STUDY ON PERFORMANCE EVALUATION OF RIGHT MAIN DISTRIBUTARY IN UPPER GANGA CANAL SYSTEM

A DISSERTATION

Submitted in partial fulfillment of the requirements for the award of the degree

of

MASTER OF TECHNOLOGY

in

IRRIGATION WATER MANAGEMENT

By

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CANDIDATE'S DECLARATION

I hereby certify that the dissertation entitled, **"STUDY ON PERFORMANCE EVALUATION OF RIGHT MAIN DISTRIBUTARY IN UPPER GANGA CANAL SYSTEM"**, which has been presented in partial fulfillment of the requirement for the award of the DEGREE OF MASTER OF TECHNOLOGY IN IRRIGATION WATER MANAGEMENT and submitted in the Water Resources Development Training Centre, Indian Institute of Technology Roorkee is an authentic record of my own work carried out during the period from 1st July 2003 to 30th June 2004 under the guidance of Prof. and Head U. C. Chaube and Prof. Raj Pal Singh, WRDTC, IIT Roorkee.

The matter embodied in this dissertation has not been submitted by me for the award of any other degree.

Place: Roorkee

Date: 26 June 2004.

(RAKESH PRASAD)

This is to certify that the above statement made by the candidate is correct to the best of our knowledge.

(Prof. R. P. Singh)

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SYNOPSIS

The Upper Ganga Canal (UGC) was commissioned in the year 1854, by diverting water from the River Ganga at Haridwar into the UGC system. Successive improvements have been made over the years and the design discharge of 189 cumecs has been gradually increased to present-day capacity of 297 cumecs. The total command area of UGC is 2.023 M ha out of which the CCA on outlets is 1.011 M ha. This is spread over the western part of Uttar Pradesh and some part of Uttranchal State in India.

The original planning and design objectives of the scheme are not relevant in context of present day extensive agriculture and ever increasing irrigation demands existing for all the time in a year. A major part of water supply is going through the extensive sugarcane cultivation in the upper part of the project area.

Right Main Distributary system (takes off from Deoband Branch) having a total CCA of 5890 ha, is proposed to be studied in this dissertation. Field studies and research covered in the dissertation had been carried out during last one year. The dissertation prepared from this study consists of seven chapters as mentioned in the contents.

It has been observed in different irrigated command areas, that the gap between the irrigation potential created and its utilization is large. This large gap is due to various reasons including lack of equity, reliability and availability in distribution of water in the entire command area, insufficient use of water, deterioration of physical system, adverse environmental impact, water logging and others.

The three important components of irrigation system are: water delivery, water application and water disposal sub systems. The objective of delivery system is to distribute water in appropriate amount at time and place where it can be profitably utilized for crop production. The evaluation of system is needed to see whether water delivery system is delivering water in appropriate amount at time and place i.e. equity, adequacy, timeliness and reliability is maintained. Evaluation of system also determines whether crop production is increased and utilization of water resources is up to optimum extent, whether maintenance and operational plan is followed and carefully implemented and any correction is required for improved performance of existing system and adequate input for better design of new systems.

The scope of the study is to examine and evaluate, with recent practices about the deficiency of engineering infrastructure, existing efficiency in operation, present status of equity in distribution of water, use of available water resources, improvement in irrigation infrastructure, overall yield of crops and impact of socio-economic aspect in the command of canal.

The object of the study is to get both understanding for required suitable improvement in the system and optimal utilization of available resources.

Normally the water availability is less than the requirement in non-storage system. In this regard, this study covers the concept and presently adopted conjunctive use of water, so that the ground water level is maintained at the required level. It makes utilization of both the surface water and ground water. The water for surface irrigation, which is recharging the ground water, is pumped out through well irrigation and water table do not rises upto root zone of the crop and the ill effects are eliminated. This study also focuses about the adequate provision and maintenance of drainage system.

This study concludes and suggests for future study about proper land development, operation and maintenance of the distribution network and field channels, encouraging farmers participation in distribution and proper management of available water, efficient method of application of water, selection of crop and improved agronomic practices so that the efficiency of existing infrastructure can be increased and available water resources can be utilized optimally.

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ABBREVIATIONS USED

M. Tech.	:	Master of Technology
WRDTC	:	Water Resources Development Training Centre
IITR	:	Indian Institute of Technology Roorkee
ICID	:	International Commission on Irrigation and Drainage
ASCE	:	American Society of Civil Engineers
CSSRI	:	Central Soil Salinity Research Institute
CMFRI	:	Central Marine Fisheries Research Institute
WRD	:	Water Resources Development
UGC	:	Upper Ganga Canal
UGIMP	:	Upper Ganga Irrigation Modernization Project
PUGC	:	Parallel Upper Ganga Canal
LGC	:	Lower Ganga Canal
MGC	:	Madhya Ganga Canal
IWM	:	Irrigation Water Management
CCA	:	Culturable Commanded Area
Irr. Project	:	Irrigation Project
KM	:	Kilometer
RD	:	Reduced Distance
Ha	:	Hectare
No.	:	Number
Cumecs	:	Cubic meter per second
Dy	:	Distributary
Mr.	:	Minor
Annex.	:	Annexure
RWS	:	Relative Water Supply
IQR	:	Inter-Quartile Ratio
EC	:	Electro-Conductivity
Meq/l	:	Milli equivalent per litre
MO&M	:	Management, Operation and Maintenance
O&M	:	Operation and Maintenance

GWT	:	Ground Water Table
HYV	:	High Yield Variety
CWC	:	Central Water Commission
FSL	:	Full Supply Level
RGWD	:	Relative Ground Water Depth
RPP	:	Relative Productivity Potential
CADA	:	Command Area Development Authority
U.P.	:	Uttar Pradesh
ISF	:	Irrigation Service Fee
EIRR	:	Economic Internal Rate of Return
AMC	:	Available Moisture Content
I. I.	:	Intensity of Irrigation
E. E	:	Executive Engineer
S.D.O.	:	Sub-Divisional Officer
J.E.	:	Junior Engineer

CHAPTER-I

INTRODUCTION

1.1 GENERAL:

The success of an irrigation water delivery system can be measured by how well it meets the objectives of irrigation i.e. delivering an adequate and dependable supply of water in an equitable efficient manner to the users served by the system. In many irrigation systems, inequitable and unreliable water distributions are major water management problem. In monitoring and evaluating water-delivery system, it is necessary to know how well a system performs in its present state relative to system objectives. This dissertation deals with performance measures (quantifiable) to analyze a water delivery system in terms of adequacy, equity, timeliness and sustainability.

A water-delivery system comprises of structural and management components. The structural components comprise of the facilities for conveyance, regulation and measurement of water. The management component is responsible for efficient operation and maintenance of the hydraulic structures to implement water delivery schedules that specify timing and amount of delivery. System performance suffers if either or both the components are deficient. So it is necessary to evaluate the contributions of above four factors to the overall performance of the system.

1.2 DEFINITIONS:

1.2.1 Adequacy: Delivery of Required Amount:

A fundamental concern of water delivery system is to deliver the amount of water required adequately to irrigate crops. The required amount, determined as that needed to achieve the given agricultural policy, is a function of the area of land irrigated, crop consumptive use requirements, crop-water production functions, application losses and cultural practices, such as land preparation and salt leaching. Adequacy of delivery is dependent on water supply, specified delivery schedules, the capacity of hydraulic structures to deliver water according to the schedules, the operation and maintenance of the hydraulic structures.

1.2.2 Equity: Delivery of Fair Amount

Equity as related to water-delivery systems can be defined as the delivery of a fair share of water to users throughout the system. A share of water represents a right to use a specified amount. The fair share of water may be based on a legal right for water as in a prior appropriation system, or may be set as a fixed proportion of a water supply, as is done in many rotational delivery schemes. Equity of water delivery is a difficult objective to measure because there are many factors that determine the meaning of a "fair share" and because a fair share is often interpreted subjectively. However, it is important to define measures relating to equity so that systems can be designed or rehabilitated to deliver water in an impartial manner to users served by the system. In the present study, equity is defined as ratio of volume delivered respectively, to the most favored upper 25% of command area and the least favored lowest 25% of command area.

1.2.3 Timeliness: Uniform Delivery Over Time

Timeliness means correspondences of water supply to crop water requirements and it relates to distribution of water supply across the season to some utility-based standard. The standard is delivered from crop water requirement. Svendsen and Small (1990) argued that in the absence of any readily identifiable distinction between reliability and timeliness, the single concept of timeliness would be more useful.

1.2.3.1 Reliability

The concept of reliability means the degree to which the irrigation system and its water deliveries conform to the prior expectation to the users.

Reliability relates to a fairly constant rate of supply.

1.2.3.2 Dependability:

It is defined as the delivery of a relatively uniform amount of water over time (Moledn, 1988). A system, which performs in a consistent manner, may be considered dependable. Dependability of water delivery is important to farmers, because it allows for proper planning. A system that dependably delivers an inadequate amount of water may be more desirable than one that delivers on the average an adequate yet unpredictable supply.

1.2.4 Sustainability:

Sustainability means long lasting or long term development of performance. Aspects of physical sustainability that can be affected by irrigation managers relate primarily to over or under supply of irrigation water leading to water-logging or salinity.

$$\text{Sustainability} = \frac{\text{Current Irrigable area}}{\text{Initial total irrigable area}}$$

The initial area refers to total irrigable area in the design of the system or in the latest rehabilitation. Current irrigable area is due to land lost because of salinity, water shortage, and low profitability of agriculture due to urban and industrial development.

1.3 Water Delivery Performance:

Performance measures as defined by Molden and Gates (1990) are functions of state variables that have direct impact on the fulfillment of system objectives and incorporate the time and space variability of state variables and account for contributions to system performance from the structural and management components of the system.

1.3.1 Major State Variables:

The major state variables that determine water-delivery-system performance may be defined in terms of an amount of water Q, which may refer to rate, volume, frequency or duration of water delivery. In present study, we focus on volumes (Ha-m) of water delivery. At a point x in the system and time t, we define the amount Q_D (x, t) to be the actual amount delivered by the system. The amount Q_R (x, t) is the amount of water required for consumptive use, leaching, land preparation, farm application and conveyance losses downstream of the delivery point x and time t. In a rotation system, the amount scheduled i.e. Q_S (x, t) is prescribed by the organization in charge of water delivery. The amount of water delivered by the system giving perfect operation is the amount deliverable i.e. Q_D (x, t).

1.3.2 Performance Standards:

Performance standards as suggested by Molden and Gates (1990) is given below:

Table- 1.1

Measures	Performance Class		
	Good	Fair	Poor
P_A i.e. Adequacy	0.9~1.00	0.7~0.9	<0.7
P_E i.e. Equity	0.85~1.00	0.7~0.85	<0.7
P_t i.e. Timeliness	0.75~1.00	0.25~0.75	<0.25
P_s i.e. Sustainability	0.95~1.00	0.85~0.95	<0.85

1.4 Study Area and Historical Background

This performance evaluation study has been carried out in the command area of Right Main Distributary of Deoband branch in Upper Ganga Canal (UGC) system. The command area of Right Main Dy lies partly in Haridwar, Saharanpur and Muzaffarnagar districts each. The Upper Ganga Canal (UGC) system commissioned as far back as 1854-55 has its origin from the mythological river Ganga. The project of Upper Ganga Canal was conceived and constructed by Proby T. Cautley during the period 1840-54. Mr. Proby T. Cautley designed and constructed a versatile network incorporating almost all type of engineering cross-drainage marvels and regulating structures. The UGC system comprises of 6540 km of irrigating channels in which it has 910 km of main and branch canals and 10.11 lakh ha of culturable area presently. The length of main canal is 274 km and the canal capacity has been gradually increased and is now 295 cumecs (10500 cusecs). The maximum capacity of the canal in the head reach is proposed to be as 30 cumecs (13068 cusecs) which includes 20% extra inflow for silt ejector. This UGC system provides irrigation facilities in 10 districts in western U.P. consisting of Haridwar, Muzaffarnagar, Meerut, Ghaziabad, Bulandsahar, Aligarh, Mathura, Agra, Mainpuri and Etawah. The Deoband branch is one of the major branch canal taking off from right bank of Upper Ganga Canal at km. 35.342. Its discharging capacity at the head is 24.794 cumecs as per design but actual capacity at head is 19.13 cumecs at present. Its total length is 82.828 km and total CCA of this Branch canal system is 55006 ha. The Deoband Branch canal feeds 17 off takes comprising of Distributaries/Minors on both banks and one of this is Right Main Dy system takes off at 7.26 km of Deoband branch from left bank. The total length of

Right Main Dy is 17.702 km and authorized discharge is 2.69 cumecs (95 Cusecs). The direct irrigation from Right Main Dy is done in 2111 ha of CCA through outlets of Right Main Dy and total CCA is 5890 ha from whole of Right Main Dy system, which includes Bhaisani and Barla Dys and Khoja Nagla, Bijopura and Khampur minors. The total number of outlets is 176 and the average size of the chak on the outlet is 33 hectares. The total length of Right Main Dy system is 46.87 km.

