34	
36	17		17		14				12		12		22		31		29		12		7		8	
37	17		13		10				10		10		20		24		22		11		9		17	
38	6		6		5				5		7		12		12		12		8		4		9	
39	160		128		41				41		59		152		184		175		97		163	30	126	
40	52		37		16				16		23		45		51		50		42		18	24	44	
41	58		44		22				22		27		53		65		57		46		29	15	47	31
42	48		44		15				15		10		49		49		48		49		18	15	19	12
43	28		23		9				9		14		25		31		27		28		11	12	27	31
44	C		C		C				C		C		C		C		C		C		C		C	
45	C		C		C				C		C		C		C		C		C		C		C	
46	C		C		C				C		C		C		C		C		C		1	1	2	1
47	C		C		C				C		C		C		C		C		C		C	C	C	
48	4	31	3	28	2	31			2	13	6	30	5	31	7	30	4	31	1	31	2	10	5	31

DISCHARGE (Q) AND NO. OF RUNNING DAYS (D) YEAR :1988

DISCHARGE IN CUMEC-DAY

S.NO	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D
1	1573	31	1357	29	1557	31	337	10	876	17	966	30	1428	31	1447	31	1607	30	1772	31	1922	30	2554	31
2	572		439		474		127	10	333	20	417		438		456		473		543		562		726	
3	492		395		446		121	11	363	20	438		469		476		459		533		518		762	
4	64		53		63		18	11	44	19	53		56		46		64		64		83		106	
5	413		335		372		94	11	251	19	328		405		407	31	389		454		452		607	
6	8		10		7		1	11	6	18	10		12	31	12	26	8		112		20		24	
7	133		123		129		42	12	80	18	54		5	26	2	17	5		5		4		8	
8	22		19		20		5	12	16	18	62		158	31	156	31	129		130		142		154	
9	43		33		42		11	12	28	18	24		27		27		23		29		29		33	
10	40		31		35		C		22	18	28		44		41		44		50		53		66	
11	22		15		19		5	12	12	17	20		36		27		32		39		45		50	
12	222		173		211		67	12	152	19	93		21		14		17		20		22		24	
13	14		10		12		2	11	6	15	93		228		244		254		245		250		324	
14	39		28		37		11	11	22	18	23		17		9		18		12		17		23	
15	105		84		104		37	12	70	18	55		34		31		55		42		36		66	
16	35		32		41		11	11	21	17	54		94		99		144		125		132		116	31
17	5		5		4		1	11	3	17	15		40		29		40		35		40		34	22
18	8		6		7		2	11	3	17	4		5		3		3		4		7		10	31
19	12		11		11	31	5	11	4	17	7		8		3		4		6		13		8	21
20	7		7		7	26	3	11	4	17	7		9		8		12		8		14		10	31
21	24		17		20	26	7	10	14	18	14		9		7		8		9		10		9	
22	472		382		413	31	108	10	265	20	170		22		15		25		18		23		20	
23	431		350		397		106	11	286	20	308		382		392		476		439		414		572	
24	448		413		442		119	10	291	20	353		387		265		392		[illegible]		376		528	
25	45		42		438		11	11	18	15	196		349		39[illegible]		415		420		519		582	
26	302		268		319		74	12	212	19	[illegible]		29		39		32		32		44		65	
27	18		18		15		4	11	9	18	131		300		285		340		340		387		498	
28	12		13		10		3	11	5	18	10		15		5		9		15		20		24	
29	3		2		1		1	11	1	17	6		14		5		7		8		12		22	
30	222		204		282		64	11	162	19	64		4		1		1		1		2		3	
31	252		233		294		76	12	175	19	161		234		271		293		277	31	322		387	
32	30		28		34		8	11	15	18	115		254		249		214		287	12	342		373	
33	25	31	26	29	27	31	6	11	11	18	24	30	18		19		24	30	32	31	37		48	
34	5	25	2	21	4	27	2	11	1	15	2	22	5		3		4	18	4	22	6		9	
35	72	31	68	29	66	31	11	12	74	19	36	30	26		27		36	30	31	31	34		45	
36	12	28	16		16		4	12	12	18	5	18	C		3		C		4	31	5		4	
37	13	28	14		14		4	12	10	18	30	25	57	31	63		70	30	55	31	81		63	
38	9	31	9		9		2	11	6	18	4	24	5	23	C	31	9	16	7	20	11	[illegible]	9	
39	94		84		115		20	10	51	18	21	28	11	23	7	21	9	18	11	21	17	25	15	
40	32		25		39		7	9	23	18	13	30	7	23	14	22	12	25	12	31	18	25	15	
41	41		31		48		8	9	22	16	43		98		110		130	30	97		126	30	135	
42	C	31	C	29	C	31	C		C		C		33	25	29	20	41		44		59		57	
43	18	26	11	19	18	22	5	8	11	16	21		44	25	40	21	55		39		64		71	
44	C		C		C		C		C		C		C		C		C		C		C		C	
45	C		C		C		C		C		C		24	25	23	25	23		21		28		27	
46	C		C		C		C		C		C		C		C		C		C		C		C	
47	C		C		C		C		C		C		C		C		C		C		C		C	
48	3	24	3	23	C		C		2	16	C	30	C		C		C	30	C	31	C	30	C	31

DISCHARGE (Q) AND NO. OF RUNNING DAYS (D) YEAR :1989

DISCHARGE IN CUMEC-DAY

S.NO	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D
1	2187	31	1909	28	1609	31			1143	20	1498	30	2368	31	1111	31	1336	30	1623	31	1828	30	2426	31
2	646		525		465				299		586		535		407		404		573		584		779	
3	596		544		471				337		566		544		378		378		442		476		718	
4	80		260		58				22		86		82		31		73		52		65		116	
5	497		473		383				255		416		465		356		339		388		430		606	
6	58		15		11				6		15		13		8		5		16		14		16	
7	11		9		8				2		4		13		6		5		2		2		10	
8	38		109		104				74		119		117		111		104		107		130		179	
9	125		21		18				21		27		24		25		22		24		23		31	
10	272		47		33		C		30		47		41		37		41		41		56		80	
11	54		37		38		A		23		36		35		31		27		32		38		58	
12	21		19		19		N		12		18		17		15		23		15		20		31	
13	267		234		227		A		164		234		338		205		266		252		423		320	
14	21		11		12		L		11		14		22		10		24		20		16		29	
15	52		35		25				20		41		48		25		49		53		42		56	
16	128		112		111		C		83		115		82		66		103		105		116		156	
17	43		29		32		L		20		43		39		21		30		31		37		55	
18	10		6		6		O		4		5		6		3		4		3		4		7	
19	8		7		7		S		5		7		8		3		7		3		4		9	
20	14		11		14		E		7		9		8		5		9		7		10		15	
21	12		8		6		D		4		6		5		4		6		7		9		12	
22	26		23		24				13		23		17		13		15		18		41		33	
23	505		457		401				285		444		473		297		351		405		427		646	
24	482		423		380				270		444		495		298		298		308		386		580	
25	568		494		380				294		500		584		291		328		513		492		276	
26	60		57		45				27		52		54		37		34		39		80		74	
27	442		413		342				281		383		452		242		275		328		387		652	
28	18		84		16				9		16		20		15		14		15		15		21	
29	17		14		16				6		13		25		11		12		20		13		24	
30	3		3		4				2		4		6		5		5		7		5		9	
31	349		318		279				213		287		399		202		243		253		317		418	
32	328		321		261				213		277		400		181		218		256		312		407	
33	40		31		30				17		27		33		20		20		26		30		46	
34	6		4		5				2		4		6		2		2		3		5		6	
35	37		34		29				15		25		33		20		25		30		22		40	
36	4		3		1				3		4		4		4		3		5		5		4	
37	63		75		60				47		84		89		50		44		47		76		84	
38	10		9		6				6		9		9		5		7		6		10		9	
39	12		12		14				8		9		10		10		11		17		14		14	
40	17		25		14				7		13		10		8		10		13		16		15	
41	109		110		113				76		104		152		51		102		106		116		153	
42	48		39		45				24		37		53		24		19		37		44		48	
43	59		38		51				30		46		58		33		40		50		50		62	
44	C		C		C				C		C		C		C		C		C		C		C	
45	23		18		25				12		23		32	31	28		27		26		26		27	
46	C		C		C				C		C		19	2	C		C		C		C		C	
47	C		C		C				C		C		2	1	C	31	C	30	C	31	C		C	
48	C	31	C	28	C	31			C	20	C	30	22	7	41	22	17	9	4	2	C	30	C	31

DISCHARGE (Q) AND NO. OF RUNNING DAYS (D) YEAR :1990

DISCHARGE IN CUMEC-DAY

S.NO	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D	Q	D
1	1789	31	1791	28	1046	21					1392	25	1751	31	2049	31	2086	30	1286	31	1297	30	1698	31
2	650		737		328						406		620		597		581		382		375		631	
3	626		506		305						375		592		623		567		366		390		538	
4	93		65		42						45		68		82		84		46		45		85	
5	517		436		209						338		477		509		475		326		363		449	
6	13		12		9						6		13		14		15		12		11		17	
7	8		4		3						4		6		10		10		7		7		8	
8	147		119		75						113		172		207		187		127		131		182	
9	27		23		13		C				24		34		41		35		24		29		33	
10	63		49		40		A				44		71		55		61		48		52		75	
11	46		33		23		N				34		50		62		48		32		40		60	
12	23		19		12		A				15		26		23		26		16		20		31	
13	295		226		140		L				160		257		367		273		237		218		182	
14	27		19		7						10		20		27		18		19		17		11	
15	53		33		15		C				30		46		77		49		30		41		30	
16	145		113		69		L				83		118		163		128		97		100		137	
17	43		39		20		O				30		38		53		41		23		24		32	
18	7		4		2		S				3		6		8		6		6		6		7	
19	8		6		3		E				4		7		15		11		8		7		10	
20	11		10		7		D				8		10		18		10		10		9		13	
21	9		7		6						5		7		20		6		6		6		8	
22	26		17		13						11		17		23		18		15		14		22	
23	535		458		267						348		498		497		484		332		374		411	
24	486		338		202						327		420		479		432		297		240		266	
25	542		458		286						351		520		547		543		362		407		437	
26	54		45		26						37		62		61		66		31		43		72	
27	485		395		183						281		396		465		444		246		217		248	
28	22		16		11						7		22		31		24		15		14		4	
29	21		17		10						5		18		23		19		10		6		12	
30	6		5		2						2		5		7		7		4		3		5	
31	388		299		150						234		312		378		391		312		198		196	
32	352		291		130						216		271		373		372		292		171		166	
33	43		31		13						25		33		43		38		20		22		13	
34	6		7		C						3		7		6		8		9		C		C	
35	34		24		60						21		37		36		34		25		26		19	
36	4		3		C						3		5		4		3		2		3		3	
37	86		70		24						44		37		83		73		76		43		45	
38	10		8		2						7		9		7		7		3		7		4	
39	14		14		9						13		14		15		14		10		11		11	
40	17		13		6						16		14		17		16		8		15		10	
41	110		109		74						87		133		131		152		146		92		113	
42	50		41		26						24		47		43		59		38		38		42	
43	55		48		29						31		60		50		65		54		45		51	
44	C		C		C						C		C		C		C		C		C		C	
45	23		21		20						15		30		24		32		33		25		30	
46	C		C		C						C		C		C		C		C		C		C	
47	C		C		C						C		C		C		C		C		C		C	
48	C	31	C	28	C	21					C	25	C	31	C	31	C	30	C	31	C	30	C	31

CROSS-SECTION DETAILS OF THE CANALS IN CENTRAL GODAVARI DELTA

1. CENTRAL DELTA MAIN CANAL : (all values in mts.)

Length of Canal	0.0 Kms to 13.28 Kms	
	Head	Tail
Bed Level	10.21	9.01
Bed Width	29.28	34.77
F.S.L	12.60	11.60
T.B.L	15.25	13.73
Bed Fall	1/19215	
Side Slope	1:1	1:1

2. AMALAPURAM CANAL

Length of Canal	13.2 Kms to 18.6 Kms		18.6 Kms to 30.8 Kms	
	Head	Tail	Head	Tail
Bed Level	7.93	7.03	7.00	6.75
Bed Width	15.25	15.86	15.25	15.86
F.S.L	10.31	9.17	9.98	9.12
T.B.L	11.70	10.90	10.90	10.15
Bed Fall	1/20000		1/6667	
Side Slope	1:1	1:1	1:1	1:1

Length of Canal	30.8 Kms to 47.96 Kms		47.96 Kms to 55.29Kms	
	Head	Tail	Head	Tail
Bed Level	5.79	1.95	1.90	1.49
Bed Width	15.24	10.06	15.24	5.94
F.S.L	7.92	3.84	3.87	3.47
T.B.L	8.84	4.76	4.78	4.38
Bed Fall	-NA-		1/6090	
Side Slope	1:1	1:1	1:1	1:1

Length of Canal	55.29 Kms to 64.19 Kms	
	Head	Tail
Bed Level	0.10	0.03
Bed Width	7.64	3.36
F.S.L	1.99	1.86
T.B.L	2.91	2.78
Bed Fall	1/125960	
Side Slope	1:1	1:1

3. BENDA CANAL

Length of Canal	48.6 Kms to 51.80 Kms		51.80 Kms to 61.10Kms	
	Head	Tail	Head	Tail
Bed Level	1.95	1.76	1.31	0.61
Bed Width	7.26	7.11	9.36	8.78
F.S.L	3.85	3.67	2.68	2.10
T.B.L	4.77	4.58	3.59	3.01
Bed Fall	1/201640		1/17400	
Side Slope	1:1	1:1	1:1	1:1

4.**GANNAVARAM CANAL**

Length of Canal	13.28 Kms to 27.40 Kms		27.40 Kms to 40.00Kms	
	Head	Tail	Head	Tail
Bed Level	7.93	7.14	5.71	5.31
Bed Width	15.25	15.25	15.40	10.22
F.S.L	10.25	9.37	7.85	7.82
T.B.L	11.09	10.69	8.75	8.14
Bed Fall	1/18751		1/20000	
Side Slope	1:1	1:1	1:1	1:1

Length of Canal	40.0 Kms to 54.40 Kms		54.40 Kms to 62.30Kms	
	Head	Tail	Head	Tail
Bed Level	5.02	2.67	2.53	2.03
Bed Width	15.90	11.10	5.70	5.70
F.S.L	7.16	4.81	4.69	4.19
T.B.L	8.07	5.72	5.59	5.09
Bed Fall	-NA-		1/13005	
Side Slope	1:1	1:1	1:1	1:1

Length of Canal	62.30 Kms to 72.30 Kms	
	Head	Tail
Bed Level	0.96	1.15
Bed Width	5.40	4.80
F.S.L	3.45	2.80
T.B.L	4.05	3.70
Bed Fall	1/51460	
Side Slope	1:1	1:1

5.**BANK CANAL**

Length of Canal	13.20 Kms to 22.25 Kms		22.25 Kms to 43.20Kms	
	Head	Tail	Head	Tail
Bed Level	7.93	7.48	7.474	3.42
Bed Width	18.15	18.15	18.15	12.20
F.S.L	10.89	9.92	9.912	5.889
T.B.L	11.30	11.40	10.83	6.803
Bed Fall	1/12000		-NA-	
Side Slope	1:1	1:1	1:1	1:1

Length of Canal	43.20 Kms to 62.50 Kms		62.50 Kms to 73.8kms.	
	Head	Tail	Head	Tail
Bed Level	3.382	2.07	NA	NA
Bed Width	13.20	13.20	NA	NA
F.S.L	5.883	3.562	NA	NA
T.B.L	6.74	5.19	NA	NA
Bed Fall	-NA-		-NA-	
Side Slope	1:1	1:1	NA	NA

ANNEXURE - 7

STATEMENT SHOWING THE MONTHWISE TOTAL INFLOWS OF THE RIVER AKHANDA GODAVARI AT DOWLESWARAM BARRAGE SITE (in Cusecs)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
1980	276065	213399	238545	174364	168246	1622862	7563358	16866929	11650161	1571053	664944	477209
1981	388758	284900	269940	245525	298140	303025	5856148	16869551	8809204	565335	8782272	368830
1982	363504	308532	253182	170909	184394	261753	3198279	10014570	5019555	1480798	838764	416324
1983	341346	300123	328929	167506	167916	698260	5578605	21571528	16955811	11130503	1115519	643501
1984	552527	430014	449615	348652	360396	861409	4785316	11263599	2893146	1333181	509109	403877
1985	340286	285180	254310	209721	165888	311843	4446254	9789361	2717638	3587090	648671	406511
1986	312728	290120	294975	171082	132963	467949	7870568	10106799	2069339	1216572	535453	451441
1987	455329	343572	297691	187408	128601	307694	3169376	6100668	6309299	2277262	1345797	659581
1988	239198	206974	231660	191890	143405	452150	14578670	18275980	13389670	8809950	1255800	414010
1989	739860	325430	364910	378720	212870	546510	12106190	14550880	10473950	8668690	982680	502940
1990	749000	322770	430510	325000	1653650	4230855	1034960	33134750	33134750	11026370	3387740	10599670
1991	698660	572430	554260	539170	463598	1081070	5758450	14417265	2177810	22955280	1296530	618050

ANNEXURE 8

NUMBER OF TUBEWELLS IN THE STUDY AREA-YEARWISE

S.No.	Year	No.of Tube wells & Filter Points	Average no. of working hours
1	upto 1981-82	2840	8
2	1982-83	3200	8
3	1983-84	3450	8
4	1984-85	3635	8
5	1985-86	3835	8
6	1986-87	3870	8

Source : Chief Planning Office, E.G.Dist., Kakinada
The above figures for the study area of 825 Sq.k.. have been worked out in proportion to the area of Central Delta.

REDUCED GROUNDWATER LEVELS (Mts.)OF OBSERVATION WELLS IN EAST GODAVARI AND WEST GODAVARI DISTRICTS OF GODAVARI DELTA AREA

A) EAST GODAVARI DISTRICT

RAZOLE R.L of G.L = 4.25 mts.

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUGUST	SEPT	OCT	NOV	DEC
1980	1.55	1.55	0.94	0.92	0.9	1.11	1.21	1.25	1.27	1.28	1.34	1.3
1981	1.27	1.25	1.22	1.2	1.17	1.15	1.18	1.95	2.28	2.22	2.2	2.15
1982	2.11	2.08	2.05	2.01	1.98	1.05	1.4	1.45	1.53	1.52	1.55	1.29
1983	1.25	1.23	1.2	1.17	0.33	0.95	1.0	1.02	1.13	1.17	1.17	1.99
1984	1.95	1.91	1.88	1.65	1.2	0.83	2.05	2.0	1.65	1.59	1.74	1.45
1985	1.61	1.65	1.72	1.81	1.92	1.93	1.94	2.0	1.85	1.57	1.7	1.36
1986	1.35	1.65	1.71	1.65	1.75	1.9	1.45	1.75	2.6	1.97	2.2	1.96
1987	1.99	1.86	1.82	1.75	1.3	1.15	1.2	1.51	2.4	2.4	2.44	2.4
1988	1.93	1.87	1.65	1.52	1.3	1.21	1.2	1.00	3.14	2.08	1.97	1.99
1989	2.15	1.77	1.8	1.43	1.28	1.48	1.63	2.4	2.32	2.25	1.82	1.67
1990	1.7	1.73	1.88	1.46	1.95	2.22	2.04	3.11	3.05	2.92	2.03	1.77
1991	1.63	1.21	0.86	0.96	0.35	1.33	1.65	2.56	2.27	2.59	-	-

BENDAMURLANKA R.L. of G.L = 1.385 mts

1980	0.14	-0.5	0.29	0.44	-0.88	0.39	0.55	0.44	0.35	0.32	0.61	0.53
1981	0.765	0.585	0.385	0.485	-	-	-	-	-	-	0.305	-
1982	-	-		-	1.54	-	-	1.45	-	-	0.485	-
1983	0.335	0.625	0.455	-	-0.565	-	-	-	-	-	0.055	-
1984	0.34	0.26	0.34	-0.77	-1.07	-0.17	0.14	0.36	0.38	0.42	0.49	0.24
1985	0.38	0.31	0.31	0.14	-0.79	-0.65	-0.4	-0.07	0.46	0.62	0.46	0.61
1986	0.465	0.315	0.255	0.15	-0.645	-0.495	0.215	0.415	0.335	0.495	0.555	0.295
1987	0.485	0.365	0.215	-0.12	-0.415	-0.215	-0.145	0.325	0.315	0.565	0.455	0.405
1988	0.365	0.085	0.395	0.15	-0.345	-0.405	0.315	0.035	0.515	0.325	0.495	0.595
1989	0.635	0.395	0.235	-0.69	-0.135	0.385	0.505	0.635	0.555	0.455	0.426	0.515
1990	0.445	0.885	0.015	-0.505	1.02	0.585	0.435	0.385	0.375	0.215	0.305	-0.155
1991	-0.385	-0.11	-1.13	-1.24	-1.19	0.535	0.555	0.675	0.675	1.215	-	-

ANALAPURAM R.L. of G.L = 3.405 mts

1980	2.63	2.55	2.38	2.48	1.68	1.68	2.78	2.68	2.78	2.68	2.58	2.28
1981	2.575	2.625	2.575	2.145	1.725	1.615	1.825	2.645	2.645	2.725	2.625	2.525
1982	2.605	2.6	2.6	2.1	1.74	1.83	2.08	2.52	2.56	2.56	2.705	2.595
1983	2.635	2.615	2.625	2.105	1.725	1.875	2.275	2.595	2.705	2.785	2.675	2.615
1984	2.63	2.63	2.43	1.84	1.59	1.58	2.1	2.66	2.73	2.68	2.68	2.58
1985	2.73	2.67	2.33	2.0	1.68	1.63	2.3	2.69	2.64	3.03	2.43	2.51
1986	2.525	2.455	2.525	2.025	1.345	2.305	1.385	2.365	2.405	2.465	2.845	2.425
1987	2.405	2.325	2.345	1.645	1.865	1.495	1.425	2.155	2.365	2.545	2.545	2.465
1988	2.345	2.215	1.905	1.605	1.475	1.325	0.605	1.725	2.565	2.315	1.975	2.375
1989	2.405	2.385	2.075	1.505	1.275	1.755	2.235	2.415	2.505	2.405	2.25	2.4
1990	2.295	2.955	2.395	1.875	2.875	2.165	2.475	2.455	2.495	2.125	2.515	2.075
1991	1.755	1.285	1.345	1.155	0.835	2.255	2.505	2.715	2.645	3.135	-	-

AINAVILLI R.L. of G.L = 5.55 mts

1980	-	-	1.48	1.13	0.85	0.58	0.98	1.33	2.53	2.58	3.23	3.1
1981	2.23	1.88	1.58	1.13	0.73	0.4	0.53	1.14	2.27	2.95	2.89	2.33
1982	1.88	1.47	1.28	1.0	0.73	0.43	0.66	0.9	1.5	1.63	1.78	1.9
1983	1.48	1.26	1.12	0.91	-0.61	-0.47	-0.28	0.07	3.43	3.82	2.52	1.98
1984	1.38	1.08	0.78	-0.64	-1.07	0.78	1.07	1.44	1.78	1.92	1.95	1.87
1985	1.88	1.53	1.17	0.96	0.63	0.47	0.77	1.83	2.03	2.24	2.61	2.41
1986	2.15	1.9	1.66	1.10	0.8	0.49	0.88	1.35	3.09	2.64	2.64	2.54
1987	2.11	1.85	1.5	1.37	0.94	0.72	0.8	1.19	1.49	1.8	2.3	2.86
1988	2.26	1.88	1.49	1.01	0.78	0.39	0.74	0.4	4.72	3.45	2.67	2.26
1989	2.6	1.64	1.49	1.1	0.75	0.9	1.4	2.1	4.31	3.2	2.39	2.08
1990	1.96	1.85	1.9	1.75	4.7	4.25	4.2	3.55	3.23	3.07	3.31	3.87
1991	3.85	4.09	2.96	2.88	2.9	1.63	2.42	2.64	3.61	5.19	-	-

CHEYYERU R.L. of G.L = 2.90 mts

1980	1.76	1.56	1.37	1.46	1.04	0.85	1.39	1.32	1.85	1.56	1.88	1.9
1981	1.645	1.565	1.495	1.215	1.115	0.835	0.845	1.595	1.455	2.245	1.915	1.595
1982	1.475	1.425	1.365	1.245	1.075	0.785	0.725	0.705	1.765	1.465	2.015	1.535
1983	1.495	1.435	1.425	1.265	1.045	0.86	1.575	2.125	1.875	2.355	1.155	1.615
1984	1.56	1.49	1.38	1.28	0.6	0.71	0.9	1.41	1.41	1.65	1.82	1.6
1985	1.61	1.52	1.44	1.24	1.06	0.7	-	1.36	1.52	2.51	2.1	1.37
1986	1.445	1.385	1.265	1.155	0.855	0.605	0.445	0.565	1.515	1.265	1.805	1.665
1987	1.395	1.295	1.215	1.155	0.825	0.575	0.385	0.405	0.885	1.195	1.925	2.025
1988	1.525	1.325	1.125	1.005	0.805	0.545	0.735	0.695	2.165	1.625	1.045	1.275
1989	1.545	1.165	1.145	0.905	0.305	0.695	0.965	1.195	1.995	1.725	1.345	1.225
1990	1.105	1.445	1.295	1.095	2.345	1.745	1.545	0.895	0.575	0.355	1.835	1.375
1991	1.195	1.435	0.305	0.225	0.245	0.395	0.645	0.745	1.645	1.545	-	-

ANATHAVARAM R.L. of G.L = 4.44 mts

1980	DATA NOT AVAILABLE											
1981	DATA NOT AVAILABLE											
1982	-	-	-	-	-	-	3.09	3.32	3.52	3.42	3.91	3.5
1983	3.43	3.46	3.44	3.08	1.91	1.92	2.36	3.14	2.68	2.84	2.48	2.44
1984	2.5	2.42	2.32	2.0	1.32	2.41	3.46	3.64	3.4	3.59	3.69	3.53
1985	3.53	3.46	3.36	2.98	2.79	2.7	3.11	3.72	3.56	4.09	3.54	3.49
1986	3.64	3.5	3.35	3.11	2.34	2.59	2.89	3.24	3.58	3.8	3.29	3.3
1987	3.43	3.4	3.32	3.19	2.22	2.05	2.64	3.25	3.54	3.66	3.74	3.72
1988	3.48	3.32	3.19	2.96	2.6	2.78	3.7	3.49	3.9	3.39	3.33	3.55
1989	3.44	3.35	3.21	2.46	2.39	2.49	3.42	3.67	3.68	3.43	3.37	3.51
1990	3.31	4.19	3.31	2.69	3.79	3.44	3.67	3.61	3.58	2.31	3.68	3.69
1991	3.21	3.32	2.55	2.26	2.29	3.44	3.59	3.6	3.94	4.24	-	-