There are two main irrigation seasons, April to September (Kharif) and October to March (Rabi). In kharif season crops grown are Rice, Millet, Sorghum and fodder while in Rabi season crops grown are Wheat, Berseem, Mustard etc. Sugarcane is the perennial crop. Due to non-availability of adequate water supply, "Rostering" of system is being followed. The data collected from Ganga Canal Division, Muzaffarnagar are given below:

Table-1.2

Gross Area District wise

Districts	Area in Acres	Area in Hectares
Saharanpur	255900	103560
Muzaffarnagar	491200	198782
Meerut	9150	3703
Total Division	756250	306045

Table-1.3

District wise CCA and Road Muzaffarnagar Division Ganga Canal

Districts	CCA in Acres	CCA in Ha.	Roads in km
Saharanpur & Haridwar	97045	39273	154
Muzaffarnagar	191774	77610	492
Meerut	1250	505	4
Total	290069	117388	650

Table-1.4: District wise Crops Grown In Acres

Name of Crop	District		
	Saharanpur	Muzaffarnagar	Meerut
Sugarcane	29114	60574	5586
Rice	14577	30287	2793
Others	20379	42402	3910
Total Kharif	**64070**	**133263**	**12289**
Rabi	39788	82785	7635
Total	**103858**	**216048**	**19924**

Table-1.5

CCA in Acres in Muzaffarnagar District

Ganga canal ----------	222044
Yamuna canal --------	175915
Tubewells -------------	145548
Total	**543507**

Table-1.6: Target of Muzaffarnagar Division, Ganga Canal (District wise)

District	Unit	Kharif	Rabi
Haridwar	Hectares	12500	6200
Saharanpur	"	18000	8700
Muzaffarnagar	"	62610	39850
Meerut	"	500	250
Total	"	**93610**	**55000**

Table-1.7

Table-1.7 District wise CCA in Hectares (Muzaffarnagar Division)

District	Ganga canal	Deoband Branch	Total
Haridwar	7114	3971	11085
Saharanpur	8505	19683	28188
Muzaffarnagar	46362	31330	77692
Meerut	423	-	423
Total in Ha.	**62404**	**54984**	**117388**
Total in Acres	**154203**	**135868**	**290071**

Table-1.8

Proposed Potential Area (PPA) Canal wise in Acres (Muzaffarnagar Division)

Canal	CCA in Acres	Kharif PPA (Acres)	Rabi PPA (Acres)
Ganga Canal	154203	101774	63223
Deoband Branch	135868	89673	55706
Total	290071	191447	118929

Table-1.9

Proposed Cropping Intensity as per Ramganga Project

Paddy	15%
Other Kharif	21%
Sugarcane	30%
Total Kharif	66%
Rabi	41%
Total	107%

Table-1.10

District wise Length of Channels and Drains In km.

Particular	Haridwar	Saharanpur	Muzaffarnagar	Meerut	Total
Canal Length	121.956	135.202	696.426	5.028	958.612
Drain Length	-	172.0	377.0	-	549.0

CHAPTER-II

INFRASTRUCTURE DETAILS OF PROJECT

2.1 RIGHT MAIN DISTRIBUTARY:

The command area lies between latitude $29^0 50'$N to $29^0 55'$N and longitude $77^0 50'$E to $77^0 55'$E and has a CCA of **2111 Ha** from direct outlets of this distributary and total of **5890 Ha** from whole of Right Main Dy system. The discharging capacity of this Dy is **2.69 cumecs (95 cusecs)**. It has **54 numbers** direct outlets in this distributary only. The total length of this distributary is **17.702 km.** It takes off at 7.26 km of Deoband Branch. It has two nos of distributaries and three nos of minors as shown in schematic diagram.

2.2 BHAISANI DISTRIBUTARY:

The distributary takes off at **16.40 km.** of Right Main Dy. The total length of this distributary is **13.60 km**. The authorized capacity of the distributary is **1.22 cumecs (43 cusecs).** The direct outlets on this distributary are **65 numbers** and the total CCA on direct outlets is **2237 Ha.** Three numbers of minors namely Khoja Nagla, Bijopura and Khampur take off from this distributary.

2.3 BARLA DISTRIBUTARY:

The distributary takes off at **17.70 km** of Right Main Dy. The total length of this distributary is **7.25 km.** The authorized capacity of the distributary is **0.339 cumecs (12 cusecs).** The direct outlets on this distributary are **32 numbers** and the total CCA on outlets is **708 Ha.** This distributary starts from tail of Right Main Dy and it has no Dy/Minors further.

2.4 KHOJA NAGLA MINOR:

The minor takes off at **5.60 km** of Bhaisani distributary. The total length of this minor is **4.02 km.** The authorized capacity of the minor is **0.25 cumecs (9.0 cusecs).** The direct outlets on this minor are **17 numbers** and the total CCA on outlets is **568 Ha.** It has no further branches.

2.5 BIJOPURA MINOR:

The minor takes off at **10.32 km.** of Bhaisani distributary. The total length of this minor is **1.72 km.** The authorized capacity of the minor is **0.085 cumecs (3.0 cusecs).** The direct outlets on this minor are **4 numbers** and the total CCA on outlets is **138 Ha.** It has no further branches.

2.6 KHAMPUR MINOR:

The minor takes off at **10.69 km.** of Bhaisani distributary. The total length of this minor is **2.60 km.** The authorized capacity of the minor is **0.085 cumecs (3.0 cusecs).** The direct outlets on this minor are **2 numbers** and the total CCA on outlets is **128 Ha.** It has no further branches.

Table No. 1 in Annexure-2 gives salient features of distributaries and minors under case study.

Table No. 2 in Annexure–2 gives details of infrastructure, canal lining and road communication of distributaries and minors under case study.

CHAPTER-III

SURVEY OF LITERATURE

3.1 PERFORMANCE

(i) It is the degree to which an organization's products and services respond to the needs of their users.

(ii) It is the efficiency with which the organization uses the resources at its disposal.

Achievement of entered level of service (that has been set and agreed upon) is the basis for good operational performance. Operational performance specifically measures the extent to which intentions are being met at any moment and thus requires measurement of actual input and output on a regular basis. Strategic performance assesses the extent to which all available resources (financial resources, natural resources and human resources to operate, maintain and manage irrigation system) have been utilized to achieve the agreed service level efficiency.

$$\text{Agreed service level} = \frac{\text{Intended level of Delivered Resources}}{\text{Required level of considered Resources}}$$

Agreed service level changes with a change in the availability of resources (i.e. water, energy, manpower and funds).

Target reflects the objectives of managers of different level. A system manager uses outcome of the annual/seasonal planning process. High-level agency managers use design criteria as their targets. Policy makers think in terms of potential performance with respect to use of natural resources.

The rising cost irrigation development, dissatisfaction with current level of performance and greater awareness of environmental issues are mainly responsible for undertaking performance evaluation. These efforts (By Government agencies associated with irrigation development, funding agencies like World Bank and the water users) are being made on the assumption that it is possible to improve the performance through modern technology and management techniques. The knowledge of pre-improvement phase of performance and projections of performance levels in post-improvement phase is essential for suggesting improvement.

3.2 OBJECTIVES OF IRRIGATION WATER MANAGEMENT:

(i) In reacher nations (having larger land units), measuring devices are installed at outlets; which puts more control and responsibility into the hands of the farmer. The farmer can supply water to the crop efficiently, matching supply to growth requirement and to weather.

(ii) The authority's relationship with farmer is good who can charge a realistic price for water as a commodity.

(iii) The authority may not need to trouble itself for equity of water distribution. Farmers can understand and accept the constraint i.e. water deficiency and plan their field activities appropriately to minimize the problem.

(iv) In a canal-fed, small holder, surface irrigation systems of developing countries like India, the authority's role is to ensure that water is fairly distributed in space and time (WATER-MANAGEMENT), i.e. to deliver water in sufficient quantities, according to a time schedule that matches the requirements for healthy plant growth, and with fair distribution among many users.

3.3 CHARACTERISTICS OF IRRIGATION WATER MANAGEMENT

(i) There are four phase/levels of water management.

- Water capture (by a "public works" authority) i.e. harnessing of natural resources by dams, barrages, intakes, and pumpstations.
- Main system distribution (engineer-managed within a state irrigation or agriculture authority).
- Sub-system distribution i.e. serving area of the order of 50~500ha (farmer-group managed or influenced, but with ill-defined legal/administrative framework).
- Water applications at the field i.e. last stage (By individual farmer). In this stage, land shaping and grading, and irrigation technique are considered by individual farmer with/without assistance/advice from public authority.

(ii) The last (farmer) level lacks clear organizational arrangement, which requires "farmer participation". The purpose is to encourage creation of formal organizations of farmers that will have responsibility in this area and also to push the boundary of the lower level management sector farther upstream than in the past.

(iii) The success of IWM must flow from the top down i.e. farmers cannot produce well unless intake & distribution systems deliver to them adequate, timely and predictable water-flows.

(iv) At lower level, demand is more than requirement. Hence a body of knowledge on the functioning of systems is to be built to diagnose management deficiencies.

3.4 CAUSES OF POOR PERFORMANCE IN AN IRRIGATION SYSTEM:

(i) Physical causes i.e. insufficient control structures to enable the engineering management to exert theoretically desirable level of control at all junction points of the main system.

(ii) Management deficiencies i.e. the operating manual (which guides the actions of field staff) may be inappropriate to present circumstances or may not exist.

(iii) Insufficient staff to discharge the functions.

(iv) Staffs may lack communications.

(v) Social constraints i.e. natural resistance to watering at night.

3.5 PERFORMANCE OBJECTIVES:

The performance of a management system can only be evaluated in terms of its objectives. Irrigation schemes have multiple and sometimes conflicting objectives and the perception about performance will vary depending upon the value attached to the different goals by the person or organization making the assessment. There are different aspects of project performance that may relate to financial, institutional, design, construction and operation of the system.

Smith (1990) gives detailed list of the characteristics of the project performance in respect of financial institutions and socio-economic agricultural operational factors.

Chambers (1984) has listed some of the perception of the good performance by different disciplines and sections of the society.

Small & Svendsen (1990) stated that the goals were crucial to performance evaluation and their clear specification and classification as to whether they were related to inputs, outputs or efficiency is needed. Small & Svendsen conceptualized irrigation purposes within a nested means and end framework in which a narrow purpose is seen as a means of achieving some specified end as follows:

Table- 3.1

LEVEL OF OBJECTIVE	MEANS	END
Proximate	Operation of irrigation facilities	Supplying water to crop
Intermediate-1	Supplying water to crop	Sustained increase in agricultural productivity
Intermediate-2	Sustained increase in agricultural productivity	Increased incomes in rural sector
Intermediate-3	Increased incomes in rural sector	Rural Economic Development
Ultimate	Rural Economic Development	(i) Improved livelihood of rural people (ii) Sustained socio-economic development for entire economy

Here the end of the first level of objective becomes the means of next higher level of objectives. The constraints at different levels influence the performance of other levels.

Here discussion is limited to technical performance at the hydraulic level of water distribution system. Hence success of this irrigation system can be measured by how it supplies the required quantity of water at the right time in an equitable manner to users served by the system.