MUMMIDIVARAM R.L. of G.L = 3.75 mts

1980	DATA NOT AVAILABLE											
1981	DATA NOT AVAILABLE											
1982	-	-	-	-	-	-	1.695	2.235	2.575	2.175	3.375	2.665
1983	2.475	2.515	2.495	1.925	1.325	1.935	1.785	2.575	3.105	2.325	3.175	2.375
1984	2.68	2.6	2.55	2.18	1.67	2.28	2.48	3.18	2.58	2.62	2.91	2.68
1985	2.78	2.63	2.58	2.11	1.63	1.63	2.78	3.48	2.58	3.08	2.68	2.46
1986	2.375	2.495	2.475	2.315	1.275	1.635	1.825	2.675	2.575	2.775	3.0	3.24
1987	3.075	3.175	3.06	1.625	1.575	1.475	1.975	2.025	3.255	3.325	3.375	3.175
1988	3.235	2.995	2.425	2.445	1.475	1.435	3.075	3.675	3.575	2.755	-	-
1989	3.155	2.725	2.965	1.165	0.675	1.755	2.405	2.675	2.435	1.925	1.975	1.895
1990	1.775	2.225	1.775	1.125	2.375	1.715	2.055	1.865	2.115	1.825	2.255	1.965
1991	1.625	2.495	1.275	0.575	0.345	1.655	2.035	2.245	2.375	2.285	-	-

MACHAVARAM R.L. of G.L = 5.05 mts

1980	4.21	2.34	2.37	2.06	1.1	1.27	2.89	3.79	3.68	2.89	3.26	3.48
1981	2.92	2.75	2.39	2.06	1.35	0.94	1.88	1.65	2.14	2.41	3.11	2.19
1982	3.0	2.76	2.51	1.95	1.48	0.96	0.96	0.73	2.6	2.89	3.04	2.6
1983	2.24	2.07	1.32	1.39	1.05	-	-	1.49	-	-	3.1	3.08
1984	2.79	-	-	-	0.78	1.16	1.61	2.98	2.48	2.22	3.09	2.59
1985	2.37	2.08	1.84	1.48	1.09	0.94	1.89	2.54	-	-	2.68	-
1986	-	-	-	-	0.96	-	-	2.68	3.79	3.28	4.97	2.9
1987	2.69	2.52	2.32	1.87	1.59	1.19	-	1.99	2.09	2.74	2.99	3.04
1988	3.78	1.9	1.82	1.55	1.24	0.67	0.87	4.56	4.41	2.98	2.69	2.58
1989	2.69	2.32	2.41	1.54	0.83	1.06	1.57	4.22	3.94	3.29	2.63	2.4
1990	2.38	2.39	2.91	2.2	4.4	3.14	3.22	3.88	3.94	3.99	2.17	2.21
1991	1.84	2.45	2.15	1.43	0.96	2.06	3.6	3.7	3.74	3.82	-	-

YANAM R.L. of G.L = 5.32 mts

1980	3.14	2.89	2.54	2.34	2.32	2.24	2.44	2.84	2.99	3.04	3.28	3.64
1981	2.935	2.835	2.485	2.385	2.135	1.935	2.085	2.885	3.035	3.585	3.535	3.235
1982	2.435	2.585	2.485	-	1.965	-	-	-	-	-	2.815	2.535
1983	3.235	3.385	3.235	2.485	2.815	2.665	2.865	2.835	3.235	3.435	3.285	3.385
1984	-	-	-	2.99	1.81	2.74	2.64	2.44	-	2.69	2.47	3.04
1985	3.09	2.89	2.79	-	-	2.84	2.99	-	2.94	2.84	2.94	3.07
1986	3.115	3.065	3.115	3.015	2.015	2.965	2.865	2.865	2.915	2.965	2.865	-
1987	2.965	3.015	3.015	2.915	2.095	-	-	2.165	2.565	-	3.365	-
1988	-	1.065	-	-	1.335	1.985	2.315	2.665	3.285	2.865	2.715	2.465
1989	2.295	3.045	3.365	3.225	1.215	1.855	4.205	3.805	3.565	3.55	3.105	2.985
1990	2.965	2.815	2.735	2.705	3.61	3.235	3.365	3.555	3.525	3.665	3.425	3.305
1991	3.015	2.895	2.835	2.375	2.065	2.695	2.835	2.795	3.115	2.905	-	-

MUNGANDA R.L. of G.L = 6.16 mts

1980	3.14	2.53	2.75	2.58	1.76	2.16	3.59	3.53	3.72	3.35	3.41	3.23
1981	3.28	3.11	2.91	2.71	2.06	1.36	1.71	3.36	3.25	3.52	3.36	3.06
1982	3.03	2.84	3.01	2.66	2.06	1.76	1.61	2.26	3.16	3.06	3.21	3.09
1983	2.91	2.86	2.86	2.51	1.9	1.66	2.0	3.11	3.66	3.79	3.41	2.96
1984	3.11	2.96	2.94	2.56	1.81	1.56	1.76	2.93	3.1	3.01	3.16	3.04
1985	3.08	2.93	2.73	2.62	2.16	1.77	1.86	3.16	3.11	3.73	3.21	2.99
1986	3.19	3.15	3.04	2.66	1.99	1.76	1.99	2.94	3.26	3.28	3.78	3.05
1987	3.11	2.89	2.66	2.66	2.09	1.71	1.36	2.51	3.26	3.29	3.21	3.23
1988	3.08	2.41	2.18	2.38	1.96	1.46	1.73	4.06	3.7	2.99	2.86	2.87
1989	2.96	2.8	2.88	2.02	1.48	2.0	2.86	4.3	3.41	3.21	2.85	2.56
1990	2.48	2.88	3.2	2.74	5.44	3.24	3.27	4.09	4.19	3.74	3.23	3.04
1991	2.63	2.44	2.07	1.78	1.56	2.56	3.51	3.48	3.61	3.72	-	-

KATTUNGA R.L. of G.L = 9.74 mts

1980	5.84	3.07	3.24	3.07	2.04	3.29	6.13	8.12	8.11	7.48	6.49	5.19
1981	5.235	5.135	4.985	3.105	2.935	1.985	7.55	7.785	7.485	7.435	6.835	6.735
1982	6.685	4.685	6.825	4.035	7.165	6.925	-	7.085	7.035	6.935	5.385	5.335
1983	4.355	4.105	3.885	3.615	2.605	2.235	7.045	7.035	6.935	6.985	6.115	2.185
1984	5.59	4.69	3.89	3.19	2.09	1.79	2.09	5.49	4.89	5.34	6.19	3.89
1985	5.14	3.49	3.24	3.19	2.29	0.79	1.59	6.49	5.44	6.49	6.44	5.69
1986	5.285	4.835	4.685	3.385	2.085	1.885	3.335	7.235	7.385	7.185	6.085	5.685
1987	5.335	5.335	5.685	3.185	2.285	1.89	2.29	5.74	6.84	6.685	5.485	5.185
1988	3.385	2.935	2.685	2.435	3.285	1.935	2.335	7.495	8.245	5.495	3.66	3.715
1989	4.375	3.725	3.925	2.405	1.505	2.785	5.185	5.745	5.645	5.665	5.405	5.325
1990	3.235	3.165	4.535	3.535	4.935	4.365	4.565	8.935	5.21	4.07	5.825	5.665
1991	5.435	3.815	3.335	1.985	1.935	3.385	5.855	6.025	6.685	6.635	-	-

MADIKI R.L. of G.L (upto 1985) = 12.66 mts, From 1986 = 13.11 mts

1980	-	-	-	-	6.09	4.82	5.47	6.27	-	-	8.56	-
1981	-	-	-	-	6.315	5.868	5.715	6.65	4.805	5.355	9.6	-
1982	-	-	7.015	6.615	6.265	7.015	5.715	6.625	6.915	8.015	8.015	7.945
1983	7.185	6.875	6.815	6.655	6.615	6.605	6.725	6.945	6.945	10.33	9.065	8.565
1984	7.95	7.47	7.02	6.62	6.02	5.66	5.67	6.16	6.8	6.81	6.8	6.81
1985	6.97	6.73	6.62	6.02	5.64	5.22	5.37	5.12	6.92	-	8.17	-
1986	-	-	-	-	-	-	5.765	5.515	10.51	9.015	8.565	8.065
1987	7.615	7.115	7.015	6.415	5.915	5.415	5.115	6.515	7.015	8.015	7.765	7.565
1988	7.315	6.995	6.965	6.015	5.965	5.865	6.015	8.795	11.86	10.73	8.765	7.805
1989	7.855	7.375	7.285	7.015	6.365	6.415	6.965	9.885	9.805	10.165	8.315	8.085
1990	7.515	7.585	7.625	7.305	9.215	8.165	8.335	11.75	10.71	11.565	8.995	8.715
1991	8.715	7.455	7.115	6.625	6.015	6.135	6.865	7.045	9.515	8.445	-	-

ALAMURU R.L. of G.L = 10.30 mts.

1980	6.85	6.59	6.21	4.84	4.25	4.0	8.03	9.06	8.95	9.02	8.09	7.05
1981	6.515	7.07	7.015	6.0	6.015	5.0	5.07	8.1	9.035	9.05	8.07	6.695
1982	6.345	5.845	5.795	5.795	4.695	3.995	4.795	7.095	8.395	7.945	7.645	6.795
1983	6.245	5.89	6.245	5.645	4.995	3.845	4.095	7.495	9.145	9.345	7.895	6.545
1984	7.1	6.6	6.7	5.25	4.05	3.75	4.7	8.1	7.2	7.5	7.0	5.75
1985	6.2	6.2	5.4	4.5	3.9	3.9	4.04	7.3	7.7	9.05	6.45	5.8
1986	5.295	5.845	5.675	5.595	5.245	3.445	3.345	4.595	7.695	7.695	7.595	5.895
1987	5.445	5.895	5.395	4.795	3.445	4.495	4.215	6.895	6.895	7.595	6.495	6.895
1988	4.695	4.245	3.895	3.795	3.995	3.845	5.595	7.335	8.505	7.745	7.685	7.525
1989	7.175	7.815	8.295	6.275	3.375	4.165	8.645	8.445	8.445	8.265	6.545	6.435
1990	6.495	6.775	6.725	5.585	6.195	6.255	7.175	9.245	9.245	9.075	7.615	7.505
1991	7.415	7.325	7.245	9.395	5.995	6.595	7.495	8.395	8.485	8.618	-	-

TEKI R.L. of G.L = 6.88 mts

1980	3.96	3.8	3.49	3.18	3.12	3.09	5.64	5.41	5.05	4.84	5.79	3.49
1981	-	-	-	-	-	3.135	3.695	5.335	4.935	4.935	-	-
1982	4.505	4.515	4.635	4.135	3.255	-	-	-	-	-	3.985	-
1983	-	4.635	4.435	3.135	3.185	-	-	-	-	-	4.185	-
1984	-	-	-	-	2.76	3.08	3.64	-	3.64	4.94	3.74	-
1985	4.44	4.64	-	3.44	2.86	2.74	3.69	5.74	5.99	5.79	5.49	-
1986	-	4.535	3.685	3.735	3.825	-	1.685	4.135	-	-	4.015	-
1987	-	-	4.215	3.085	2.715	3.135	2.085	3.985	4.795	4.935	3.985	3.735
1988	3.565	3.965	3.785	4.415	2.875	-	2.825	-	-	-	4.235	4.125
1989	3.875	4.675	6.135	4.185	2.385	2.835	5.625	5.335	5.245	4.935	4.145	4.025
1990	4.005	4.665	4.535	4.475	4.755	3.835	4.265	5.125	5.075	5.885	4.565	4.485
1991	4.205	4.075	4.015	3.785	3.265	3.875	4.265	4.465	4.995	5.105	-	-

B) WEST GODAVARI DISTRICT

GOPALAPURAM R.L. of G.L = 46.07 mts

1981	42.77	42.57	42.22	40.67	40.42	40.27	38.87	42.87	44.37	44.37	44.37	44.27
1982	42.67	41.87	41.57	40.87	41.57	40.72	40.47	41.07	43.87	43.77	44.27	43.47
1983	41.87	42.87	42.17	42.12	41.17	41.07	41.87	42.87	45.07	44.87	44.77	43.97
1984	43.27	42.97	42.62	42.39	41.87	41.77	42.27	43.87	43.87	42.67	42.52	42.97
1985	42.77	42.27	41.27	40.97	41.57	40.57	40.77	42.87	42.87	43.07	43.77	43.27
1986	42.67	42.27	41.77	40.87	40.42	40.87	41.87	44.07	44.22	44.02	43.44	43.24
1987	43.19	42.89	41.99	41.69	41.37	41.27	40.97	40.97	42.27	43.17	43.97	43.97
1988	43.17	42.52	42.27	41.87	40.97	41.17	40.27	44.49	44.97	44.42	43.57	43.02
1989	41.97	42.17	41.61	40.57	40.57	40.80	41.20	44.39	44.01	43.92	43.47	42.87
1990	41.45	41.62	41.82	40.97	44.17	43.72	43.16	43.97	44.33	44.49	43.97	42.97
1991	-	43.02	42.55	41.22	41.57	42.72	44.15	44.60	-	44.12	44.12	43.54

NARASAPURAM R.L. of G.L = 4.25 mts

1981	-	-	-	-	1.995	-	-	-	-	-	-	2.785
1982	2.615	-	-	-	1.845	-	-	-	-	1.895	2.525	2.265
1983	2.245	2.055	2.015	1.895	1.775	1.735	1.925	2.295	2.895	3.805	3.545	3.115
1984	2.915	2.725	2.525	2.445	2.305	-	2.095	2.545	2.295	2.845	3.145	2.935
1985	2.825	2.395	2.265	2.125	2.045	1.925	1.775	2.225	2.615	3.045	3.225	2.905
1986	2.885	2.715	2.595	2.395	2.185	2.045	2.135	2.195	2.955	3.045	3.345	3.095
1987	2.785	2.565	2.245	2.225	2.065	1.945	1.795	2.015	2.095	2.095	2.625	2.995
1988	2.795	2.575	2.315	2.145	2.215	2.065	1.985	3.395	3.725	3.615	2.945	-
1989	2.495	2.205	2.225	2.215	2.045	1.695	3.305	3.425	3.375	3.335	3.125	2.805
1990	2.745	2.795	2.925	2.395	3.345	2.875	3.065	3.405	3.315	3.745	3.305	3.095
1991	2.845	2.495	2.365	2.235	2.005	2.295	2.805	2.865	3.595	3.475	3.585	3.415