The water delivery system can have many objectives. Most of them can be included in adequacy, equity, timeliness and water quality. The water delivery management is not end in itself, but is a means of increasing agricultural productivity in a sustainable manner and ultimately improving the quality of life. Abernethy (1987) has shown how all the objectives can be combined into a single objective of productivity.

3.6 PARAMETERS OF IRRIGATION PERFORMANCE:

The performance objectives have to be expressed in terms of measurable quantities called state variables. These state variables are combined in various forms to develop indicators or parameters of performance. Non-exhaustive lists of these indicators can be found in Eisel (1988), Smith (1990) and Svendsen and Small (1990).

Clyma and Lowdermilk (1988) identified the parameters that need to be monitored for diagnosing the performance of irrigation system with a management focus for system outcomes. Those parameters are yield, cropping intensity, variance in yield, cropped area for productivity of agriculture. Also the parameters are volume, flow and time, variance of outlet ratio, dependability, actual water delivered/scheduled delivery, ratio of actual supply and designed supply for equity and adequacy.

This means that the parameters we need to measure in any evaluation of irrigation performance will be (i) **adequacy** (ii) **equity** (iii) **timeliness** (iv) **sustainability** (v) **reliability** as has been discussed in introduction chapter.

Adequacy, equity and timeliness are primary parameters. Sustainability and reliability are subsidiary parameters.

The purpose of an irrigation system is, in the end, production of some crop. So any departures from the optimum water supply, whether in regard to adequacy, to equity or to timeliness, has to be evaluated in terms of its impact on crop.

3.6.1 Adequacy:

It means adequate water supply to irrigate crops. The adequacy of water supply is controlled by available supply for distribution, water delivery schedule, and capacity of the hydraulic structure to supply water according to schedule and operation and maintenance of the system.

The early measures of adequacy revolved around duty of water. Abernethy (1990) mentioned that the concept of duty is especially suited to water deficit environment. It is approximately related to water requirement only. The water requirement for a given agricultural policy is a function of the land area, crop consumptive use, and application losses and leaching requirement.

Oad and Podmore (1989) suggested that the knowledge of relative water supply (RWS) could be used to specify characteristics, irrigation organization and system management. The degree to which capability is actually realized is called intensity of management. By varying intensity, it is possible to match supply with the demand.

Relative Water Supply (RWS): In the physical sense, Relative water supply (RWS) is the ratio of water supplied to an irrigation unit and the demand for water in that unit over a period of time.

$$RWS = \frac{\text{Water supplied to a command area}}{\text{Demand of water in that area}} = \frac{IR + RN}{ET + S \& P}$$

Where,

IR = Mean irrigation application (mm/day)

RN = Mean rainfall (mm/day)

ET = Mean evapotranspiration (mm/day)

S & P = Seepage and deep percolation (mm/day)

Hence RWS is inverse of water use efficiency. When RWS is low, it represents water scarcity giving rise to higher tension. (Tyagi, N.K., December 1993).

Abernethy (1990) argued that inclusion of percolation losses into demand affected the meaning of RWS. Because of losses where more (may be due to poor water management practices), demand would be more and hence RWS would be low indicating a better management.

Molden and Gates (1990) developed a procedure to determine relative contribution of hydraulic structures and management procedures to water delivery adequacy. As per Clemmens and Bos (1990):

$$\text{Water delivery performance} = \frac{\text{Amount of water actually delivered}}{\text{Amount of water intended to be delivered}}$$

If the amount of water actually delivered is based on frequent flow measurements, there is greater likelihood that managers can match actual to intended / scheduled flows. If water delivery performance ratio ≈ unity, then the management inputs must be effective.

Besides water delivery performance ratio, the following also measures adequacy.

(i) $$\text{Field application ratio} = \frac{ETp - Pe}{\text{Volume of water delivered at field}}$$

Where,

ETp = Evapotranspiration by irrigated crop

Pe = Effective part of precipitation

ETp-Pe = Volume of irrigation water needed to avoid undesirable stress in the crops throughout the growing cycle.

(iii) $$\text{Overall performance ratio} = \frac{ETp - Pe}{Vc + Vi}$$

Where,

Vc = Volume of irrigation water delivered from river/reservoir

Vi = Inflow from other sources to conveyance system.

3.6.2 Equity:

It refers to the quality of distribution of a given output. Equity may be defined as the fair share of water to users at different points in the system.

Abernethy (1990) proposed the use of inter-quartile ratio defined as the ratio of volume delivered respectively, to the most favored upper 25% of command area and the least favored lowest 25% of the command area. The meaning of IQR is readily grasped by a layman, so it facilitates communication among those involved in the inequity problem. The desirable density of measurements for definition of IQR is in the range 20-50 measurement points. Within the land area supplied from each measuring points, it is necessary to make some assumption about the degree of equity that exists downstream. Common value of IQR=3. There is some degree of co-relation between the incidence of inequity and irregularity in supply. The areas (near canal tails) which are at the bottom of an equity curve (Fig. 3.1) are the most likely to receive their water erratically. Their season totals of water received may include periods of excess supply (for instance, after a mid-season rainfall when every one's requirements are temporarily satisfied).

3.6.3 Timeliness:

Timeliness means correspondence of water supply to crop water requirements and it relates to distribution of water supply across the season to some utility based standard. For many irrigation activities the flow rate must be near the intended flow rate for water use to be effective (Clemmens & Bos, 1990).

The simplest method to access timeliness is to calculate relative productivity potential. Monthly data appear to give a good indication of whether discharge is more or less timely supplied.

3.6.4 Sustainability:

Aspects of physical sustainability that can be affected by irrigation managers relate primarily to over or under supply of irrigation water leading to water logging or salinity.

$$\text{Sustainability} = \frac{\text{Current irrigable area}}{\text{Initial total irrigable area}}$$

The sustainability of irrigation is also determined by the ratio as follows:

$$\text{Relative Ground Water Depth} = \frac{\text{Actual groundwater depth}}{\text{Critical groundwater depth}}$$

The critical groundwater depth mostly depends on the (effective rooting depth) of the crop. If the actual groundwater depth is near the critical depth, the time interval between readings of the ratio should be near one month. One year is suitable for most other purposes.

3.6.5 Water Quality:

The characteristics of irrigation water itself have bearing on the performance of water delivery system. Temperature, sediment and dissolved salts affect the performance of irrigation system. Temperature of irrigation water through its effect on soil can affect the plant growth.

The positive effect of sediment is in its soil-building role in sandy soil and supply of nutrients for crops. The negative effect of sediment can be the sealing of soil surface, raised field elevations relative to canal outlets and thereby reduced water supplies.

The effects of salt in irrigation water supplies have been researched and standards are available for various salts for crops in a given soil and climate (Ayers and Westcot, 1988 and Tyagi, 1992).

The relative change of salinity at considered locations within the irrigated area can be quantified by:

$$\text{Relative EC Ratio} = \frac{\text{Actual EC value}}{\text{Critical EC value}}$$

The critical EC-value depends on the salt tolerance of the irrigated crops. If we want to quantify the effect of a certain user on the salinity of the irrigation water in the canal system, we recommend measuring the EC upstream and downstream of the user.

The rate of change of the concentration of organic matter in irrigation water mainly results from either natural fall of leaves and branches from trees and vegetation along with the canal or disposal of trash by humans along the canals. Total dissolved organic matter (% volume), colour and smell are recommended to be measured. An equivalent ratio as shown for EC value should be used.

The major source of chemical pollution may have either a non-agricultural or agricultural source; urban and industrial sewage water flowing into the canal, and pesticides plus fertilizer leached from the root zone. At least concentrations of Nitrates (NO3-1 in meq/l) and of Phosphates (P in meq/l) are to be measured. Equivalent ratios as shown for the EC value should be used.

3.7 THE CONCEPT OF POTENTIAL PRODUCTIVITY:

(i) Irrigation systems are meant for providing water to crops for raising productivity of land and water. The excess or deficit of water supply has impact on crop yield though the effect varies with stage. The effect of water shortage may be reflected within a season where as excess application may not have immediate effect unless it creates conditions of oxygen deficiency. Review works of Doorenbos and

Kassam, 1979, enables us to estimate the effect of water deficiencies on crop yield and to differentiate between effects, on ultimate yield, of water shortage that may occur at different stages in crops history. From this kind of information, we can calculate a ratio, between output that can be achieved under this water supply and the output that would have been achieved if the water supply had been ideally matched to the needs of crop. This ratio is called potential productivity of this particular pattern of water delivery, Abernethy (1984, 1986). It produces a number in the range 0 to 1 which would be obtainable under a given water supply regime. The execution of this calculation should take account of soil characteristics. Because, in practice, water is supplied irregularly, and what matters is not precise timeliness of delivery, but the state of the moisture content in the root zone. The potential productivity index is worked out on the basis of weekly or ten-daily averages of water inputs and outputs, with allowances for field seepage loss based on whatever local observations may be obtainable. Such an index would, in one value, sum up the system's performance in meeting crop demand fairly well if relevant data for adequacy and timeliness could be collected.

(ii) Productivity means production per unit of input. We may have a land productivity (tonnes/hectare) or yield. We may have water productivity (kg of crop/m^3 of water) or water use efficiency. Hence, input means hectare of land or m^3 of water in case of land or water respectively. Where the water management is a focus, water may be the dominant constraint on output. Fig. 3.2 (derived from Abernethy, 1985,1986) is an observed history of water deliveries throughout one season to a land unit in Sri-lanka, where rice was the sole crop. In the figure the crop water requirement (inclusive of a seepage allowance, and with deduction made for effective rainfall) is shown. From this we see that in the early and late stages of the season deliveries were in excess of needs, whereas in the middle of the season there was not enough water. If we are in conditions of overall water deficiency in this particular system, we must regard water productivity as an important facet of good management performance. We must equally be concerned with the water waste implied by the periods of over-supply. Using this reasoning, and yield versus water deficit coefficient provided by Doorenbos & Kassam, 1979, we find that this particular water supply regime would give a land productivity (yield) of 88.0%; but gives a potential water productivity of 66.8% (i.e. less than land productivity for adequate water supply system as in case of south-east Asian rice systems); but water productivity exceeds land productivity in water deficient systems such as much of Pakistan.

The concept of potential productivity, as a numerical parameter, enables us to link adequacy and timeliness into one number or indicator of performance.

3.8 MANAGEMENT DEFECTS IN A SYSTEM:

Fig. 3.3 illustrates one way in which we can use the concept of potential productivity of water P (%) in diagnosis of the management defects in a system. P_0 represents ideal case i.e. water productivity under optimally controlled conditions, with uniform distribution of water at times closely matched to crop need, and with comprehensive lining for seepage control. P_1 represents maximum attainable performance level, which depends upon available set of canals, regulators etc. As time passes, P_1 regresses to the left due to deterioration of canals and structures. The area P_0 - P_1 is attributable to the set of physical facilities. P_2 represents the potential productivity that could be achieved, if we operate the available facilities in full accordance with operating rules. Because there are many practical constraints; the number of staff, there hours of working, distance between structures etc. These constraints will be reflected in the operating rules that are supposed to guide field staff actions. Hence P_1 – P_2 is attributable to the constraints upon operation rules. P_3 represents the curve that we find from direct measurement of the water distribution as it actually occurs in the system. $P_2 – P_3$ is attributable to the execution of those rules in the field. P_4 represents actual crop production obtained in the field as a proportion of the theoretically available output of the same crop, under same levels of inputs and agricultural practices, but with perfect water supply. $P_3 – P_4$ is attributable to the water application activities of individual farmers.

3.9 ECONOMIC VIABILITY OF INDICATOR:

The system manager is most likely to be concerned with the financial resources available at system level and the source of those funds. He is less concerned with overall profitability of the agriculture and least concerned with overall profitability of the irrigation project that created the system.