POLAVARAM R.L. of G.L = 23.93 mts

1981	16.26	15.68	15.13	14.73	14.28	13.77	13.56	15.03	21.93	21.03	20.03	19.13
1982	18.15	17.35	16.53	15.53	15.09	14.80	14.58	15.08	17.23	17.26	17.11	16.63
1983	15.73	15.18	14.67	14.23	13.83	13.45	13.38	14.18	23.08	23.33	21.58	19.83
1984	18.93	18.23	17.53	16.78	16.13	15.33	15.48	16.13	16.93	16.63	16.23	15.63
1985	15.08	14.58	14.28	13.83	13.53	13.05	12.98	13.93	14.33	15.23	15.58	14.98
1986	14.53	14.13	13.83	13.53	12.93	12.33	12.63	13.43	22.43	20.78	19.88	19.13
1987	18.33	17.73	17.08	16.38	15.53	15.18	14.83	15.38	17.33	17.63	17.88	17.98
1988	17.48	16.93	16.43	15.73	15.68	15.73	15.53	19.78	21.31	-	19.48	18.48
1989	17.78	17.83	16.56	15.58	15.08	14.93	15.37	17.90	19.81	19.41	18.45	18.06
1990	17.72	16.95	16.72	16.38	17.68	17.75	18.17	23.43	22.95	22.58	20.58	18.84
1991	20.57	18.12	17.53	16.78	16.23	16.53	17.25	17.87	18.08	18.89	18.13	17.58

PRAKKILANKA R.L. of G.L = 20.84 mts

1981	DATA NOT AVAILABLE											
1982	DATA NOT AVAILABLE											
1983	DATA NOT AVAILABLE											
1984	-	-	-	18.94	18.79	-	-	-	-	-	-	-
1985	-	-	-	-	-	-	18.41	17.21	-	-	-	-
1986	16.19	15.45	15.11	14.49	13.67	15.05	15.405	16.965	18.315	-	-	-
1987	-	15.91	-	-	-	-	-	17.39	-	-	18.92	-
1988	17.05	16.53	15.32	16.97	16.24	15.46	-	19.28	20.04	19.04	17.74	17.09
1989	16.41	16.14	15.02	14.96	14.11	15.81	16.43	19.06	19.18	18.56	17.54	17.04
1990	16.30	16.02	16.00	15.51	18.46	18.41	17.91	20.61	19.65	19.36	18.76	18.14
1991	18.70	16.80	16.19	15.26	13.89	17.05	17.34	18.49	18.04	19.06	18.71	17.60

USURUMARRI PADU R.L. of G.L = 11.84 mts

1981	DATA NOT AVAILABLE											
1982	-	-	-	-	-	-	9.26	9.66	9.66	9.67	9.73	9.75
1983	9.74	9.66	9.67	-	8.96	9.26	-	10.52	10.26	-	9.9	10.11
1984	10.01	-	9.69	-	8.96	9.29	9.86	9.81	10.01	10.18	-	9.91
1985	9.76	9.96	9.21	-	8.96	-	10.36	10.36	10.27	10.25	10.17	-
1986	10.22	9.69	9.47	9.04	8.99	9.01	9.76	10.36	-	10.18	9.81	-
1987	-	-	9.46	9.51	-	-	-	10.33	10.36	10.65	10.62	10.46
1988	9.81	-	-	-	9.61	9.56	9.86	10.59	10.81	10.31	9.86	9.79
1989	9.99	9.88	10.36	9.96	9.34	9.43	10.51	10.61	10.51	9.36	9.83	9.69
1990	9.56	9.74	8.87	9.51	10.51	10.18	9.97	10.09	10.36	10.73	10.61	10.51
1991	9.71	9.6	9.43	9.31	9.36	9.99	10.55	10.66	10.39	10.53	10.46	10.29

KOVVUR R.L. of G.L = 17.56 mts

1981	DATA NOT AVAILABLE											
1982	DATA NOT AVAILABLE											
1983	DATA NOT AVAILABLE											
1984	-	-	-	11.21	11.14	11.04	-	-	-	-	-	11.79
1985	11.89	11.91	11.39	11.04	10.69	10.64	11.04	12.36	11.77	11.57	11.62	15.87
1986	15.81	16.06	15.76	15.56	15.76	11.26	11.66	12.06	12.01	-	-	-
1987	-	-	15.96	15.86	15.16	14.96	14.86	15.46	16.74	16.91	16.81	16.76
1988	16.31	16.16	16.01	15.71	16.11	15.86	15.46	17.01	17.15	16.69	16.26	15.91
1989	15.92	15.91	15.87	15.56	15.10	15.93	16.35	16.64	16.96	16.79	16.36	16.11
1990	16.29	16.06	15.91	15.87	16.57	16.71	16.41	17.31	16.96	16.81	16.61	16.26
1991	DATA NOT AVAILABLE											

PENUGONDA R.L. of G.L = 6.57 mts

1981	5.045	5.03	4.90	4.73	4.63	3.28	4.08	5.19	4.92	5.17	5.03	4.87
1982	4.97	4.93	4.89	4.15	4.41	3.07	3.975	4.59	5.07	5.07	5.28	4.97
1983	4.92	4.87	4.94	4.62	4.27	3.17	-	-	-	-	-	5.08
1984	5.08	4.47	5.02	5.39	3.52	3.77	4.64	4.93	4.92	5.12	5.07	5.47
1985	5.07	5.05	4.94	4.55	3.87	3.64	4.37	5.27	5.10	5.32	4.97	4.97
1986	5.10	5.15	5.09	4.82	4.07	3.98	4.66	4.86	5.15	5.21	5.05	4.97
1987	4.97	5.02	4.99	4.47	3.77	3.46	4.27	4.77	4.97	5.07	5.16	4.96
1988	4.87	4.74	4.69	4.58	4.32	4.01	5.17	5.83	5.92	5.27	4.77	4.27
1989	4.81	4.79	4.75	3.52	3.26	3.37	5.52	4.97	5.42	4.79	4.62	4.73
1990	4.80	4.87	4.96	4.59	5.07	4.59	4.67	5.01	4.86	5.03	4.69	4.58
1991	4.69	4.62	4.26	3.81	3.92	3.99	4.85	5.16	5.26	5.13	4.85	5.09

PALAKOL R.L. of G.L = 2.72 mts

1981 TO 1988 STATION NOT EXISTING												
1989	-	-	-	-	-	1.22	1.72	2.37	1.98	1.97	1.6	1.25
1990	1.22	1.75	1.94	1.23	1.67	1.77	-	1.9	1.73	2.1	1.97	1.94
1991	1.87	1.52	1.05	0.91	0.57	2.0	2.14	1.98	2.24	2.08	1.7	1.71

ACHANTA R.L. of G.L = 4.68 mts

1981 TO 1988 STATION NOT EXISTING												
1989	-	-	-	-	-	3.17	-	4.52	4.44	3.88	3.66	3.85
1990	3.97	4.07	4.1	3.89	3.94	3.86	3.72	3.83	3.95	4.12	3.92	3.80
1991	3.94	3.85	3.24	2.76	2.12	2.40	2.65	2.90	3.84	3.92	4.02	3.83

MOGALTUR R.L. of G.L = 2.73 mts

1981 TO 1988 STATION NOT EXISTING												
1989	-	-	-	-	-	0.45	-	1.21	2.22	2.09	1.89	1.54
1990	1.47	1.76	2.01	1.41	2.36	1.78	1.85	2.48	1.94	2.51	1.93	1.72
1991	1.49	1.09	0.90	0.80	0.74	1.06	1.53	1.62	1.99	2.22	2.44	2.25

YELAMANCHILI R.L. of G.L = 3.18 mts

1981 TO 1988 STATION NOT EXISTING												
1989	-	-	-	-	-	0.84	-	2.53	2.48	1.74	1.53	1.32
1990	1.48	1.72	1.72	1.16	1.88	1.58	1.77	1.88	1.60	2.08	1.62	1.38
1991	1.33	1.18	1.07	0.93	0.66	0.80	1.51	1.77	2.36	2.47	1.95	1.69

IRAGAVARAM R.L. of G.L = 6.40 mts

1981 TO 1988 STATION NOT EXISTING												
1989	-	-	-	-	-	5.29	5.26	5.48	5.31	5.05	4.14	5.22
1990	5.22	5.31	5.14	4.38	5.39	4.83	5.22	5.28	5.16	5.34	5.01	4.82
1991	5.23	5.16	4.72	4.48	3.46	3.72	5.11	5.29	5.38	5.23	4.86	4.75

ANNEXURE - 10

CHEMICAL QUALITY OF WATER SAMPLES OF OPEN WELLS IN CENTRAL GODAVARI DELTA
OF EAST & WEST GODAVARI DISTRICTS OF ANDHRA PRADESH

LIST OF OBSERVATION WELLS :

LEGEND (O.W):

1 = RAZOLE	2 = BENDAMURLANKA	3 = AMALAPURAM	4 = AINAVILLI	5 = CHEYYERU	6 = ANATHAVARAM
7 = MUMMIDIVARAM	8 = MACHAVARAM	9 = YANAM	10 = MUNGANDA	11 = KATTUNGA	12 = PALAKOL
13 = KOVVUR	14 = PRAKKILANKA	15= PENUGONDA	16 = GOPALAPURAM	17 = POLAVARAM	18 = NARASAPURAM
19 = USURUMARRIPADU	20 = MOGALTUR	21 = ACHANTA	22= UNDRAJAVARAM	23= IRAGAVARAM	24 = ELAMANCHILI

LEGEND :

I = Date of sample collection II = Aquifer Depth III = PH (0 c) IV = Sp. Conductance at 25 C (Microsiemans)
V = TDS calculated by multiplication of Sp.Conductance by 0.64 VI=Carbonate (mg/lit)/epm represented by Ca,
VII = Bicarbonate (mg/lit)/epm represented on CO3 VIII = Chlorine(mg/lit)/epm IX = Sodium (mg/lit)/epm
X = Potassium (mg/lit)/epm XI = Calcium (mg/lit)/epm XII = Magnesuem (mg/lit)/epm XIII = Total hardness expressed as CaCO3
XIV = SAR , XV = RSC

NOTE : PS = PROBABLY SAFE US = UNSUITABLE EPM = EQUIVALENT PARTS PER MILLION

YEAR : 1982

O.W. No.	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	
1	24.05.82	3.90	7.42	1180	755	99.9	253/5.06	153/4.37	107/4.65	43/1.10	56/2.80	33/3.21	300	2.68	0.95	
	25.11.82	2.65	7.73	1150	736	99.9	372/7.44	112/3.16	112/4.88	35/0.90	80/4.00	15/1.23	260	3.01	2.21	
2	26.05.82	2.39	7.33	1250	800	99.9	319/6.38	153/4.31	121/5.26	8/0.20	56/2.80	49/4.03	340	2.85	0.45	
	25.11.82	1.75	8.05	1492	955	99.9	310/6.2	176/4.96	187/8.13	11/0.20	64/3.20	34/2.80	300	4.69	0.20	
3	24.05.82	2.35	7.42	1116	714	99.9	275/5.50	72/2.03	131/5.70	17/0.43	44/2.70	39/3.21	270	3.47	0.09	
	26.11.82	1.62	7.65	1200	768	99.9	402/8.04	120/3.38	155/6.74	13/0.33	64/3.20	39/3.21	320	3.76	1.63	
4	25.05.82	5.80	7.27	1870	1197	99.9	308/6.16	297/8.38	162/7.04	36/0.92	64/3.20	83/6.83	500	3.14	3.87	
	25.11.82	4.40	7.16	1810	1158	99.9	265/5.30	272/7.67	198/8.61	52/1.33	104/5.2	53/4.36	480	3.94	4.26	
5	25.05.82	2.93	7.57	765	490	99.9	220/4.40	54/1.52	48/2.09	29/0.74	32/1.60	39/3.21	240	1.35	0.41	
	26.11.82	2.10	7.72	612	392	99.9	186/3.72	56/1.88	49/2.13	27/0.69	48/2.40	19/1.56	200	1.51	0.24	
6	DATA NOT AVAILABLE															
	26.11.82	1.76	7.88	144	921	99.9	550/11.0	128/3.61	163/7.09	34/2.40	120/6.0	5/0.41	320	3.96	4.59	
7	DATA NOT AVAILABLE															
	28.11.82	2.30	7.93	1854	1187	99.9	180/3.6	344/9.7	264/11.48	2/0.05	32/1.60	88/7.24	440	5.46	0.28	
8	22.05.82	4.60	7.47	625	400	99.9	231/4.62	27/0.76	53/1.43	3/0.08	52/2.60	24/1.97	230	0.95	0.05	
	25.11.82	7.83	7.83	805	515	99.9	265/5.30	14/1.80	82/3.57	8/0.20	56/2.8	19/1.56	220	2.42	0.94	
9	14.05.82	4.15	7.60	1488	952	99.9	253/5.06	167/4.71	182/7.91	50/1.28	80/4.0	39/3.21	360	4.17	2.15	
	23.11.82	3.30	7.73	1732	1108	99.9	392/7.84	176/4.96	232/10.09	78/1.99	64/3.2	34/2.80	300	5.83	1.84	
10	22.05.82	5.08	7.42	2692	1723	99.9	506/10.1	360/10.1	268/11.63	277/7.0	68/3.40	58/4.77	410	5.76	1.95	
	25.11.82	3.71	7.74	2640	1690	99.9	617/12.3	320/4.0	310/13.48	289/7.4	80/4.0	29/2.38	320	7.55	5.96	
11	20.05.82	8.66	7.96	2470	1581	99.9	330/6.6	423/11.9	342/14.87	4/0.10	48/2.40	63/5.18	380	7.64	0.98	
	27.11.82	5.30	7.60	2000	1280	99.9	300/6.0	272/7.67	366/15.91	5/0.13	48/2.40	58/4.77	360	8.40	1.17	
12	15.05.82	2.98	8.38	905	579	0.80	3.8	2.54	4.91	0.31	1.2	2.38	180	3.67	1.02 P.S	
	DATA NOT AVAILABLE															
13	20.05.82	7.39	7.67	544	348	NIL	3.0	2.28	1.52	0.08	2.4	1.56	200	1.08	-0.96 P.S	
	19.11.82	6.85	7.8	452	289	NIL	3.2	0.51	1.09	0.08	2.4	0.82	160	0.86	-0.02 PS	
14	21.05.82	4.6	8.44	848	543	1.2	5.8	1.52	5.43	0.03	0.40	3.21	180	4.04	3.39 US	
	19.11.82	1.79	7.74	568	364	NIL	4.0	0.79	1.83	0.08	2.0	1.97	200	1.3	+0.03 PS	
15	15.05.82	3.38	8.09	2806	1796	NIL	6.2	14.21	14.83	7.37	1.2	7.98	460	6.92	-2.98 PS	
	10.11.82	2.15	8.36	4120	2637	0.8	5.2	18.16	20.96	10.23	1.2	10.0 3	560	8.85	-5.23 PS	
16	21.05.82	6.4	8.07	659	422	NIL	2.44	1.49	2.61	0.1	0.8	3.21	200	1.84	-1.57 PS	
	19.11.82	3.65	8.25	746	477	NIL	2.6	2.34	3.57	0.18	1.2	2.38	180	2.67	-0.98 PS	
17	21.05.82	10.2	7.3	1593	1020	NIL	4.7	5.47	4.61	0.1	6.0	5.59	580	1.92	-6.89 PS	
	19.11.82	8.0	7.91	1352	865	NIL	1.8	4.94	2.87	0.2	4.4	6.0	520	1.26	-8.6 PS	
18	15.05.82	3.2	8.2	1273	815	NIL	3.34	3.81	4.7	0.77	4.0	1.97	300	2.72	-2.03 PS	
	10.11.82	2.0	8.3	1168	748	0.8	3.4	3.1	4.3	1.02	3.6	3.21	340	2.33	-2.61 PS	
19	DATA NOT AVAILABLE															
	10.11.82	2.32	8.25	4840	3098	1.2	6.8	21.26	9.17	0.1	1.2	2.8	200	6.48	-0.2 PS	