3.10 FINANCIAL VIABILITY OF IRRIGATION SYSTEMS:

One set of indicators concerns with efforts to raise revenues from water users that help to support management, operation and maintenance (M, O&M) costs as follows:

(i) $\text{Total financial viability} = \dfrac{\text{Actual MO \& M allocation}}{\text{Total MO \& M requirements}}$

(iii) $$\text{Return on investment} = \frac{\text{Gross value of output}}{\text{Investment for irrigation system}}$$

3.10 SOCIAL VIABILITY

If long-term sustainability of irrigation is an objective and if improving and maintaining social well being is ultimately important, then social viability is relevant from a strategic management perspective.

(i)

$$\text{Administrative performance} = \frac{\begin{array}{c}\text{Equivalent water rights} \\ \text{paid current years}\end{array} + \begin{array}{c}\text{Equivalent water rights} \\ \text{paid previous years}\end{array}}{\text{Total equivalent water rights due to current year}}$$

Equivalent water rights are expressed in m^3/ha. Delayed payment of water charges may cause major annual fluctuation in above indicator of "administrative viability" which is quantified as moving average over 3 – 5 years.

(ii)

$$\text{Irrigation employment generation} = \frac{\text{Annual day / ha labour by scheme}}{\text{Annual number of official working days}}$$

CHAPTER-IV

STUDY OF PROJECT

4.1 IRRIGATION SYSTEM IN STUDY AREA:

The area selected for performance evaluation lies in the command of Right Main distributary system that includes Bhaisani Dy, Barla Dy, Khoja Nagla minor, Bijopura minor and Khampur minor. Right Main Dy takes off from Deoband Branch. Measurement of water supply i.e. discharges were taken at head of Right Main Dy and at head reaches and tail reaches of Bhaisani Dy, Barla Dy, Khoja Nagla Mr., Bijopura Mr. and Khampur Mr. (Annexure-3, Table No-1 to 6)

4.2 TOPOGRAPHY OF THE COMMAND:

Topography of the command is gently sloping. The natural ground slope is defined with a well-developed drainage network draining mostly to river Sila and Kali.

The area is normal rainfall area with average annual rainfall of 1000 mm. (Table no-3, Annexure-2).

The principal crop is sugarcane in the entire command. In the existing command sugarcane is grown under irrigated condition. The farmers are aware of modern and improved method of cultivation. The average yield of sugarcane in irrigated and non-irrigated condition is 70 and 37.5 tonnes/hectare respectively. The average yield of paddy in irrigated and non-irrigated condition is 5 and 3 tonnes/hectare respectively. The average yield of other kharif e.g. Sorghum in irrigated and non-irrigated area is 5 and 2.5 tonnes/hectare respectively. The average yield of wheat in irrigated and non-irrigated area is 4 and 2 tonnes/hectare respectively. The average yield of fodder crop like Berseem in irrigated and non-irrigated condition is 40 and 20 tonnes/hectare respectively.

4.3 CLIMATOLOGY AND HYDROLOGY:

The climate of the command of Upper Ganga Canal system is tropical monsoon climate. It is characterized by general wetness of the air. There are three distinct seasons in the area. Hot summer from March to the middle of June and the wet monsoon from mid of June to the end of October follow the winter season from November to the end of February. The area experiences heavy rainfall from southwest monsoon i.e. from June to September followed by slow rainfall due to Northeast monsoon i.e. from October to mid of December. (Table no-3, Annexure: 2)

The average annual rainfall is 1000 mm falling mostly during Southwest monsoon followed by Northeast monsoon.

Temperature and humidity are high throughout the year. (Table No.-4, Annexure: 2). The mean maximum monthly temperature ranges from 31.18° c to 32.14 ° c and the mean minimum monthly temperature ranges from 7.02 ° c to 12.3 ° c. The mean monthly relative humidity ranges from 40.05% to 73.11%.

The rain gauges were established in nearby the command is at Roorkee and Muzaffarnagar, where daily observations of rainfall and other climatically data are taken. The monthly abstract for eighteen years (i.e. 1986 to 2003) of one raingauge station suited at Roorkee WRDTC (vicinity of the command area) is furnished in table no.-3 to 5, Annexure: 2. Other climatical parameters such as temperature, humidity, wind velocity, sunshine hours, number of rainy days in a month along with monthly mean rainfall for the WRDTC Roorkee station is furnished monthwise in Table No. -4, Annexure: 2.

4.4 WATER QUALITY:

It may be mentioned that cattle in the area have been using water from canal for their use and no harmful effects have been observed so far, also no any side effects have been observed in the crops so far.

4.5 GROUND WATER TABLE:

The depth of ground water from surface of earth in different locations near head reach, middle reach and tail reach of different Dys and Minors through open wells and piezometer have been observed. The results of pre-monsoon depth of GWT and post-monsoon depth of GWT are enclosed in table no.-16 &17, Annexure: 4. The calculations of Relative Ground Water Depth (RGWD) of paddy, sugarcane, wheat, sorghum and berseem crops for different canals at different reaches have been done and enclosed in table no.- 18 to 22, Annexure: 4. Results show that GWT touches the root zone in sugarcane crop during post-monsoon period in tail reaches of Bhaisani Dy and in head reach of Bijopura minor.

4.6 CROPPING PATTERN:

Cropping pattern and irrigation areas under different crops were taken from the records of Irrigation Department, Muzaffarnagar Division, Ganga canal and are enclosed in table no.-1 Sheet no.- 1&2, Annexure: 4.

It is studied that the additional sugarcane cultivation is becoming a habit of the cultivators, which was not in practice before when irrigation was not done properly through UGC system.

The sugarcane cultivation is cultivated in 55.1% of total command area under consideration, although the system was proposed for 30% only for designing the section. Paddy and other kharif i.e. Sorghum, Millet and fodder crops are the main crops for kharif season. Likewise Wheat, Potato and Berseem are the main crops for Rabi season.

4.7 CROP WATER REQUIREMENT:

Monthly crop water requirements have been calculated for individual crop and furnished in table no.-10 (Sheet-1 to5), Annexure: 2 with its abstract showing monthly gross irrigation water requirement from table no-2 to 4, Annexure: 4.

The data of WRDTC Roorkee station (very near to command area under consideration) is furnished as fallow to calculate Reference crop evapotranspiration (ETo) for different months by Modified Penman method.

(i) Location: Roorkee, Haridwar, Uttaranchal

(ii) Latitude of command area: 29.50° N to 29.60° N (Average)

(iii) Elevation of the command area: +245 to 255m above msl i.e. +250 m (Average)

(iv) Average monthly mean maximum temp. = 24.47°C at WRDTC Roorkee station.

(v) Average monthly mean minimum temp. at WRDTC Roorkee = 17.36 °C.

(vi) Average monthly mean temp. at WRDTC Roorkee = 20.92 °C.

(vii) Monthly mean Relative Humidity percent at 8:30 hours at WRDTC Roorkee station = 67.29

(viii) Monthly mean Relative Humidity percent at 17:30 hours at WRDTC Roorkee station = 53.58

(ix) Monthly mean Relative Humidity percent (in average) at WRDTC Roorkee station = 60.43

(x) Monthly mean wind velocity (Average) at WRDTC Roorkee station (in km/day) = 26.44

(xi) Monthly mean sunshine hours at WRDTC Roorkee station = 8.06 hours.

(xii) Annual average rainfall at WRDTC Roorkee station = 1000.3 mm.

(xiii) No. of rainy days in a year = 58

But for calculation of Reference crop evapotranspiration of different months, month wise data should be taken from table no.-4, Annexure: 2.

Mean monthly rainfall is also available in table no.-3, Annexure: 2

As per instruction of Central Water Commission (CWC), 75% chance rainfall has been utilized for calculating effective rainfall in various reaches of canal. For 75% chance rainfall, eighteen years (1985 to 2003) rainfall data have been used. Rainfall of every month separately arranged in descending order, then probability and return period have been calculated as furnished in table no.-5, Annexure: 2. Then return periods versus rainfall have been plotted as done in Sheets for Probable rainfall of various months. Then 75% probability means return period of 1.33 value, respective rainfall value is obtained by plotting. The respective rainfall value for various months is the 75% probable rainfall.

4.7.1 EFFECTIVE RAINFALL:

Effective rainfall supplies a portion of the consumptive use by crops. Effective rainfall means portion of total rainfall that lies in the root zone of the crops and is utilized by crops in form of evapotranspiration. The excess rainfall, which is more than the storing capacity of root zone, is lost either as surface run-off or as deep percolation below the root zone. Thus in this command area having average annual rainfall of 1000 mm (mostly during June –August), the effectiveness of rainfall is relatively high.

4.7.2 SOIL CHARACTERISTICS:

Characteristics of soil influence the rate of infiltration, moisture holding capacity and moisture movement in the soil body; this ultimately affects the extent of effective rainfall. The soil depth, texture, structure and organic matter content of the soil influence the infiltration, permeability and moisture retention capacity of a soil. A higher infiltration rate reduces surface run-off, which increases effective rainfall. This occurs in command area under investigation due to sandy-loam type of soil in majority cases.

4.7.3 INITIAL SOIL MOISTURE CONTENT:

The effective rainfall is affected by the moisture content available in the soil at the time of rainfall. The higher the moisture content, the lower the infiltration rate and higher the surface run-off which decreases the effective rainfall in irrigation command of canal. The lower the moisture content, the higher the infiltration rate and lower the surface run-off which increases effective rainfall in non-irrigated command of canal.

Hence in an average 75% chance rainfall has been utilized for calculating effective rainfall in canal command as per instruction of CWC.

4.7.4 MANAGEMENT PRACTICES:

Soil management practices, which affect the physical characteristics of soil like infiltration, permeability and water retention capacity, influence the extent of effective rainfall. Water conservation practices like bunding, terracing, ridging increases effectiveness of rainfall in command area under consideration.

4.7.5 CONSUMPTIVE USE RATE:

Where consumptive use rate of a crop is high, available moisture in the soil profile gets depleted rapidly, thus providing storage capacity at a relatively rapid rate for subsequent rainfall. When a substantial storm occurs, the amount of water required to bring the moisture in the profile back to the field capacity level would be relatively large and losses due to run-off/deep percolation would be relatively small. Hence, effective rainfall is more.

4.7.6 NET IRRIGATION REQUIREMENT

Net irrigation requirement depends upon capacity of soil profile at root zone depth to store readily available moisture for plant use. When capacity of soil profile at root zone depth is low, only a small percentage of the precipitation may be sufficient to fill the soil profile to field capacity and effective rainfall will be low and hence net irrigation requirement will be high.

4.8 CALCULATION OF REFERENCE CROP EVAPOTRANSPIRATION FOR DIFFERENT MONTHS USING MODIFIED PENMAN METHOD:

The calculation of crop evapotranspiration has been given in Appendix-1. ETo has been calculated by using the software of Penman-Monteith having average value of each climatical parameters. It has been also calculated manually by Modified Penman method. The greater value of both the methods comes out from Modified Penman method and that is adopted for the further calculations and results.

4.9 CANAL OPERATION PLAN:

Within the framework of diversion headwork operating rules, water distribution has been guided by the following principles.

(i) The main canal is operating continuously during land preparation, crop establishment and flowering stage of crop and intermittently during nursery and post-flowering stage.

(ii) Canal runs at FSL during continuous /intermittent supply as far as possible.

(iii) During October~January for vegetables and November~March for Berseem and Potato, partial water supply becomes necessary in all the channels, which is being supplied equitably.

(iv) The off-takes from main canal has been operated on "ON & OFF" mode.

(v) The off-takes of minors have been proportionately distributed without gates. It is operated on "ON & OFF" mode.

(vi) The outlets in distributaries and minors are provided with proportional distributor without gate.

(vii) Farmer's committee has not been formed for any outlets to watch and distribute the water among the farmers equitably.

4.10 RELATIVE WATER SUPPLY (RWS) FOR ADEQUACY:

These principles have been followed for water distribution in all command. Specific delivery schedules, canal discharges etc. required for each command have been prepared according to crop water requirement. In table no.-8 of Annexure: 4, the monthly water requirement (Demand) in volume and discharge along with the days required in each month for the distributaries and minors to remain open are indicated.

In table no.-1 to 6 of Annexure: 3, gauge-discharge table and monthly drawal of water (supply) at head and tail reaches through the Right Main Dy, Bhaisani Dy, Barla Dy, Khoja Nagla minor, Bijopura minor and Khampur minor are given.

In Table no.-2 (Annexure: 4), month-wise gross irrigation water requirement of month May to October of each channel of Right Main Dy system has been calculated. In Table no.-3 (Annexure: 4), month-wise gross irrigation water requirement of month November to April of each channel have been calculated. Table no.-4 gives the summary of gross irrigation water requirement of each channel and grand total for each month of Right Main Dy system.

Table no.-5 (Annexure:4) shows the cropping pattern of tail reaches of each channel. Table no.-6 & 7 of Annexure: 4 calculates the month-wise gross irrigation water requirement of Barla Dy, Khoja Nagla minor, Khampur and Bijopura minors of month May to October and November to April respectively.

In table no.-9 (page-1&2) of Annexure: 4, relative water supplies of all channels from May to October (month-wise) for total reach and tail reach are given

In table no.-10(page-1&2) of Annexure: 4, relative water supplies of all channels from November to April (month-wise) for total reach and tail reach are given.

In table no.-11 of Annexure: 4, abstract (summary) of relative water supply of all channels season wise (May to Oct. & Nov. to April) for total reach and tail reach are given.

4.11 RELATIVE PRODUCTIVITY POTENTIAL FOR ADEQUACY AND TIMELINESS:

In table no.-12(Page-1&2) &13(Page-1&2) of Annexure: 4, water delivery performance in terms of relative productivity potential is mentioned for total reach and tail reach of Right Main Dy, Bhaisani Dy, Barla Dy, Khoja Nagla minor, Bijopura minor and Khampur minor for both the season. Crop production in these tables is collected from data's of agricultural department. Table no.-14 of Annexure: 4 gives abstract of water delivery performance in terms of relative productivity potential season wise (i.e. May~Oct. & Nov.~April) for total reach and tail reach.

4.12 INTER QUARTILE RATIO (IQR) FOR EQUITY:

Table no.-15 of Annexure: 4 represent IQR for the canal system selected. Data of average volume (ha-m) delivered to the most favored upper 25% of CCA and average volume (ha-m) delivered to the least favored lowest 25% of CCA are collected from Muzaffarnagar Division, Ganga Canal, Irrigation Department (U.P.).

4.13 RELATIVE GROUNDWATER DEPTH AND SUSTAINABILITY:

Sustainability relates to over or under supply of irrigation water leading to waterlogging or salinity.

Waterlogging of the land occurs when water table rises and soil in root zone of the plant gets saturated and air circulation is stopped. The yield of the crop is usually affected when depth of water table below the land surface is equal to or less than the value given below for different crops i.e. below effective rooting depth.

Table- 4.1

Sl. No.	Type of Crop	Average effective rooting depth (metre)
1	Paddy (Rice)	0.60
2	Sorghum	0.60
3	Sugarcane	0.90
4	Wheat	0.60
5	Berseem	0.50

Annexure: 4, Table no.- 18, 19, 20, 21, 22 gives Relative Ground Water Depth (RGWD) for paddy, sugarcane, wheat, sorghum and berseem respectively. For sugarcane crop (Table no.-19, Annexure: 4) in the command of Bhaisani Dy, ground water level touches the root zone in the tail reach only during post- monsoon, which is alarming situation in this area. In head reach of Bijopura minor for the same crop, the situation is same and these areas require proper drainage arrangement.

Annexure: 4, Table no.-23 gives sustainability of irrigable area for last six years. Sustainability means long lasting or long-term existing or long term consistency in crop yield. The table shows that average sustainability of whole Right Main Dy system is 76.5%, which is fair. In other words we can say that the area irrigated by canal system is 76.5% and other area is irrigated by their own tubewells or non-irrigated.

4.14 DETAILS OF OUTLETS

Details of outlets, their size, location and chainage with type of fall along with their discharges are given in Table no.-29 from page 1 to 4. From this table the total discharge withdrawal by channel can be calculated when it runs with its full capacity.

4.15 ECONOMIC ANALYSIS

Table no- 24 to 27 (Annexure: 4) shows the economic analysis. Farm budget per hectare i.e. cost of cultivation (2003-2004), cost of main product and byproduct in with project and without project cases have been calculated and then project benefit for both the cases have been calculated and then net benefit has been found. On the basis of net benefit, the economic analysis has been performed and the result in form of economic internal rate of return of 15.1% has been found, which is satisfactory.

CHAPTER-V

IRRIGATION OUTLET

5.1 Function of an Outlet

An outlet is a device provided at the head of watercourse to control flow of water from a canal to the watercourse. It also provides a means for measuring the quantity of water delivered in the watercourse. It plays a vital role in distributing water equitably and efficiently and the proper functioning of the distribution system is dependent on the performance of the outlet structures in accordance with design assumptions.

5.2 Type of Outlets

Outlets may be divided into the following three categories:

5.2.1 Modular Outlet: -

An outlet is termed as modular or rigid when the discharge through the same remains independent of water levels in the parent channel and watercourse within certain limits. Such an outlet would give fixed supply of water irrespective of the discharge in the channel. If the discharge in the channel is higher than designed, the excess water will reach at the tail and may go to waste. On the other hand if the discharge is lower, the outlets in head reaches will continue to take their prescribed share, resulting in shortage of water in the tail reaches. Since in practice it may be difficult to run a channel at all time with a constant discharge, the above limitations restrict the use of rigid modules mainly to the following cases:-

1. Direct outlets on Branches, which are usually operated with fluctuations according to the availability of water.
2. Outlets just upstream of cross-regulator or raised crest falls where heading up may be necessary to feed the offtaking channel.

In view of the above limitations, utility of rigid modules and their complicated designs and construction they have not in common use of distribution system of UGC command.

5.2.2 Non-modular Outlet:-

Discharge through a non-modular outlet depends on the difference of water levels in the parent channel and the watercourse. Thus variation in any of the two would affect the discharge through such an outlet. The most common type of non-modular is a pipe outlet widely used in UGC system. The pipe is generally kept horizontal and at right angles to the direction of flow in the parent channel. The pipe outlets are ungated and run continuously so long as the channel runs. The discharge formula is

$$Q=CA\ (2gh)^{1/2}$$

Where Q is the discharge of the outlet.

C is a constant depending on the length of pipe and coefficient of fluid friction in the pipe.

A is the area of internal section of pipe.

h is the difference in water levels in the parent channel and the watercourse.

The pipe outlet is provided with head and tail walls to safeguard it against tampering by the cultivators and to prevent any leakage of water along the outer periphery of the pipe. The axis of the pipe is kept 9 inches below the FSL in the Dy/Minor. In the case of Branches, the pipe is fixed at a depth depending upon the minimum water level with which a Branch may have to be run in rosters according to availability of water. No outlets are generally allowed in Main canal. Obviously the discharge through such outlets fixed on Branches would be much higher when the Branch is running with full design discharge.

In UGC system the following table of average discharge of pipe outlets on Dys/Minors has been approved as a ready reckoner for the field engineers.

Table- 5.1

Table of Discharges of Pipe Outlets in vogue in UGC system.

Ventage(diameter of circular pipe)		Unit	Average discharge for			
			Free overfall	Outlet with submerged outfall		
Inches	Cm.			0 to 20% lift areas	21 to 50% lift areas	Over 50% lift areas
1	2	3	4	5	6	7
6	15.0	Cusec	0.90	0.66	0.55	0.40
		Cumec	0.025	0.0185	0.0154	0.011
5	2.15	Cusec	0.68	0.50		
		Cumec	0.019	0.014		
4	10.0	Cusec	0.40	0.30	0.25	0.20
		Cumec	0.011	0.008	0.007	0.006
3	7.50	Cusec	0.20	0.15		
		Cumec	0.006	0.004		

The above table applies to pipe length upto 18 feet. When the outlet length exceeds 18 feet, the next higher Ventage is adopted. The table is based on normal conditions of head over the axis of the pipe. The discharge through the pipe outlet varies with $(h)^{1/2}$ and may fluctuate considerably if the supplies in the canal are fluctuating.

The outlet size is selected for any command based on duty factor (outlet factor) for the crop to be irrigated and the intensity of irrigation proposed

Merits and Demerits of Non-modular Outlets: -

(i) These are not easily adjustable, as it would require dismantling and reconstruction of the structure.

(ii) The submerged outlet can be converted into free fall and the discharge can be increased by the cultivators by letting the water drop into a sump from where it is lifted by the cultivators with the help of a pump or Persian wheel.

(iii) The discharge of the pipe outlet increases if a part length of pipe is removed by the cultivators or the pipe is lowered.

(iv) The discharge is also dependent on the condition of clearance of silt and weed growth in the watercourse. Badly maintained watercourse may cause rise in water level and make the outlet more submerged than in normal condition. Thus even with the same water level in the parent channel, the discharge in the watercourse may vary.

(iv) The fluctuations in water level in the parent channel result in inequitable distribution of water in the command of the channel.

(v) The non-modular pipe outlets draw less silt in the head reaches and thus more silt often gets deposited in the head reaches of a channel which impaires its discharging capacity.

Despite all the above aspects a pipe outlet is the most simple and popular outlet.

5.2.3 <u>Semi-modular Outlets:-</u>

Semi-modular outlets also known as flexible outlets are those through which discharge is dependent on the water level in the parent channel but is independent of water level in the watercourse so long as the minimum working head required for its working is available. The important types of semi-modular outlets are described below:

1.<u>Pipe outlets discharging freely in the air:</u>

The discharge is proportional to $(h)^{1/2}$ where h is the head of water or the difference between water level in the parent channel and the axis of the pipe outlet. This condition is created artificially in some cases by dropping the water into a sump and then lifting it again.

Since the conditions of free fall into the air are limited, the pipe outlets donot operate as semi-modules. Moreover the discharge passing through the outlet is proportional to the discharge carried by the parent channel only within a limited range of setting of the outlet (h/d), which is about 0.2 in the case of lined channel and about 0.3 in the case of unlined channels. For other settings the discharge passing out will not be truly proportional. The distribution of silt is also not proportional in the case of pipe outlets. In view of these limitations it has been proposed to provide orifice type semi-modular outlets or open flume outlets in the Upper Ganga Irrigation Modernization Project.

2.Orifice Semi-modules:

It consists of an orifice provided with a gradually expanding flume. The flow through the orifice being hyper-critical results in the formation of jump and thus making the discharge independent of the water level conditions in the watercourse. The most common type of orifice semi-modular outlet is the Adjustable Orifice Semi-module (AOSM), which is widely used in India and Pakistan. It is an improvement over Crump's Adjustable Proportional Module (APM), which was although truly proportional for discharge but did not draw proportional silt and therefore the parent channel suffered from silting.

The AOSM is very suitable for drawing proportional discharge in channels of UGIMP where two FSLs will be run, both in the parent channel and the watercourse, the Kharif FSL being higher than Rabi FSL. No adjustment will be required in the setting of the outlet within the range of Kharif and Rabi FSLs. The limitation is that from practical considerations the throat width of the orifice,Bt should not be kept less than 6 cm even if it so works out from the discharge formula and the height of the orifice,Y should be calculated corresponding to the Bt provided. For small discharges of less than 0.65 cusec or so Bt would work out to less than 6 cm. To keep Bt to the minimum of 6 cm,Y would work out less resulting in higher setting of the AOSM. Likewise Y should also not be less than 6 cm from practical considerations and if Y works out to be less than 6 cm from calculation, the AOSM would not be fully meeting the requirement of proportionality for Kharif and Rabi discharge. The AOSM is usually found to have a higher setting to meet the requirement of proportionality and hence does not draw its fair share of silt. However the advantage of proportionality should override the marginal drawback in drawing fair share of silt.

Discharge Formula:

Crump's formula for Adjustable Proportional Module (APM) also applies to it, which is as below:

$$q = CBtY(2gHs)^{1/2}$$

In simplified form the formula in metric units is

$q = 0.0403\ BtY(Hs)^{1/2}$

Where q is in litres per second.

And Bt, Y and Hs are in centimeters.

If Bt, Y and Hs are in meters,

C = 4.03 and we get q in cumecs.