1983

1	20.06.83	3.92	8.44	1373	879	77/1	355/7.1	126/3.55	92/4.0	80/2.05	88/4.4	53/4.38	400	1.91	0.12
	10.11.83	2.90	7.41	1995	1277	99.9	470/9.4	199/5.61	163/7.09	34/0.87	160/8	58/4.77	640	2.81	3.37
2	26.06.83	2.80	8.04	1122	718	99.9	289/5.38	148/4.17	125/5.43	11/0.28	32/1.60	44/3.62	260	3.36	0.16
	11.11.83	2.18	7.81	1673	1071	99.9	430/8.6	199/5.67	175/7.61	10/0.26	96/4.80	53/4.36	480	3.56	0.56
3	19.06.83	2.47	7.70	996	637	99.9	250/5.0	89/2.51	96/4.13	11/0.28	24/1.29	49/4.03	260	2.56	0.23
	11.11.83	1.57	7.71	1253	802	99.9	470/9.4	36/1.02	112/4.8	11/0.28	64/3.20	49/4.03	360	2.56	2.17
4	19.05.83	5.83	7.86	1858	1189	99.9	298/3.9	252/7.1	180/7.83	45/1.15	88/4.40	63/5.18	480	3.58	3.62
	10.11.83	2.66	7.24	2610	1670	99.9	490/9.8	369/30.4	219/9.52	120/3.0	178/8.8	49/4.03	640	3.76	3.03
5	19.06.83	2.92	8.72	806	516	58/1	173/3.4	81/2.28	59/2.57	31/0.8	64/3.20	19/1.56	240	1.67	0.14
	11.11.83	1.55	7.59	484	310	99.9	180/3.6	36/1.02	35/1.52	20/0.51	48/2.4	10/0.82	160	1.20	0.38
6	19.06.83	2.82	9.15	709	454	77/1	211/4.2	37/1.04	55/2.39	30/0.77	48/2.40	19/1.56	200	1.70	1.80
	11.11.83	1.80	7.49	1834	1174	99.9	710/14.2	135/3.8	239/10.4	90/2.30	72/3.60	53/4.36	400	5.21	6.24
7	19.06.83	3.25	7.29	1808	1157	99.9	307/6.14	259/7.3	188/8.17	2/0.05	56/2.80	88/7.24	500	3.65	3.90
	11.11.83	2.20	7.13	2810	1798	99.9	560/11.2	419/11.6	219/9.52	2/0.05	176/8.8	112/9.2	900	3.17	6.81
8	21.05.83	4.87	8.21	503	322	99.9	192/3.84	22/0.62	30/1.30	4/0.10	32/1.60	29/2.38	200	0.92	0.14
	10.11.83	2.59	7.49	1185	758	99.9	380/7.60	114/3.2	90/3.91	9/0.23	104/5.2	29/2.38	380	2.01	0.02
9	28.05.83	4.38	7.95	1710	1094	99.9	216/4.32	174/4.9	190/8.26	78/1.9	76/3.8	32/2.63	320	4.61	2.11
	25.11.83	3.18	7.72	1685	1078	99.9	384/7.68	170/4.79	169/7.35	89/2.28	80/4.0	49/4.03	400	3.87	0.35
10	20.06.83	5.37	8.20	2490	1594	99.9	413/8.26	318/8.97	256/11.1	300/7.0	40/2.0	49/4.03	300	6.41	2.23
	10.11.83	3.66	7.74	3090	1978	99.9	580/11.6	355/10.0	300/13.0	268/7.3	64/3.2	78/6.41	480	5.95	1.99
11	20.06.83	8.38	7.57	2390	1824	99.9	422/8.44	481/13.6	368/16.0	3/0.08	64/3.2	97/7.98	560	6.77	2.74
	10.11.83	4.57	8.04	3570	2285	99.9	470/9.40	568/16.0	488/21.2	8/0.20	128/6.4	97/7.98	720	7.91	4.98
12	DATA NOT AVAILABLE														
	DATA NOT AVAILABLE														
13	24.05.83	8.41	7.96	454	291	NIL	2.68	0.62	1.35	0.10	1.2	1.97	160	1.07	-0.49 PS
	21.11.83	6.55	7.87	399	255	NIL	2.94	0.73	1.09	0.05	1.6	1.23	140	0.92	-0.11 PS
14	24.05.83	5.4	7.81	766	490	NIL	3.22	0.85	2.17	0.03	1.6	3.62	260	1.34	-2.0 PS
	17.11.83	1.7	7.40	1046	669	NIL	6.4	2.4	2.39	0.08	4.8	3.21	400	1.19	-1.61 PS
15	08.05.83	3.38	8.43	3250	2080	0.76	5.64	12.1	14.7	9.21	2.0	7.98	500	6.58	-3.58 PS
	29.11.83	NA	7.41	4250	2720	NIL	13.72	16.61	19.57	10.23	7.2	11.6	940	6.38	-5.08 PS
16	24.05.83	10.5	7.75	705	451	NIL	3.44	1.47	2.87	0.13	2.0	1.97	200	2.04	-0.53 PS
	18.11.83	2.71	7.02	1295	829	NIL	8.0	2.4	4.22	0.2	4.4	4.36	440	2.02	-0.76 PS
17	12.05.83	9.68	8.43	1506	964	38	3.76	5.64	8.13	1.13	1.6	4.03	280	4.85	-1.11 PS
	26.11.83	4.4	7.85	1875	1200	NIL	5.3	1.24	5.13	0.77	4.0	8.8	640	2.03	-7.5 PS
18	07.05.83	3.21	8.2	1176	753	NIL	3.76	3.61	4.57	1.02	4.0	2.8	340	2.48	-3.04 PS
	24.11.83	1.72	7.29	1205	771	NIL	4.12	3.47	4.13	0.9	4.0	3.21	360	2.18	-3.09 PS
19	08.05.83	3.54	7.95	4320	2765	NIL	7.7	20.25	17.96	12.79	1.6	9.62	560	7.58	-3.52 PS
	21.11.83	2.62	7.25	5370	3437	NIL	15.4	19.04	HIGHLY SALINE						

1984

1	23.05.84	3.90	8.38	2230	1427	19/0.4	500/10	334/9.4	178/7.74	43/1.10	176/8.8	49/4.03	640	3.06	2.45	
	21.11.84	3.30	8.26	1440	922	99.9	446/8.9	220/6.2	119/5.17	34/0.87	128/6.4	34/2.80	460	2.41	0.28	
2	23.05.84	2.75	8.66	1384	886	58/1.1	350/7.0	132/3.7	172/7.48	10/0.26	56/2.80	39/3.21	300	4.31	2.15	
	21.11.84	2.05	8.49	1250	800	20/0.4	352/7.0	210/5.9	141/6.13	9/0.23	64/3.20	58/4.77	400	3.07	0.53	
3	22.05.84	2.65	8.70	1285	822	58/1.1	400/8.0	105/2.96	172/7.48	10/0.26	48/2.40	39/3.21	280	4.47	3.55	
	21.11.84	1.55	8.11	1250	800	99.9	512/10	150/4.25	110/4.76	44/1.13	80/4.0	63/5.18	460	2.23	1.06	
4	22.05.84	5.65	7.91	2510	1606	99.9	380/7.6	396/11.1	333/11.4	35/0.90	184/9.2	24/1.97	560	6.13	3.57	
	21.11.84	4.38	8.30	2125	1360	10/0.2	400/8.0	420/11.8	217/9.43	30/0.77	136/6.8	53/4.36	560	3.99	2.96	
5	22.05.84	3.05	8.75	750	480	48/0.9	220/4.4	44/1.24	89/3.87	25/0.64	56/2.8	19/1.56	220	2.62	1.00	
	21.11.84	2.09	8.02	420	269	99.9	149/2.9	40/1.13	26/1.13	12/0.31	56/2.8	5/0.41	160	0.89	0.23	
6	22.05.84	3.01	8.79	768	492	106/2	230/4.6	44/1.24	86/3.87	14/0.36	64/3.2	19/1.56	240	2.51	1.96	
	21.11.84	1.73	8.32	1250	800	21/0.4	492/9.8	120/3.38	141/6.13	80/2.05	64/3.2	49/4.03	360	3.22	3.01	
7	22.05.84	3.15	8.33	2180	1395	5.8/1	500/10	137/3.86	267/11.6	2/0.05	104/5.2	73/6.0	560	4.91	0.04	
	21.11.84	2.10	7.75	2625	1680	99.9	205/4.1	540/15.23	250/10.87	3/0.08	128/6.4	117/9.6	800	3.84	11.92	
8	23.05.84	4.91	8.53	705	451	58/1.1	250/5.0	18/0.51	89/3.87	3/0.08	40/2.0	24/1.97	200	2.75	2.19	
	21.11.84	2.92	8.06	875	560	99.9	316/6.3	60/1.69	65/2.83	6/0.15	80/4.0	29/2.38	320	1.58	0.06	
9	17.05.84	4.31	7.41	405	259	99.9	90/1.80	10/0.28	19/0.83	3/0.08	32/1.60	19/1.56	160	0.66	1.36	
	28.11.84	3.65	8.21	1875	1200	99.9	364/7.2	250/7.05	167/7.26	72/1.84	112/5.6	58/4.77	520	3.19	3.09	
10	23.05.84	5.40	8.79	2563	1640	77/1.5	600/12	290/8.18	311/13.5	222/5.68	96/4.8	49/4.03	440	6.43	4.71	
	21.11.84	3.81	8.35	2375	1520	20/0.4	539/10	330/9.31	238/10.3	300/7.67	64/3.2	63/5.18	420	5.06	2.80	
11	23.05.84	8.55	8.65	3070	1965	134/2	480/9.6	528/14.9	467/20.3	2/0.05	96/4.80	88/7.24	600	8.27	0.24	
	22.11.84	5.87	8.45	2500	1600	20/0.4	445/8.9	530/14.95	333/14.48	3/0.08	88/4.40	73/6.0	520	6.35	1.10	
12					DATA NOT AVAILABLE											
					DATA NOT AVAILABLE											
13	19.05.84	7.85	7.76	672	430	NIL	2.6	2.26	1.74	0.13	1.6	3.21	240	1.12	-2.21 PS	
	26.11.84	7.07	8.0	800	512	NIL	5.01	1.13	1.96	0.2	3.6	1.97	280	1.17	-0.55 PS	
14	15.05.84	2.65	3.21	440	282	NIL	2.4	1.97	1.61	0.03	0.4	2.8	160	1.27	-0.8 PS	
	21.11.84	2.4	8.05	762	448	NIL	2.24	1.69	1.83	0.05	1.6	4.03	280	1.09	-3.39 PS	
15	23.05.84	4.0	8.5	1875	1200	0.8	2.4	9.59	12.3	2.56	1.2	6.0	360	6.48	-4.0 PS	
	17.11.84	2.35	8.5	4375	2800	1.48	11.16	22.0	20.78	9.08	6.4	10.77	860	7.09	-4.53PS	
16	16.05.84	4.75	8.14	816	522	NIL	3.0	3.10	3.35	0.13	0.4	4.03	220	2.25	-1.43 PS	
	22.11.84	4.25	8.04	1125	720	NIL	7.06	2.82	3.87	0.18	4.4	2.38	340	2.1	-0.28 PS	
17	18.05.84	8.9	7.9	1500	960	NIL	3.0	7.05	3.48	0.18	4.0	7.57	580	1.45	-8.57 PS	
	24.11.84	8.75	8.26	1400	896	NIL	5.58	7.05	3.39	0.2	8.0	1.97	500	1.52	-4.39 PS	
18	23.05.84	2.72	8.43	906	580	0.8	3.2	2.26	4.91	0.28	2.8	1.97	240	3.18	-0.77 PS	
					DATA NOT AVAILABLE											
19	22.05.84	4.75	8.85	5000	3200	1.6	7.4	25.66	25.57	13.07	9.2	10.36	530	11.13	-1.56 PS	
	18.11.84	2.5	8.56	5250	3360	1.86	14.88	24.82	18.35	21.01	6.0	10.77	840	6.34	-0.03 PS	

1985

1	08.05.85	3.90	7.52	1012	648	99.9	182/3.6	171/4.82	88/3.85	21/0.54	40/2.0	39/3.21	260	2.38	1.57
	25.11.85	4.50	7.58	1605	1027	99.9	552/11.0	240/6.77	175/7.6	47/1.20	112/5.6	44/3.62	460	3.54	1.82
2	09.05.85	3.19	7.59	1334	854	99.9	260/5.20	219/6.18	150/6.52	13/0.33	32/1.60	58/4.77	320	3.65	1.17
	26.11.85	1.80	7.56	1495	957	99.9	294/5.88	290/8.18	150/6.52	10/0.26	48/2.40	83/6.83	460	3.04	3.35
3	09.05.85	2.54	7.16	1415	906	99.9	358/7.16	190/5.36	140/6.09	72/1.84	88/4.40	39/3.21	380	3.10	0.45
	26.11.85	1.60	7.25	1448	927	99.9	368/7.36	220/6.20	115/5.0	58/1.48	48/2.4	78/6.40	440	2.38	1.45
4	09.05.85	5.89	7.69	1750	1120	99.9	117/2.34	380/10.7	175/7.61	89/2.28	56/2.8	58/4.77	380	3.91	5.23
	26.11.85	3.74	7.01	2300	1472	99.9	304/6.08	480/13.5	188/8.17	89/2.28	152/7.6	58/4.77	620	3.29	6.29
5	09.05.85	2.83	7.46	599	383	99.9	150/3.0	67/1.69	41/1.78	26/1.74	40/2.0	24/1.97	200	1.26	0.97
	26.11.85	2.10	8.29	494	316	99.9	184/3.68	50/1.41	25/1.09	11/0.28	32/1.60	29/2.38	200	0.77	0.30
6	09.05.85	2.85	7.48	678	434	99.9	234/4.68	48/1.35	58/2.52	36/0.92	40/2.00	19/1.56	180	1.89	1.12
	26.11.85	1.75	7.37	1319	844	99.9	506/10.1	130/3.67	133/5.78	89/2.28	72/3.60	49/4.03	380	2.96	2.49
7	09.05.85	3.71	7.54	2200	1408	99.9	338/6.76	418/11.8	225/9.78	3/0.08	72/3.60	102/8.39	600	3.99	5.23
	26.11.85	2.36	7.15	2180	1395	99.9	460/9.20	420/11.8	206/8.96	6/0.15	112/5.6	97/7.98	680	3.44	4.38
8	08.05.85	4.70	7.65	568	364	99.9	250/5.0	29/0.82	33/1.43	3/0.08	56/2.8	24/1.97	240	0.93	0.25
	25.11.85	3.01	7.23	885	566	99.9	349/6.98	80/2.26	56/2.43	5/0.13	56/2.8	49/4.03	340	1.13	0.15
9	08.05.85	4.42	7.89	1859	1190	99.9	266/5.32	257/7.25	190/8.26	88/2.25	104/5.2	34/2.8	400	4.13	2.68
	18.11.85	3.05	8.57	1214	777	40/0.8	100/2.0	300/8.46	165/7.17	70/1.79	16/0.80	29/2.38	160	5.69	0.38
10	08.05.85	5.08	7.97	2590	1658	99.9	371/7.42	380/10.7	250/10.8	333/9.52	64/3.20	58/4.77	400	5.45	0.55
	25.11.85	3.77	7.55	2650	1696	99.9	506/10.1	410/11.6	269/11.7	278/7.1	56/2.8	83/6.83	480	5.33	0.49
11	08.05.85	9.06	7.60	2400	1536	99.9	532/10.6	269/7.69	313/13.6	2/0.05	48/2.40	107/8.8	560	5.75	0.56
	26.11.85	6.14	7.51	2500	1600	99.9	304/6.08	570/16.0	333/14.5	5/0.13	48/2.40	88/7.24	480	6.60	3.56
12					DATA NOT AVAILABLE										
					DATA NOT AVAILABLE										
13	17.05.85	7.51	7.69	344	220	NIL	3.24	0.28	1.0	0.08	2.0	0.82	140	0.84	-0.84 PS
	26.11.85	2.37	7.45	2170	1389	NIL	7.72	10.43	10.13	2.25	3.6	5.18	440	4.83	-1.06 PS
14	15.05.85	3.39	7.52	472	302	NIL	3.8	1.07	1.52	0.03	1.2	2.8	200	1.07	-0.2 PS
	27.11.85	4.35	7.5	2360	1510	NIL	5.88	11.84	11.61	0.61	2.8	7.98	540	5.0	-4.9 PS
15	29.05.85	3.9	7.99	2690	1722	NIL	7.04	15.28	12.22	6.24	2.0	8.39	520	5.36	-3.35 PS
	19.11.85	2.46	7.76	4050	2592	NIL	9.02	23.69	19.83	10.13	3.6	10.77	720	7.4	-5.35 PS
16	13.05.85	6.4	7.33	658	421	NIL	3.8	2.14	2.39	0.18	1.6	2.38	200	1.69	-0.18 PS
	29.11.85	3.78	7.51	1014	649	NIL	4.04	2.82	4.48	0.18	1.6	3.62	260	2.77	-1.18 PS
17	14.05.85	11.18	7.18	1343	860	NIL	3.24	6.18	2.74	0.08	3.6	7.98	580	1.14	-8.34 PS
	28.11.85	9.56	7.4	1704	1091	NIL	4.42	7.19	4.04	0.18	4.8	7.4	610	1.64	-7.78 PS
18	29.05.85	2.92	7.97	954	611	NIL	3.62	4.57	3.26	0.92	4.0	2.8	340	1.77	-3.18 PS
	13.11.85	1.9	7.4	1092	699	NIL	4.04	5.36	4.13	0.61	5.2	1.97	360	2.18	-3.13 PS
19	22.05.85	3.67	7.77	4130	2643	NIL	11.98	20.11	15.74	16.47	0.8	10.03	540	6.76	-1.15 PS
	19.11.85	2.75	7.83	4020	2573	NIL	11.22	19.6	17.91	18.67	1.6	6.83	420	8.72	-2.79 US

1986

1	26.05.86	4.20	8.06	1683	1077	99.9	369/7.38	294/8.29	186/8.1	44/1.13	80/4.0	39/3.21	360	4.26	0.17
	13.11.86	2.56	7.70	1822	1166	99.9	284/5.68	230/6.49	208/9.0	6/0.15	40/2.0	88/7.24	520	4.21	3.56
2	28.05.86	2.55	7.87	1278	818	99.9	243/4.86	231/6.51	139/6.04	9/0.23	16/0.80	63/5.18	300	3.49	1.12
	15.11.86	1.50	7.60	3050	1952	99.9	257/5.14	672/18.9	364/15.8	8/0.20	96/4.80	112/9.21	700	5.98	8.87
3	27.05.86	2.82	7.33	448	287	99.9	126/2.52	21/0.59	24/1.04	40/1.02	40/2.0	5/0.41	121	0.95	0.11
	15.11.86	1.55	7.86	1092	699	99.9	148/2.96	192/5.41	107/4.65	3/0.08	32/1.60	53/4.36	300	2.69	3.00
4	30.05.86	5.80	7.51	2000	1280	99.9	155/3.10	420/11.84	192/8.35	89/2.38	88/4.4	49/4.03	420	4.07	5.33
	17.11.86	3.47	6.75	2010	1286	99.9	162/3.24	384/10.83	200/8.70	89/2.28	104/5.2	53/4.36	480	3.98	6.32
5	29.05.86	3.00	7.50	603	386	99.9	230/4.26	32/0.90	40/1.74	35/0.90	48/2.40	10/0.82	160	1.37	1.04
	16.11.86	1.64	7.82	463	296	99.9	135/2.70	19/0.54	27/1.17	17/0.43	32/1.60	90/1.56	160	0.93	0.46
6	28.05.86	2.72	7.27	1000	640	99.9	272/5.44	63/1.78	76/3.30	49/1.25	36/1.60	44/3.62	260	2.04	0.22
	16.11.86	1.49	8.46	1529	979	28/0.5	418/8.36	154/4.34	185/8.0	100/2.5	32/1.60	53/4.36	300	4.66	2.96
7	29.05.86	3.15	7.10	2120	1357	99.9	262/5.24	389/10.9	242/10.5	4/0.1	32/1.60	92/7.57	460	4.91	3.93
	17.11.86	1.27	7.13	1167	747	99.9	243/4.86	124/3.50	135/5.87	5/0.13	24/1.20	53/4.36	280	3.52	0.70
8	26.05.86	4.73	7.53	506	324	99.9	194/3.88	21/0.59	31/1.35	3/0.08	32/1.6	24/1.97	180	1.01	0.31
	14.11.86	2.10	7.30	1143	732	99.9	270/5.40	173/4.88	123/5.39	6/0.15	48/2.4	44/3.62	300	3.08	0.62
9	14.05.86	5.48	7.73	2020	1293	99.9	350/7.0	136/3.84	180/7.83	78/2.0	112/5.6	49/4.03	480	3.57	2.63
	17.11.86	3.13	8.35	210	134	10/0.2	38/0.76	11/0.31	19/0.83	3/0.08	16/0.80	5/0.41	60	1.67	0.25
10	22.05.86	5.20	8.00	2580	1651	99.9	407/8.14	431/12.15	243/10.5	320/8.2	24/1.20	63/5.18	320	5.92	1.76
	14.11.86	3.38	7.70	2800	1792	99.9	418/8.36	384/10.82	336/14.6	266/6.8	56/2.8	53/4.36	360	7.72	1.20
11	24.05.86	8.95	7.74	2050	1312	99.9	349/6.98	473/13.34	286/12.4	3/0.08	24/1.20	92/7.57	440	5.94	1.79
	12.11.86	4.15	7.61	2040	1306	99.9	270/5.4	384/10.83	327/14.2	4/0.10	32/1.60	53/4.36	300	8.24	0.56
12					DATA NOT AVAILABLE										
					DATA NOT AVAILABLE										
13	14.05.86	2.91	8.51	940	602	1.16	5.76	1.89	3.09	0.56	3.2	3.21	320	.73	-0.51 PS
	27.11.86	6.46	8.81	1274	815	1.62	4.86	5.13	6.0	1.79	1.6	4.36	0	3.48	0.52 PS
14	15.05.86	7.17	8.46	2730	1747	1.54	5.76	12.46	13.35	.87	4.0	9.21	660	5.19	-5.91 PS
	30.11.86	11.61	8.51	1964	1257	0.54	2.16	9.[illegible]	12.04	0.51	2.0	5.18	360	6.35	-4.48 PS
15	21.05.86	3.75	8.75	3260	2086	1.16	5.0	15.71	14.3	7.67	2.8	7.98	540	6.16	-4.62
	24.11.86	5.6	8.36	4700	3008	0.54	10.26	25.18	20.09	12.48	5.6	13.57	960	6.49	-8.37 PS
16	27.05.86	7.0	8.1	815	522	NIL	2.68	1.64	3.74	0.2	2.0	1.97	200	2.31	1.65 MARGINAL
	01.12.86	9.85	8.45	844	540	0.54	2.7	2.99	4.0	0.18	2.8	1.56	220	2.71	-1.12 PS
17	16.05.86	12.2	8.28	1425	912	0.76	2.86	6.77	3.35	0.05	5.2	6.41	580	1.39	-7.97 PS
	27.11.86	12.1	8.27	1355	867	NIL	2.16	5.95	3.43	0.26	3.6	6.41	500	1.53	-7.85 PS
18	24.05.86	2.81	8.35	1011	647	0.2	3.0	3.78	3.61	0.92	4.0	1.97	300	2.09	-2.77 PS
	17.11.86	3.8	8.36	1306	836	0.82	2.7	5.13	4.7	0.28	5.6	3.21	440	2.24	-5.29 PS
19	22.05.86	3.69	8.32	4300	2752	2.3	9.6	18.95	15.52	18.54	1.2	7.57	440	7.41	3.13 US
	24.11.86	5.09	8.41	4470	2861	1.08	9.46	22.25	17.39	21.64	0.6	9.38	500	7.78	0.56 PS