When the orifice height and Bt are known for an outlet, the discharge is easily computable from a single gauge reading G showing the height of water level in the parent channel above the crest as shown in the figure and using the formula

$$q = 0.0403BtY(G\text{-}Y)^{1/2}$$

as Hs = G-Y

Since Bt and Y for a particular outlet are known, q can be computed for different values of G depending upon the likely water levels in the parent channel.

It is recommended to engrave and paint the gauge on the slanting surface of the u/s wing wall of the outlet in its straight portion, whose zero reading should correspond to the crest level of the outlet. On one side of the gauge, values of G should be engraved and painted at different levels while on the other side corresponding values of discharge should be painted in accordance with the computations made for each value of G in the office from the known values of C, Bt and Y of the particular outlet. The discharge through the outlet can thus be read at site directly on the gauge in this type of outlet.

Hydraulic Properties:

As in the case of Crump's APM, this type of outlet is also instantaneously proportional when the bottom of the roof block (Hs) is at 0.3 of the full supply depth (D) of earthen parent channel. For lined parent channels in which channel index is about 8/3 proportionality is obtained when Hs/D = 1/2/8/3 = 0.2 approximately, i.e., when bottom of roof block (Hs) is at 0.2 of the full supply depth (D). Since Y is generally kept equal to Hs, the setting for proportionality (G/D) is 0.6 in an unlined channel and 0.4 in a lined channel. At this setting, the outlet does not draw its fair share of silt from the parent channel. To overcome this deficiency, it has been recommended by some authorities to fit a 90^o bend pipe of suitable length at the mouth of the AOSM. The cross sectional area of the bend pipe is kept the same as that of the orifice and the mouth of the bend is kept at about 0.8D.

Flexibility (F) of any outlet is m/n*D/h

Where, m is outlet index.

n is channel index.

D is water depth in parent channel.

h is head working on the outlet.

For AOSMs fitted in earthen channels

m =1/2

n =5/3

Flexibility = 1/2D/5/3h = 3/10 D/h = 0.3 D/h = 0.3 D/Hs

When there is fall in the water level of parent channel, the proportional decrease in Hs is more than the proportional decrease in D. Therefore, flexibility of outlet increases and the outlet moves towards proportionality. Similarly when there is rise in the water level in the parent channel, the flexibility is reduced and the outlet moves towards rigidity.

Merits and Demerits of AOSM:

I Susceptibility to tampering:

The structure of the outlet is very strong and has a long serviceable life. But cases of tampering with it are not infrequent. The roof block is sometimes raised bodily and refixed but such type of tampering is easily detected. A wooden plank is sometimes inserted at the downstream side of the roof block and covered with earth and grass, thus forming an airtight room in continuation of the roof block. This increases the discharge due to imperfect aeration of the jet.

II Suitability and range of operation:

The outlet can work semi-modularly for all heads and with all working heads above the minimum modular head and for all discharges from 1 cusec to 5 cusec (28 l/sec to 150 l/sec), which is the discharge range generally required. These are eminently suited for head and middle reaches of distributors and minors where sufficient working heads above minimum modular heads are available. In tail reaches where sufficient working heads are not available, these cannot be used.

III Adjustability

The outlet is easily adjustable at a small cost either by raising or lowering the roof block or by dismantling one sidewall.

IV Control gates:

The structure operates without any control gate and hence is easy to install and keep in practical functioning.

V. Discharge observation:

The discharge of the outlet can be computed from a single gauge reading, which can be checked whenever any officer carries out inspection of the outlet.

VI. Silt drawing capacity:

The outlet does not draw its fair share of silt when it is set to draw proportional discharge. With its setting at 0.6 it can draw 99.5% of its fair share. But with higher settings to attain proportionality the percentage drawl of silt reduces. With 0.8 setting it is capable of drawing 109.7% of its share of silt. Hence compared to other types of outlet AOSM can be considered more suitable from this aspect also

3. Open Flume Outlet:

Open Flume Outlet (OFM) is also a semi-module. It is a weir with a throat constricted sufficiently to ensure hyper-critical velocity. The length of the throat is such that the controlling section remains within it for all ranges of discharges within which the outlet has to operate. A gradual expansion is provided below the throat to obtain maximum recovery of head. The sidewalls of the structure are built in brick masonary and top is of RCC precast slab. To prevent tampering an iron base plate is fitted in the center of the controlling section in the gullet with two side plates which can be adjusted for distance by sliding base bolts. The discharge formula adopted is:

$$Q = C\,Bt\,G^{3/2}$$

Where Q is litres/sec and G is height of FSL in canal above the crest of outlet.

For different throat widths Bt, the value of C is:

Bt	C
6-9 cm	0.0160
9-12 cm	0.0163
Over 12 cm	0.0166

In the case of Open Flume Outlet also the setting is high for small outlet discharges to meet the requirement of proportionality and fair share of silt is drawn only when the crest of the outlet is at bed level or close to it. Hence the OFM is more suitable for tail reaches of Dys or on minors. The proportional distribution for Rabi and Kharif FSLs for small discharges is also better in the tail reaches than in upper reaches of a Dys.

4. Tail Cluster:

The work constructed at the tail end of a channel for the distribution of supplies there is called tail cluster. As the name implies generally two or more outlets are clustered at the tail with aggregate discharge over 0.07 cumec and the side offtakes having equal angles with respect to the centerline of the distributary. The offtaking angles are either 45°, 60°, 90° or straight in line with the channel alignment.

Tail cluster is thus a combination of two, three or four open flume outlets, so that the fluctuations in the distributary may effect them equally, the crest level of all the outlets is kept at the same level and proportionality is secured by adjusting throat width (Bt). Depth of water on the crest is kept 0.3m and value of C is 1.66 in the open flume discharge formula $Q = C\ Bt\ H^{3/2}$. The discharge formula of tail cluster thus simplifies to $Q = 1.66\ Bt\ H^{3/2}$. The angle of offtake and lower approach velocity effect in the side offtakes being not appreciable are ignored.

The tail clusters are useful in distributing the supply proportionately and in easily absorbing any excess that reaches the tail. The gullet width is widened by 20 cm at full supply level to facilitate passing down any excess supply reaching the tail without endangering safety of the structure and the canal reach upstream.

The low working head, 6 cm, required for the modular functioning of the tail outlets avoids undue raising of the full supply level in the distributary resulting in economy in the construction of the canal system.

CHAPTER-VI

DISCUSSION ON STUDY

Benefits from irrigation projects, however well planned and constructed, cannot be maximized unless the various systems involved are well managed and organized. Hence after the project is put into operation its performance must be evaluated from time to time. The deficiencies in the project performance must be found out and efforts made to improve its performance.

To study the performance of irrigation system there is a need for an agreed set of parameters, which will represent irrigation performance. It will help us to measure the effect of changes of management techniques. We can maintain a clear sense of priorities and goals for appraisal of irrigation system.

Agricultural growth with social justice depends mostly on the development of water-resources and its proper distribution, as water is one of the prime inputs for adopting the modern technology of agriculture. The National Commission on Agriculture has estimated that when all the water-resources have been developed only about 110 million hectares of cropped area out of a gross sown area of about 210 million hectares (in future) can be irrigated provided the most efficient use of irrigation is made through water distribution, minimizing losses in conveyance, preparation of fields and adoption of suitable cropping pattern taking into account soil and agro-climatic factors.

Satisfactory distribution and efficiency of irrigation water use depends on:

(a) Efficiency of the conveyance system (0.8~0.9 in our case) from head of the canal upto each outlet of about 40 ha block.

(b) Operation and regulation efficiency of the canal system.

(c) Efficiency of the conveyance system and equitable distribution of water within the 40 ha block.

(d) Field application (evaporation) efficiency (0.6~0.9 in our case.

Improvement in the efficiency of the conveyance system upto the outlets of 40 ha block is receiving adequate attention.

6.1 ROTATIONAL SYSTEM OF CANAL IRRIGATION

The responsibility for development of water resources for irrigation upto the irrigation outlet (commanding an area of about 10 to 40 ha) rests with the state irrigation department. The distribution of water beyond such outlets has been left to the farmers although it is expected that the state departments of agriculture/irrigation would provide farmers technical guidance. The Rosters are prepared with the consultation of Agricultural authority and Administrative authority and circulated to all the concerned authorities including Political bodies i.e. M.P.s, M.L.A.s and according to this periods are fixed to run the channel except some unavoidable circumstances. Farmers are well known about the rosters and prepare their field and crops accordingly. Farmers are free to use any crop. The Warabandi system in this area has been followed and the water distribution within the outlet command (field channels) upto each holding is fixed. Although there is no organized institutional arrangement for allocation and distribution of water among the numerous farmers within each outlet command in this area under case study, but the farmers are very sincere to take their due share in time. Farmers sincerely wait their turn and take the water to their field when their turn comes. By doing so, farmers themselves act as a policeman and interference from any side to follow the warabandi schedule is not required and the principle underlying the warabandi system of managing irrigation water is that the available water, whatever be its quantum, is allocated to cultivators in equal proportion to their holdings and not only to some of them to meet their total demand, is fulfilled. This also provides lesser losses from channel.

6.2 RECENT FIELD MANAGEMENT PRACTICES:

The system has different distribution practices during Rabi and Kharif seasons. During Kharif, the distribution of water is based on mean of the average area irrigated of last 10 years and the proposed irrigation during coming year. During Rabi period, the distribution is based on the available supplies in river Ganga and Yamuna at heads of UGC/LGC and Agra canal and they are shared in the ratio of Rabi and sugarcane areas as proposed for 3 canal systems. Availability of water is worked out by considering the available supplies over long past years and sharing of water is done as per standing order issued by Engineer-in-Chief IDUP in both the seasons and interdivisional distribution is done as per order of SE 1st I. W. Meerut on the principle said above.

Since the water availability is less than requirement, a rotational running of various Dys has to be planned. There are weekly osrabandis on outlets and hence the channels are run for one week or multiples at a time. The system is planned to run on rotational basis to match the availability of water with the requirement of crop in a most equitable manner. But whenever Dys run, they run with their full discharge and they feed all the minors and watercourses with their full capacities so that the water reaches upto the tails of channels.

6.3 EQUITY:

IQR has been taken as a measure of equity. From table no.-15, Annexure: 4 average value of equity is 0.465 for the system under case study, i.e. performance is just fair. From this table, the IQR value at the lowest discharge of 0.09 cumecs, is 1.28 and it increases upto 2.88 at the highest discharge of 1.22 cumecs with an average value of 2.15. In other words, the farms located in the highest discharge canal are receiving more than twice the water supply to the lowest discharge canal.

6.4 RELATIVE WATER SUPPLY (RWS):

RWS (Table no.-9, 10 &11; Annexure: 4) for adequacy varies across the distributaries/minors, season wise and reach wise. Khoja Nagla minor has relatively higher adequacy of about 40% as compared to Khampur minor with lowest adequacy of about 18%.

RWS values during Kharif season (i.e. May to October) when crop water requirement is high due to excessive sugarcane cultivation, were lower by 0%~27% as compared to Rabi season (i.e. Nov. to April). In some channels, RWS values during Kharif season were higher by 1%~4% as compared to Rabi season. There is marked variation in RWS along the canal with the average value of total reach exceeding those at the tail by 22% (Barla Dy, i.e.31% in total reach during Rabi season and 9% in tail reach during the same season, Nov. to April, table no.-11 of Annexure: 4).

The average value of RWS in Khoja Nagla minor is 40%, whereas the average value of RWS in Barla Dy is only 19%(Table No.-11, Annexure: 4). Such large difference of 21% obviously calls for immediate correction in water distribution schedule.

6.5 PRODUCTIVITY OF WATER DELIVERY:

The computed values of productivity are given in table no.-12, 13 &14 of Annexure: 4. The productivity of water delivery is normally higher in average total reach in compare of tail reaches of every channel (except Barla Dy, where situation is reverse). The average value during Kharif season (May to October) is being 9.89 in total reach as against of 8.06 during Rabi season (Nov. to April). (Table no.-14, Annexure: 4).