1987

1	21.05.87	99.9	7.80	2450	1568	99.9	320/6.40	384/10.83	236/10.26	289/7.4	40/2.0	53/4.36	320	5.75	0.04	
	23.11.87	6.55	7.80	1334	854	99.9	206/4.12	190/5.36	200/8.70	9/0.23	8/0.40	49/4.03	220	5.85	0.31	
2	22.05.87	7.80	7.80	785	502	99.9	156/3.12	96/2.71	80/3.48	5/0.13	48/2.4	29/2.38	240	2.25	1.66	
	24.11.87	4.25	7.64	2194	1404	99.9	216/4.32	470/13.25	393/17.0	9/0.23	24/1.2	34/2.80	200	12.08	0.32	
3	22.05.87	99.9	7.40	1200	768	99.9	140/2.80	288/8.12	143/6.22	5/0.13	24/1.2	49/4.03	260	3.85	2.43	
	24.11.87	5.0	7.87	1433	917	99.9	167/3.34	350/9.87	200/8.70	4/0.10	80/4.0	29/2.38	320	4.87	3.04	
4	24.05.87	99.9	7.80	559	358	99.9	195/3.90	29/0.82	43/1.87	3/0.08	16/0.8	34/2.8	180	1.39	0.30	
	24.11.87	6.93	7.72	2200	1408	99.9	127/2.54	430/12.13	225/9.78	111/2.8	80/4.0	63/5.18	460	4.56	6.64	
5	23.05.87	99.9	7.60	624	399	99.9	211/4.32	48/1.38	38/1.65	39/0.74	56/2.8	19/1.56	220	1.12	0.14	
	24.11.87	4.31	7.97	682	436	99.9	216/4.32	70/1.97	56/2.43	29/0.74	40/2.0	24/1.97	200	1.72	0.35	
6	23.05.87	99.9	7.80	550	352	99.9	125/2.50	38/1.07	50/2.17	8/0.20	24/1.2	24/1.97	160	1.72	0.67	
	24.11.87	4.26	7.64	1980	1167	99.9	539/10.78	260/7.33	288/12.5	144/3.7	24/1.2	49/4.03	260	7.74	5.55	
7	24.05.87	99.9	7.60	1380	883	99.9	545/8.90	144/4.06	240/10.4	7/0.18	16/0.8	29/2.38	160	8.27	5.72	
	24.11.87	5.20	7.91	1142	731	99.9	225/4.50	220/6.20	200/8.70	5/0.13	16/0.8	29/2.38	160	6.90	1.32	
8	21.05.87	99.9	8.20	500	320	99.9	133/2.66	48/1.35	44/1.91	7/0.18	24/1.2	19/1.56	140	1.63	0.10	
	23.11.87	6.63	7.68	1121	717	99.9	225/4.50	170/4.79	141/6.13	8/0.20	24/1.2	44/3.62	240	3.95	0.32	
9	21.05.87	5.22	7.80	1937	1240	99.9	172/3.44	269/7.59	231/10.0	129/3.3	64/3.2	44/3.62	340	5.44	3.38	
	25.11.87	5.40	7.50	1435	918	99.9	343/6.86	160/4.51	160/6.96	72/1.84	72/3.6	29/2.38	300	4.03	0.88	
10	21.05.87	99.9	7.80	1200	768	99.9	211/4.22	221/6.23	139/6.04	9/0.23	16/0.8	53/4.36	260	3.76	0.94	
	23.11.87	6.30	7.86	2540	1626	99.9	372/7.44	380/10.7	281/12.2	300/7.6	40/2.0	49/4.03	300	7.04	1.41	
11	26.05.87	99.9	7.40	2030	1299	99.9	242/4.84	374/10.55	333/14.48	3/0.08	16/0.8	63/5.18	300	8.37	1.14	
	25.11.87	4.56	7.59	2360	1510	99.9	206/4.12	510/14.38	380/16.52	6/0.15	40/2.0	63/5.18	360	8.72	3.06	
12					DATA NOT AVAILABLE											
					DATA NOT AVAILABLE											
13	21.05.87	3.33	8.4	718	460	0.7	4.96	2.26	3.04	0.9	0.8	3.21	200	2.15	1.61	MARGINAL
	27.11.87	6.4	8.38	1901	1217	NIL	4.46	9.67	11.0	2.89	0.8	5.18	300	6.36	-1.52	PS
14	29.05.87	6.57	7.9	2185	1398	NIL	4.04	11.84	13.35	0.66	1.2	6.0	360	7.04	-3.16	PS
	22.11.87	11.45	8.33	1590	1018	0.38	4.08	7.37	9.48	0.79	2.0	3.62	280	5.66	-1.16	PS
15	21.05.87	3.5	7.5	2860	1830	NIL	5.28	15.51	12.7	5.68	2.0	7.57	480	5.81	-4.29	PS
	23.11.87	5.7	7.87	5340	3418	NIL	8.38	29.33	24.03	12.79	4.0	12.01	800	8.5	-7.63	PS
16	29.05.87	7.85	7.7	572	366	NIL	2.82	1.97	2.48	0.13	2.0	1.23	160	1.95	-0.41	PS
	23.11.87	9.71	8.1	1002	641	NIL	3.34	4.4	5.22	0.2	1.6	2.8	220	3.52	-1.06	PS
17	28.05.87	9.5	8.0	1080	691	NIL	1.94	4.79	3.09	0.15	3.2	4.03	360	1.63	-5.29	PS
					DATA NOT AVAILABLE											
18	25.05.87	2.85	7.78	1288	824	NIL	4.76	5.08	5.35	1.13	3.6	3.62	360	2.82	-2.46	PS
	24.11.87	3.85	8.33	1229	787	0.38	4.64	4.68	5.61	1.02	4.4	1.97	320	3.14	-1.35	PS
19	20.05.87	3.65	8.0	4350	2784	NIL	9.68	22.56	19.57	19.82	0.4	7.98	420	9.56	1.3	MARGINAL
	22.11.87	5.05	7.73	4660	2982	NIL	12.28	23.46	19.43	19.18	1.2	7.24	420	9.46	3.84	US

1988

1	22.05.88	4.13	7.20	780	499	99.9	130/2.6	150/4.23	54/2.35	4/0.10	40/2.0	34/2.8	240	1.52	2.20	
	22.11.88	3.38	7.65	1688	1080	99.9	349/6.98	230/2.49	231/10.0	8/0.2	80/4.0	44/3.62	380	5.14	0.64	
2	26.05.88	2.45	7.60	1199	767	99.9	233/4.66	250/7.05	160/6.9	10/0.26	24/1.2	58/4.77	300	4.03	1.31	
	23.11.88	1.74	8.15	1577	1009	99.9	366/7.32	240/6.77	185/8.0	8/0.2	56/2.8	63/5.18	400	4.02	0.66	
3	26.05.88	2.73	7.2	1375	880	99.9	195/3.9	340/9.59	187/8.13	4/0.1	40/2.0	49/4.03	300	4.68	2.13	
	23.11.88	2.13	7.94	1306	836	99.9	281/5.62	240/6.77	146/6.35	3/0.08	48/2.40	49/4.03	320	3.54	0.41	
4	27.05.88	5.93	7.60	2160	1382	99.9	74/1.48	480/13.54	257/11.17	78/1.99	64/3.2	58/4.77	400	5.0	6.49	
	23.11.88	3.68	7.63	2780	1779	99.9	366/7.32	560/15.79	269/11.7	113/2.9	168/8.4	49/4.03	620	4.69	5.11	
5	27.05.88	3.05	7.6	668	428	99.9	250/5.0	80/2.26	53/2.3	38/0.97	56/2.8	15/1.23	200	1.62	0.97	
	23.11.88	2.6	8.43	1664	1065	51/1.0	298/5.96	250/7.05	142/6.17	88/2.25	96/4.8	49/4.03	440	2.94	1.84	
6	27.05.88	2.51	7.40	760	486	99.9	272/5.44	50/1.41	68/2.96	18/0.46	32/1.6	34/2.8	220	2.00	1.04	
	23.11.88	1.96	7.98	1791	1146	99.9	587/11.74	180/5.08	208/9.04	125/3.2	88/4.4	44/3.62	400	4.51	3.72	
7	27.05.88	3.37	7.80	998	639	99.9	372/7.44	120/3.38	180/7.82	5/0.13	24/1.2	29/2.38	180	5.84	3.86	
	23.11.88	2.35	8.09	990	634	99.9	298/5.96	120/3.38	111/4.83	5/0.13	56/2.8	24/1.97	240	3.13	1.19	
8	25.05.88	4.80	7.60	399	255	99.9	149/2.98	30/0.85	35/1.52	3/0.08	16/0.8	24/1.97	140	1.29	0.21	
	22.11.88	3.00	8.00	1336	855	99.9	272/5.44	230/6.49	159/6.91	8/0.2	48/2.4	49/4.03	320	3.85	0.99	
9	24.05.88	4.18	8.00	1480	947	99.9	19/0.38	250/7.05	184/8.0	44/1.13	32/1.6	49/4.03	280	4.77	5.25	
	24.11.88	3.40	8.11	706	452	99.9	199/3.98	120/3.38	63/2.74	5/0.13	40/2.6	34/2.8	240	1.77	0.82	
10	22.05.88	5.33	7.40	2670	1709	99.9	502/10.04	420/11.84	293/12.7	311/7.95	88/4.4	63/5.18	480	5.82	0.46	
	22.11.88	4.0	8.07	3430	2195	99.9	468/9.36	520/14.66	385/16.7	428/10.9	56/2.8	68/5.6	420	8.17	0.97	
11	25.05.88	8.32	8.40	1208	773	38/0.7	167/3.34	240/6.77	200/8.7	3/0.08	8/0.4	29/2.38	140	7.38	1.32	
	22.11.88	5.15	7.85	3260	2086	99.9	374/7.48	610/17.2	446/19.39	7/0.18	128/6.4	107/8.8	760	7.03	7.72	
12					DATA NOT AVAILABLE											
					DATA NOT AVAILABLE											
13	22.05.88	2.25	7.8	998	639	NIL	6.08	2.82	4.22	1.36	1.6	3.21	240	2.72	1.27	MARGINAL
	26.11.88	2.1	8.44	1512	968	0.7	6.34	5.92	7.61	2.25	2.0	4.77	340	4.14	0.27	PS
14	27.05.88	5.9	7.6	1700	1088	NIL	5.52	4.51	9.65	0.61	2.0	4.36	320	5.41	-0.84	PS
	24.11.88	3.9	7.67	1959	1254	NIL	6.34	7.33	10.87	0.92	3.6	5.18	440	5.19	-2.44	PS
15	31.05.88	3.2	7.82	2940	1882	NIL	5.62	17.48	13.61	7.67	0.8	7.57	420	6.65	-2.75	PS
	30.11.88	2.6	8.41	4880	3123	1.76	3.88	17.48	22.61	13.96	1.6	14.39	800	8.0	-10.35	PS
16	26.05.88	5.8	7.4	585	374	NIL	2.28	2.82	2.43	0.13	1.2	1.97	160	1.93	-0.89	PS
	21.11.88	3.3	7.86	1156	740	NIL	5.1	3.95	4.7	0.31	3.2	2.8	300	2.71	-0.9	PS
17	30.05.88	8.85	7.6	1572	1006	NIL	2.66	6.2	5.57	0.23	4.4	6.83	560	2.35	-8.57	PS
	19.11.88	5.25	8.26	1501	961	NIL	1.76	7.33	4.09	0.72	4.4	5.18	480	1.87	-7.82	PS
18	31.05.88	2.93	8.35	1619	1036	0.68	4.42	5.64	9.78	1.28	4.0	2.38	320	5.48	-1.28	PS
	29.11.88	1.95	8.08	900	576	NIL	4.4	2.82	2.35	0.54	3.6	2.38	300	1.36	-1.58	PS
19	30.05.88	3.18	8.1	4280	2739	NIL	9.7	24.25	15.22	19.18	1.2	7.24	420	7.41	1.26	MARGINAL
	24.11.88	2.85	7.96	4930	3155	NIL	14.26	25.78	14.65	20.46	4.4	10.03	720	5.45	-0.17	PS