The relative productivity potential is higher during kharif (May to October) as compared to Rabi season (Nov. to April). (See table no.-14, Annexure: 4). This may be due to occurrence of rain during supply periods in Kharif season. In such cases, supply is rendered surplus. Higher sensitivity of crops grown during Kharif (May to October) to moisture stress could also be the reason for low water productivity.

Sustainability (Table no.-23, Annexure: 4) comes under good performance class.

Irrigation employment generation is 70 no. (manpower) per hectare per season which is slightly lesser because of frequent uses of machinery equipment and per capita income is Rs.3234.00, which is very good.

Table no.-28, Annexure: 4 gives abstract of performance standards.

Table no.-24, Annexure: 4 gives farm budget per hectare (2003-2004), which includes cost of cultivation per hectare of various crops (without project and with project case). Table no.-25, Annexure: 4 gives farm budget per hectare (2003-2004), which includes gross income per hectare (Rs./ha) of various crops (without project and with project case). Table no.-26, Annexure: 4 give net benefit per hectare of various crops and ultimately show total net benefit of the project. Table no.-27, Annexure: 4 show the economic analysis of the project which gives the project benefit/cost ratio of 1.39 (Fair) and economic internal rate of return of 15.1% (Good). It shows the project is financially feasible, economically sound and socially viable.

Table no.-30 (Annexure: 4) shows the average area irrigated through outlets (one each of head, middle and tail reach) of Khoja Nagla and Bijopura minors. Table no.-31 calculates month-wise gross irrigation water requirement of above outlets. Table no.-32 (Annexure: 4) gives average discharge of well of different size working in the field. Table no.-33 shows water supply through outlets of head, middle and tail reaches. Table no.-34 calculates water supply by tubewells existing in the field in the command of outlets mentioned above and Table no.-35 gives the percentage contribution of ground water in the outlet command of head, middle and tail reaches of Khoja Nagla and Bijopura minors. The contribution of ground water is increasing from head reach to tail reach of channel in case of Khoja Nagla minor but the percentage of ground water is more enough and nearly equal in each reaches of Bijopura minor. This field study concludes that the availability of canal water is going on decreasing from head reach to tail reach in case of Khoja Nagla minor but in case of Bijopura minor which is at the tail portion of Bhaisani Dy, the input discharge at head is itself low, that is why, there is no sufficient canal water supply in any reach of channel. This is very critical situation of the system under case study. Farmers neither get surface water nor they get sufficient power supply to operate their tubewells. They are totally dependent upon the diesel operated pumpsets or Tractor which is being used to withdraw ground water at different location of the channel command. Table no.-36 & 37 gives the overall picture of operation and maintenance budget allocated and actual expenditure occurred, area irrigated (season-wise), revenue imposed on farmers, O & M expenditure per unit CCA and per unit irrigated area, revenue per unit of O & M expenditure and also revenue per unit CCA and per unit irrigated area of Ganga Canal Division, Muzaffarnagar.

6.6 FIELD RESEARCH

Field research has been done on selected outlets (one each of head reach, middle reach and tail reach) of Khoja Nagla and Bijopura minors. Firstly, area irrigated by above outlets through canal supply has been taken from office and the average of six years has been found in Table no.-30 (Annexure: 4). Table no.- 31 (page 1 & 2) gives the month-wise gross irrigation water requirement of the command area of above outlets in the minor. Table no.-32 calculates the average discharge of well of different sizes (i.e. 4", 5" & 6" dia.). Table no.-33 shows the canal water supply in the total reach and tail reaches of Khoja Nagla and Bijopura minors and water withdrawal by indicated outlets. Table no.-34 gives the average water supply by tubewells existing in the field. This table gives the total number of wells, total discharge, operation hour per day, operation day per year, volume of water delivered, average expense per hour and total expense per year in each outlet command under field study. These data have been collected from field study. Table no.-35 (Annexure: 4) gives the percentage ground water contribution in the command of each outlet under study. The study shows that the contribution of ground water is increasing from head reach to tail reach in case of Khoja Nagla minor but its percentage is more enough and nearly equal in case of Bijopura minor. The reason behind it that Bijopura minor starts from nearby tail of Bhaisani Dy and the discharge at the tail of Dy is less, so the discharge in Bijopura minor is not sufficient in any reach of the channel.

CHAPTER - VII

CONCLUSIONS AND SUGGESTIONS

7.1 CONCLUSIONS

The art and science of evaluating the performance of irrigation system is still in evolving stage. There is lack of field studies to correctly evaluate the usefulness of performance indicator. Further no uniform standards are available to judge the system performance as good or bad. Evaluation of water delivery performance using the currently available measures indicated the following:

(a) The Upper Ganga Canal (UGC) system is quite interesting and well established in its distribution practices. The distribution of water is judicious in 3 systems (UGC, LGC and Agra canal) with large command in Ganga basin involving different sub-basins. It is in practice from a long time back and works efficiently as per demand of time and even during green revolution, with very keen demands.

(b) The system has different distribution practices during Rabi and Kharif seasons. During Kharif, the distribution of water is based on mean of the average area irrigated of last 10 years and the proposed irrigation during coming year. During Rabi period, the distribution is based on the available supplies in river Ganga and Yamuna at heads of UGC/LGC and Agra canal and they are shared in the ratio of Rabi and sugarcane areas as proposed for 3 canal systems.

(c) This system is ideal for conjunctive use of water. What ever amount of water is available, that is distributed with the average crop areas, in a most equitable manner and the deficit is pumped from ground water by farmers themselves to meet the total crop requirement. By doing so, the ground water table is maintained in dynamic condition and no adverse effects like water logging and salinity have been observed in most of the areas. Conjunctive use practices are very well established by farmer's initiatives and availability of favorable aquifers.

(d) Since the water availability is less than requirement, a rotational running of various Dys has to be planned. There are weekly osrabandis on outlets and hence the channels are run for one week or multiples at a time. The system is planned to run on rotational basis to match the availability of water with the requirement of crop in a most equitable manner. But whenever Dys run, they run with their full discharge and they feed all the minors and watercourses with their full capacities so that the water reaches upto the tails of channels. Normally, the scarcity conditions prevail in surface water distribution and it induces the efficient use of water by farmers. Rotational running of channels has great inputs of long experience of availability and requirement of water and appropriate period to run the channel. Osrabandi makes the farmers sincere to use his turn and farmers act as a policeman and watch their turn to use water.

(e) The study had been done to construct APM to feed the watercourses in command of Pilot projects of Dys, but it has not been implemented because of the following reasons:

(1) Since there is no storage reservoir for UGC system, the constant supply can not be assured all the time when it is required and the APM can only be successful through regular and allotted supply.

(2) Due to fragmentation, the holdings are small and the APMs are not suitable for small holdings during the fluctuation in supply.

After analyzing all the conditions of flow, the best alternative is non-modular pipe outlet, where the discharge through the outlet is more proportionate as per flow condition in the parent channel. If tampering of outlets and unauthorized cuts are controlled, the pipe outlets are the best for proportionate distribution of discharges and also for drawing fair share of silt, as on smaller channels the outlets as fixed are quite close to bed level. Submerged pipe outlets are quite interesting in distribution of water beyond their simplicity. As these are operating on low head and auto functioning, no interference and discretion could be possible by field staff as he does not hold any facility to change the opening or discharge through such outlet. For systems with large number of outlets, the pipe outlets are still more practical, useful and acceptable by the farmers provided the outlets are firmly fixed and are not tampered with. The discretion of field staff is also not allowed in such outlets as they behave as auto system. All the outlets on Right Main Dy under study are pipe outlets.

There has been a very interesting feature and device to monitor the equitable distribution of water on distribution channels in UGC systems and also on Right Main Dy. The channel is provided with tail cluster to distribute the available discharge at the tail in proportion to command at a fixed gauge (one foot) embedded there in.

Simple gauge reading at the tail cluster used to confirm the delivery at all the outlets. This practice may be added on the channels in any surface irrigation system.

(f) Relative water supply as shown in the graphs, it has a general trend of a higher RWS in the average total reach and a lower RWS in the tail reaches except in Bijopura minor where RWS in tail reach has got higher value than in average of total reach in Kharif season. It shows that head reach farmers draw more water than tail reach farmers. In Rabi season, the RWS in tail reaches is more than the average total reach except Barla Dy where RWS is more in total reach than tail reach. It shows that in Rabi season, more or less the adequacy is maintained and the reason behind it that the demand of water in Rabi season is less than the demand of water in Kharif season and other reason may be the frequent use of ground water. In different channels as well as in total Right Main Dy system, the RWS has got higher value in Rabi season than Kharif season. It shows the system is more adequate in water supply in Rabi season compared with the Kharif season. This shows good performance of the channel as available supplies in Rabi are usually far less than demand.

(g) Water delivery performance in terms of Relative Productivity Potential (Measure of Timeliness) tables and graphs show that per unit water delivered the production of sugarcane is more in compare of other crops. The study area lies in the upper reach of UGC system and water supply is comparatively more in this region. Due to sufficient water supply and timeliness in water supply farmers used to grow some cash crops and sugarcane is one of the cash crop which can be taken easily where water is easily available (either it is surface water or ground water). Due to high relative productivity, sugarcane crop is taken in a major percentage of culturable area, which is followed by other crops like Paddy and Wheat, which has low productivity in compare of sugarcane.

(h) Equity (inverse of Inter-Quartile Ratio) in water distribution of whole system is nearly 0.5. It means upper reach farmers draw comparatively more water than tail reach farmers. If APMs are there, the equity in water distribution would be more. In pipe outlets, farmers use to draw more water by creating some obstruction in channel or by lowering the bed of watercourse near the outlet to create more head difference. Due to less supply in tail reach, farmers use ground water to meet the total crop water requirement. By doing so, the ground water table is maintained and no other effects like water logging and salinity have been observed. The ground water is in dynamic condition and maintained very well because of favorable aquifer. The conjunctive use practices is very well established and maintained by the farmers initiatives.

(i) Field research about ground water level, contribution of ground water in total crop water requirement, their percentage contribution, average withdrawal of different size of wells existing in the field and their operational expenses have been carried out successfully. The study has been carried out in head, middle and tail reaches of Khoja Nagla and Bijopura minors by selecting single outlet each in the reach. The study shows that the percentage contribution of ground water is increasing from head reach to tail reach in case of Khoja Nagla but its percentage is more enough or nearly equal in Bijopura minor. It means the full discharge do not reach in Bijopura minor because of its location in the tail reach of Bhaisani Dy. The condition is critical and it needs some improvement in surface water supply so that the use of surface water and ground water can balance each other.

7.2 SUGGESTIONS FOR FUTURE STUDY AND RESEARCH:

7.2.1 Proper Land Development

There are generally small holdings, which should be consolidated. The land is usually partitioned along with every division of family. It results in a decrease in the size of the holding after every partition. Partitioning of land can be prevented by proper legislation.

Proper grading of land is necessary for border strip method / check method / furrow method. Ploughing of the land should be done at the proper time and to the required depth. Organic and inorganic manures should be applied wherever required.

7.2.2 O&M of Water Courses and Field Channels

The responsibility of state irrigation department ends after bringing enough water upto canal outlets. But due to being non-educated, cultivators could not operate and maintain the field channels and regulate the structures on the watercourses properly. Hence watercourses and field channels can be operated and maintained by the department at the cultivator's cost, but handed over to cultivators for proper care.

7.2.3 Selection of Efficient Method of Application of Water

Flooding method is most common, but it is inefficient and leads to wastage of water through deep percolation and evaporation. Hence border strip method / furrow method / sprinkler method / drip irrigation method depending on soil type, ground slope, crop type, climate should be encouraged.

7.2.4 Motivation of Farmers in Water Management

Farmers should encourage and motivated for the proper maintenance and operation of watercourses and field channels so that the field efficiency can be increased.

7.2.5 Lining of Field Channels and Water Courses

About 20 to 25% of water is lost in the watercourse and field channels beyond the outlet, which can be reduced either by lining of channels or by closed conduits. Unlined watercourses are shallow and are susceptible to weed growth, which reduces conveying capacity.