1989

1	31.05.89	4.07	7.68	1662	1064	99.9	320/6.4	230/6.49	171/7.43	5/0.13	96/4.8	49/4.03	440	3.54	2.43		
	28.11.89	3.53	7.74	1373	879	99.9	370/7.4	157/4.43	158/6.87	11/0.28	24/1.2	73/6.0	360	3.62	0.2		
2	30.05.89	2.37	7.46	1470	941	99.9	418/8.36	240/6.77	143/6.22	11/0.28	72/3.60	63/5.18	440	2.97	0.42		
	30.11.89	1.81	7.50	1470	941	99.9	285/5.7	206/5.81	159/6.91	10/0.26	56/2.80	63/5.18	400	3.46	2.28		
3	31.05.89	2.83	8.01	1720	1101	99.9	374/7.48	250/7.05	222/9.65	3/0.08	72/3.6	58/4.77	420	4.72	0.89		
	30.11.89	1.85	7.83	1128	722	99.9	231/4.62	157/4.43	152/6.61	2/0.05	48/2.4	29/2.38	240	4.28	0.16		
4	30.05.89	5.60	7.52	3050	1952	99.9	445/8.9	540/15.23	327/14.22	56/1.43	216/10.8	39/3.21	700	5.37	5.11		
	30.11.89	3.96	7.38	2730	1747	99.9	277/5.54	519/14.64	267/11.61	44/1.13	112/5.6	107/8.8	720	4.33	8.86		
5	30.05.89	3.00	7.00	865	554	99.9	320/6.4	50/1.41	40/1.74	50/1.28	72/3.6	29/2.38	300	1.01	0.42		
	23.11.89	2.30	7.27	659	422	99.9	233/4.66	49/1.38	30/1.30	37/0.95	64/3.2	15/1.23	220	0.87	0.23		
6	30.05.89	2.90	7.40	1385	886	99.9	507/10.14	120/3.38	106/4.61	26/0.66	112/5.6	39/3.21	440	2.20	1.33		
	29.11.89	1.92	7.48	2160	1382	99.9	516/10.32	274/7.73	246/10.7	72/1.84	56/2.80	73/6.0	440	5.10	1.52		
7	30.05.89	4.0	7.85	1643	1052	99.9	178/3.56	190/5.36	220/9.57	76/1.94	56/2.80	29/2.38	260	5.95	1.62		
	23.11.89	2.80	7.52	1060	678	99.9	342/6.84	78/2.20	133/5.78	80/2.05	40/2.0	24/1.97	200	4.10	2.87		
8	31.05.89	4.86	8.10	838	536	99.9	320/6.40	60/1.69	42/1.83	4/0.10	80/4.0	29/2.38	320	1.02	0.02		
	29.11.89	3.06	7.69	1680	1075	99.9	400/8.0	255/7.19	181/7.87	11/0.28	96/4.80	58/4.77	480	3.60	1.57		
9	15.05.89	4.10	8.14	1735	1110	99.9	150/3.0	250/7.05	188/8.17	111/2.84	40/2.0	53/4.36	320	4.58	3.36		
	24.11.89	2.21	7.86	1990	1274	99.9	393/7.86	186/5.25	193/8.39	229/5.86	56/2.8	59/4.44	360	4.41	0.62		
10	31.05.89	5.38	8.14	2920	1869	99.9	525/10.5	380/10.72	311/13.52	346/8.85	80/4.0	63/5.18	460	6.31	1.32		
	29.11.89	4.01	7.71	2980	1907	99.9	477/9.54	412/11.62	294/12.78	325/8.31	88/4.4	63/5.18	480	5.84	0.04		
11	31.05.89	9.18	7.83	2550	1632	99.9	463/9.26	400/11.28	332/14.43	3/0.08	88/4.40	78/6.41	540	6.21	1.55		
	27.11.89	5.28	7.70	2350	1504	99.9	400/8.0	441/12.44	323/14.04	4/0.10	104/5.2	58/4.77	500	6.29	1.97		
12	28.06.89	2.35	8.09	2080	1331	NIL	8.56	8.46	14.13	0.1	1.6	6.0	380	7.25	0.96	PS	
	19.11.89	1.77	7.5	1900	1216	NIL	8.74	9.11	11.57	0.13	3.2	4.36	380	5.95	1.18	PS	
13	22.05.89	3.26	7.3	2790	1786	NIL	7.12	16.36	11.0	1.89	5.2	10.03	760	4.0	-8.11	PS	
	DATA NOT AVAILABLE																
14	23.05.89	7.7	7.86	2310	1478	NIL	7.3	5.08	13.65	0.84	3.2	6.41	480	6.23	-2.3	PS	
	DATA NOT AVAILABLE																
15	22.05.89	4.11	8.5	4020	2573	1.8	7.5	17.48	17.65	7.03	5.2	8.62	740	6.48	-5.52	PS	
	18.11.89	2.75	7.61	5130	3283	NIL	11.54	27.64	23.17	9.59	6.4	13.16	980	7.41	-8.02	PS	
16	15.05.89	6.3	8.44	648	415	0.6	2.1	2.26	2.39	0.2	1.6	2.38	200	1.69	-1.28	PS	
	24.11.89	3.4	7.45	1170	749	NIL	4.28	3.58	5.35	0.26	2.8	3.21	300	3.09	-1.73	PS	
17	23.05.89	9.65	7.53	1532	980	NIL	5.52	5.64	4.0	0.15	4.4	6.83	560	1.69	-5.71	PS	
	DATA NOT AVAILABLE																
18	26.05.89	2.85	8.35	1250	800	0.6	3.0	3.75	4.35	0.84	4.8	3.21	400	2.17	-4.41	PS	
	18.11.89	1.77	7.3	1249	799	NIL	5.2	4.96	5.09	1.02	5.2	1.97	360	2.69	-1.98	PS	
19	29.05.89	3.37	8.6	5600	3584	3.0	4.8	25.94	21.52	23.2	0.8	10.36	560	9.11	-3.36	PS	
	29.11.89	2.88	7.93	4670	2989	NIL	16.0	21.01	16.3	19.18	4.0	8.39	620	6.55	3.61	US	

20	28.06.89	3.04	8.24	2875	1840	NIL	6.9	12.41	17.39	2.84	4.8	4.03	440	8.28	-1.93 PS
	19.11.89	1.6	7.54	1885	1206	NIL	6.52	8.01	11.0	0.61	3.2	6.0	460	5.13	-2.68 PS
21	28.06.89	2.45	8.23	1780	1139	NIL	11.56	5.64	14.57	0.1	2.0	2.38	220	9.85	7.19 US
	19.11.89	1.46	7.76	2270	1453	NIL	12.46	8.01	15.3	2.89	2.0	2.8	240	9.85	7.66 US
22	28.06.89	4.73	8.55	2500	1600	0.6	7.0	9.02	7.87	10.51	2.4	4.36	340	4.28	0.84 PS
	18.11.89	3.48	7.71	2090	1338	NIL	8.92	6.35	4.91	8.31	3.6	4.36	400	2.49	0.96 PS
23	28.06.89	2.0	8.5	1406	900	1.5	6.0	2.26	11.43	0.05	0.8	0.97	140	9.71	4.73 US
	18.11.89	3.15	7.46	2300	1472	NIL	7.82	6.91	8.39	5.45	7.6	6.0	480	3.83	-1.78 PS

1990

12	25.05.90	1.7	8.57	1993	1276	0.42	3.78	9.87	10.87	0.23	0.8	6.41	360	5.73	-3.01 PS
	29.11.90	1.4	7.22	1941	1242	NIL	9.7	8.66	15.35	0.46	2.0	4.44	320	8.55	3.26 PS
13	28.05.90	1.9	7.72	2620	1677	NIL	10.48	6.66	12.2	1.53	6.8	6.41	560	4.75	-2.73 PS
					DATA NOT AVAILABLE										
14	29.05.90	3.35	7.73	1195	765	NIL	5.42	4.51	5.65	0.92	3.2	2.8	300	3.26	-0.58 PS
					DATA NOT AVAILABLE										
15	22.05.90	2.3	8.58	4690	3002	0.28	1.96	26.4	23.57	10.23	0.8	12.01	640	9.31	-10.57 PS
	22.11.90	2.68	7.52	5360	3430	NIL	6.08	27.33	26.09	11.76	2.4	12.01	720	9.72	-8.33 PS
16	28.05.90	2.7	8.56	1007	644	0.42	1.26	2.58	4.87	0.36	1.2	3.21	220	3.28	-2.73 PS
	22.11.90	2.9	8.13	923	591	NIL	3.8	2.71	4.13	0.31	1.6	3.21	240	2.66	-1.01 PS
17	29.05.90	7.08	7.49	1644	1052	NIL	1.36	4.51	6.09	0.2	5.2	5.59	540	2.62	-9.43 PS
					DATA NOT AVAILABLE										
18	25.05.90	1.55	8.27	1102	705	NIL	4.14	3.81	3.83	1.02	3.6	2.38	300	2.21	-1.84 PS
	29.11.90	1.59	7.25	1166	746	NIL	4.56	3.53	4.65	1.25	4.0	1.97	300	2.69	-1.41 PS
19	22.05.90	2.2	7.99	5800	3712	NIL	5.04	28.74	23.91	21.43	0.8	9.62	520	10.48	-5.35 PS
	29.11.90	2.1	8.09	4660	2982	NIL	12.54	19.23	19.26	18.75	0.4	7.98	420	9.41	4.16 US
20	25.05.90	1.13	8.25	2990	1914	NIL	10.98	10.77	16.48	3.84	6.8	5.18	600	6.73	-1.0 PS
	29.11.90	1.56	8.42	2400	1536	1.52	5.7	8.6	13.04	3.38	1.6	4.44	300	7.5	-0.34 PS
21	23.05.90	1.68	8.12	3600	2304	NIL	5.18	14.66	24.78	5.96	3.2	4.36	380	12.74	-2.38 PS
	30.11.90	1.7	7.93	3020	1933	NIL	12.54	11.9	21.26	4.88	1.0	5.43	320	11.86	-6.11 US
22	22.05.90	2.9	8.19	2640	1690	NIL	4.62	9.08	10.35	9.08	2.8	4.03	340	5.6	-2.21 PS
	21.11.90	3.87	7.64	1821	1165	NIL	8.74	5.36	7.39	7.75	3.4	2.96	340	4.14	2.38 PS
23	22.05.90	1.9	8.85	1127	721	NIL	3.78	2.06	8.7	0.1	0.8	1.97	140	7.39	1.43 MARGINAL
	21.11.90	2.28	7.64	1006	644	NIL	8.94	1.47	7.83	0.05	1.8	2.22	200	5.52	4.92 US
24	25.05.90	1.8	8.12	4890	3130	NIL	10.26	24.87	28.26	9.59	4.0	10.03	700	10.67	-3.77 PS
	30.11.90	2.06	7.61	4930	3155	NIL	7.6	27.07	29.39	9.77	0.6	12.99	680	11.28	-5.99 PS

ANNEXURE - 11

PARTICULARS OF PUMPING TEST

1.	Name of the work	: Pumping Test on tube well in the premises of Ravva on-shore project of ONGC.
2.	Location	: Surasani yanam, Uppalaguptam Mandal
3.	Static Water Level	: Ground Level
4.	Measuring Point	: 0.62 mts.
5	Total depth of the well	: 107.0 mts
6.	Diameter of the well	: 200mm/150mm
7.	Particulars of motor used for conducting the test	: 22.5 HP, 16 stages
8.	Method of Discharge	: Volumetric
9.	Discharge	: 1385 lpm (or) 1994.4 m**3/day
10.	Drawdown	: 2.71 mts
11.	Pumping Level	: 2.71 mts
12.	Transmissivity (T)	: 3580.88 m**2/day
13.	Specific Capacity (c)	: 511 lpm/mdd
14.	Duration of Pumping	: 240 minutes
15.	Date of the test	: 12.03.1992
16.	Geology	: Coastal Alluvium

Source: A P State Groundwater Dept,
Rajahmundry, Andhra Pradesh.

WELLL LOG DATA AT MANDAPETA , E.G.DIST.

Location : Mandapeta , 16 51' 37" & 81 55' 45"

Date : 23.06.1977 to 06.07.1977

Diameter of the tube well : 200/150/100 (mm)

LITHOLOGY :

Depth Range(mts)		Description
From	To	
0.0	1.5	Top Soil
1.5	18.0	Sand, fine to medium
18.0	19.5	Sand, coarse to very coarse
19.5	31.0	Clay
31.0	39.0	Sand, medium to very coarse
39.0	49.5	Sand, medium to coarse
49.5	55.5	Sand, fine to medium
55.5	61.5	Sand fine
61.5	67.5	Sand, fine to medium
67.5	73.5	Sand medium
73.5	80.15	Sand coarse to very coarse

Static Water level	: 4.66 m.bgl
Sp. capacity (1/m/dd)	: 500
Transmissibility (m**2/day)	: 3826
Type of pump	: Submersible (20 HP)

ANNEXURE - 13

LAND USE PATTERN OF STUDY AREA

S.No	Land Use	Area (Ha) 1983-84	1986-87	1987 - 88	1988-89	Remarks
1	Total Geographical area	82500	82500	82500	82500	Data for other years not available
2	Forest .	Nil	Nil	Nil	Nil	
3	Barren & uncultura-ble lands	13120	2575	2575	2625	Source : Chief Planning Officer E.G.Dist, Kakinada.
4	Culturable waste	1330	2890	2615	2460	
5	Pastures	735	1865	1745	1885	The figures for study area are in proportion to those for Central Delta.
6	Area under misc. tree crops	375	15	--	70	
7	Fallow Lands	4155	5545	5570	5705	
8	Land put to non-agricultural uses	9300	13580	13580	13435	
9	Net cultivated area	53485	56030	56415	56260	

ANNEXURE 14

CROPPING PATTERN OF STUDY AREA

(Area in Ha.)

S.NO	Crops	1983-84			1986-87			1987-88			1989-90			REMARKS
		Kharif	Rabi	Total	Kharif	Rabi	Total	Kharif	Rabi	Total	kharif	Rabi	Total	
1	Rice	34040	35930	69970	36000	33510	69510	36260	33930	70190	35380	33890	69270	Data for other
2	Jowar	105	240	345	20	340	360	190	325	515	--	115	115	years not
3	Maize	180	245	425	105	220	325	200	195	395	420	465	885	available
4	Ragi	--	15	15	--	--	--	--	--	--	--	--	--	
5	Greengram	--	30	30	--	220	220	--	530	530	--	6070	6070	Source: Chief
6	Redgram	5	--	5	20	--	20	40	--	40	--	--	--	Planning Officer
7	Blackgram	--	65	65	--	565	565	--	1105	1105	--	8525	8525	E.G.Dist,
8	Horsegram	--	55	55	--	10	10	--	--	--	--	--	--	Kakinada.
9	Chillies	20	30	50	10	5	15	5	10	15	10	10	20	Based upon the
10	Fruits & Vegetables	1370	90	1460	4225	60	4285	3830	285	4115	240	--	240	Statistics of
11	Sugarcane	1235	--	1235	1050	--	1050	1175	--	1175	915	--	915	Central Delta,
12	Groundnut	--	150	150	--	140	140	50	95	145	--	170	170	the figures for
13	Minor Millet	390	--	390	180	--	180	325	--	325	350	--	350	study area have been
14	Sesamum	10	550	560	20	465	485	5	595	600	--	190	190	worked out
15	Tobacco	--	1035	1035	--	955	955	--	990	990	--	1030	1030	proportionately.
16	Coconut	11555	--	11555	12780	--	12780	12840	--	12840	14000	--	14000	
Total		48910	38435	87345	54410	36490	90900	54920	38060	92980	51315	50465	101780	

ANNEXURE 15

SOURCEWISE AND SEASONWISE AREA IRRIGATED DURING DIFFERENT YEARS

S.NO	SOURCE OF IRRIGATION	YEAR & SEASON (AREA IN Ha.)												REMARKS
		1983 - 84			1986-87			1987-88			1988-89			
		Kharif	Rabi	Total	Kharif	Rabi	Total	Kharif	Rabi	Total	Kharif	Rabi	Total	
1	Canals	36470	35580	72050	37700	34350	72050	37600	33700	71300	36720	35000	71720	
2	Tube wells Filter Points	2350	2480	4830	2570	1500	4070	2600	2360	4960	3000	1380	4380	
3	Other wells	--	--	--	--	--	--	--	--	--	--	--	--	
4	Tanks	--	--	--	--	--	--	--	--	--	--	--	--	
5	Other Sources	--	--	--	--	--	--	--	--	--	--	--	--	
Total		38820	38060	76880	40270	35850	76120	40200	36060	76260	39720	36380	76100	

Source : Chief Planning Office, E.G.Dist, Kakinada.
The figures for study area are in proportion to those of central delta.

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