7.2.6 Improving Agronomic Practices

A basic knowledge of agronomic science is needed for effective use of water. The lack of knowledge leads to wastage of water. Untimely application of water and in doses higher than the actual requirement of the plant result in the wastage of water. Moreover, it is injurious to land and plant and results in low crop yield.

Different soils have different water holding capacity. The field irrigation requirement should be worked out with due regard to effective rainfall during crop period and field losses. Knowing field irrigation requirements, the frequency of application of water and depth of water in each application can be determined. For proper utilization of water, an irrigation schedule should be prepared. Losses can be reduced by proper selection of irrigation method, size of stream, duration of irrigation run.

7.2.7 Making Conjunctive Use of Water

It makes utilization of both the surface water and ground water. In the surface irrigation, there is recharge of ground water and water table rises, which may create waterlogging. In well irrigation, water table goes down because of withdrawal of ground water. By making the conjunctive use of water, ill effects of both are eliminated. This is achieved by adopting the well irrigation in a part of command area of the canal. On an average, if about one-third of the command area is irrigated by well irrigation and two-third by canals, the maximum utilization of the available potential is generally achieved. Non-availability of adequate power for tubewells is the major constraints before farmers.

7.2.8 Training

Organizing and training the farmers for distributing water among them and also better use of water within the outlet command may lead to more economical use of water.

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ANNEXURE-1
CALCULATION OF REFERENCE CROP EVAPOTRANSPIRATION (ETo) BY MODIFIED PENMAN METHOD

Station : WRDTC Demonstration Farm **Elevation : 252 m. above m.s.l.**

***Latitude* : 29.5°N** ***Longitude* : 77.5°E**

Month : January

Monthly Mean Min^{m} Temp. : 7.02^{0}C   Monthly Mean Max.^{m} Temp. : 11.96^{0}C   Monthly Average Temp. :**9.49^{0}C**

Monthly Average Relative Humidity (RH) =**69.5%,** Monthly Average Wind Velocity(w) =**13.5 km./day**

Monthly Daily Sunshine Hours(n) = **4.7 hours/day**

Reference Evapotranspiration (ETo) is given by the formula:

ETo = C [WRn + (1 - W).f(u).(e_a - e_d)]

Here, e_a = Mean Saturation Vapour Pressure = (11.5+12.3)/2 = **11.9 mbar.** (From Table No.- 18)

RH = e_d/e_a, e_d = RH x e_a = 0.695 x 11.9 = **8.27 mbar.**

e_a - e_d = Vapour Pressure Deficit = 11.9 - 8.27 = **3.63 mbar.**

f(u) = Value of wind function = 0.27(1+ u_s/100)

For wind velocity (w) = 13.5 km./day and altitude = 250m. (From Table No.- 19)

At 10 km./day, f(u) = (0.84+1.11)/2 = 0.975 and at 20km./day, f(u) = (0.86+1.13)/2 = 0.995

so, at 13.5 km./day, **f(u)** = 0.975 + {(0.995-0.975)/10}x3.5 = **0.982 km./day**

(1-W) = *Value of weighting factor for the effect of wind and humidity on* ETo at different temp. and altitude

= 0.48 - (0.03/2)x1.5 = 0.46 at 0 m. altitude and 9.5°c temp. (From Table No.- 20)

= 0.46 - (0.03/2)x1.5 = 0.44 at 500 m. altitude and 9.5°c temp.

so, at 250 m. altitude, **(1-W)** = (0.46+0.44)/2 = **0.45** **W** = 1 - 0.45 = **0.55**

Rn = Rns - Rnl where, Rn = Total net radiation in mm./day

Rns = The net incoming shortwave radiation in mm./day

Rnl = The net long wave radiation in mm./day

Rns = 0.75Ra(0.25+0.50n/N)

where, Ra = Extra terrestrial radiation in mm/day

= 8.8 + {(9.3-8.8)/2}x0.5 = **8.93 mm/day** (From Table No.- 17)

N = Maximum possible sunshine hour = 10.45 hours (From Table No.- 16)

n = Actual sunshine hour = 4.7 hours

n/N = 4.7/10.45 = **0.45**

Rns = 0.75x8.93(0.25+0.50x0.45) = **3.18 mm/day**

Rnl = f(n/N).f(T).f(e_d)

f(n/N) = function of the ratio of the sunshine durations = f(0.45) = **0.51** (From Table No.- 25)

f(T) = function of temperature = f(9.49) = **12.6** (From Table No.- 23)

f(e_d) = function of actual vapour pressure = f(8.27) = **0.22** (From Table No.- 24)

Rnl = 0.51x12.6x0.22 = **1.41 mm/day**

Rn = Rns - Rnl = 3.18 - 1.41 = 1.77 mm/ day

Wind velocity(w) = 13.5 km/day = (13.5x1000)/(24x60x60) = **0.16 m/sec.**

Using Table No. - 26

Taking ratio of u_{day}/u_{night} = 1.0,

Here, RH = 69.5%, **Rs** = Rns/0.75 = 3.18/0.75 = **4.24 mm/day**

C = 0.96 + (0.02/3)x1.24 = 0.968 at 60% RH

= 1.02 + (0.04/3)x1.24 = 1.036 at 90% RH

C = 0.968 + {(1.036-0.968)/30}x10 = **0.991** at 70% Humidity

ETo = C [WRn + (1 - W).f(u).(e_a - e_d)]

= 0.991[0.55x1.77 + 0.45x0.982x3.63] = 2.55 mm/day

ETo(January) = 2.55 mm/day

Month : February

Monthly Mean Min^m Temp. : 9.08^{0}C

Monthly Mean Max.^{m} Temp. : 15.86^{0}C

Monthly Average Temp. : **12.47^{0}C**

Monthly Average Relative Humidity (RH) =58.19%, Monthly Average Wind Velocity(w) =**25.32 km./day**

Monthly Daily Sunshine Hours(n) = **7.05 hours/day**

Reference Evapotranspiration (ETo) is given by the formula:

ETo = C [WRn + (1 - W).f(u).(e_a - e_d)]

Here, e_a = Mean Saturation Vapour Pressure = (14 + 15)/2 = **14.5 mbar.** (From Table No.- 18)

RH = e_d/e_a, e_d = RHxe_a = 0.58x14.5 = **8.41 mbar**

e_a - e_d = Vapour Pressure Deficit = 14.5 - 8.41 = **6.09 mbar.**

f(u) = Value of wind function = 0.27(1+ u_2/100)

For wind velocity (w) = 25.32 km./day and altitude = 250m.

At 200 m.altitude, f(u) = 0.86 + {(0.89-0.86)/10}x5.32 = 0.876 (From Table No.- 19)

At 300 m.altitude, f(u) = 1.13 + {(1.16-1.13)/10}x5.32 = 1.146

so, at 250 m. altitude, **f(u)** = (0.876+1.146)/2 = **1.011 km./day**

(1-W) = Value of weighting factor for the effect of wind and humidity on ETo at different temp. and altitude

= 0.42 - (0.03/2)x0.5 = 0.4125 at 0 m. altitude and 12.5^{o}c temp. (From Table No.- 20)

= 0.40 - (0.02/2)x0.5 = 0.395 at 500 m. altitude and 12.5^{o}c temp.

so, at 250 m. altitude, **(1-W)** = (0.4125+0.395)/2 = **0.404**

W = 1 - 0.404 = **0.596**

Rn = Rns - Rnl

where, Rn = Total net radiation in mm./day

Rns = The net incoming shortwave radiation in mm./day

Rnl = The net long wave radiation in mm./day

Rns = 0.75Ra(0.25+0.50n/N)

where, Ra = Extra terrestrial radiation in mm/day

= 10.7 + {(11.1-10.7)/2}x0.5 = **10.8 mm/day** (From Table No.- 17)

N = Maximum possible sunshine hour

= 11.1 hours (From Table No.- 16)

n = Actual sunshine hour = 7.05 hours

n/N = 7.05/11.1 = **0.64**

Rns = 0.75x10.8(0.25+0.50x0.64) = **4.60 mm/day**

Rnl = f(n/N).f(T).f(e_d)

f(n/N) = function of the ratio of the sunshine durations = f(0.64) = **0.68** (From Table No.- 25)

f(T) = function of temperature = f(12.5) = 13.1 + (0.4/2)x0.5 = **13.2** (From Table No.- 23)

f(e_d) = function of actual vapour pressure = f(8.41) = **0.216** (From Table No.- 24)

Rnl = 0.68x13.2x0.216 = **1.94 mm/day**

Rn = Rns - Rnl = 4.60 - 1.94 = 2.66 mm/ day

Wind velocity(w) = 25.32 km/day = (25.32x1000)/(24x60x60) = **0.29 m/sec.**

Using Table No. - 26

Taking ratio of u_{day}/u_{night} = 1.0,

Here, RH = 58.19~60%, **Rs** = Rns/0.75 = 4.60/0.75 = **6.13 mm/day**

C = 0.98 at 60% RH

so, **C** = 0.98 at 60% Humidity

ETo = C [WRn + (1 - W).f(u).(e_a - e_d)]

= 0.98[0.596x2.66 + 0.404x1.011x6.09] = 3.99 mm/day

ETo(February) = 3.99 mm/day

Month : March

Monthly Mean Min^m Temp. : 13.1^{0}C

Monthly Mean Max.^{m} Temp. : 22.14^{0}C

Monthly Average Temp. : **17.62^{0}C**

Monthly Average Relative Humidity (RH) =**48.22%**, Monthly Average Wind Velocity(w) =**37.64 km./day**

Monthly Daily Sunshine Hours(n) = **8.99 hours/day**

Reference Evapotranspiration (ETo) is given by the formula:

ETo = C [WRn + (1 - W).f(u).(e_a - e_d)]

Here, e_a = Mean Saturation Vapour Pressure = 19.4 + (20.6-19.4)x0.62 = **20.14 mbar.** (From Table No.- 18)

RH = e_d/e_a, e_d = RHxe_a = 0.4822x20.14 = **9.71 mbar**

e_a - e_d = Vapour Pressure Deficit = 20.14 - 9.71 = **10.43 mbar.**

f(u) = Value of wind function = 0.27(1+ u_2/100)

For wind velocity (w) = 37.64 km./day and altitude = 250m.

At 200 m.altitude, f(u) = 0.89 + {(0.92-0.89)/10}x7.64 = 0.91 (From Table No.- 19)

At 300 m.altitude, f(u) = 1.16 + {(1.19-1.16)/10}x7.64 = 1.18

so, at 250 m. altitude, **f(u)** = (0.91+1.18)/2 = **1.05 km./day**

(1-W) = Value of weighting factor for the effect of wind and humidity on ETo at different temp. and altitude

= 0.36 - (0.02/2)x1.762 = 0.34 at 0 m. altitude and 17.62^{o}c temp. (From Table No.- 20)

= 0.35 - (0.02/2)x1.762 = 0.33 at 500 m. altitude and 17.62^{o}c temp.

so, at 250 m. altitude, **(1-W)** = (0.34+0.33)/2 = **0.335**

W = 1 - 0.335 = **0.665**

Rn = Rns - Rnl

where, Rn = Total net radiation in mm./day

Rns = The net incoming shortwave radiation in mm./day

Rnl = The net long wave radiation in mm./day

Rns = 0.75Ra(0.25+0.50n/N)

where, **Ra** = Extra terrestrial radiation in mm/day

= 13.1 + {(13.4-13.1)/2}x0.5 = **13.17 mm/day** (From Table No.- 17)

N = Maximum possible sunshine hour = 12.0 hours (From Table No.- 16)

n = Actual sunshine hour = 8.99 hours

n/N = 8.99/12.0 = **0.75**

Rns = 0.75x13.17(0.25+0.50x0.75) = **6.17 mm/day**

Rnl = f(n/N).f(T).f(e_d)

f(n/N) = function of the ratio of the sunshine durations = f(0.75) = **0.78** (From Table No.- 25)

f(T) = function of temperature = f(17.62) = 13.8 + (0.4/2)x1.62 = **14.12** (From Table No.- 23)

f(e_d) = function of actual vapour pressure = f(9.71) = **0.20** (From Table No.- 24)

Rnl = 0.78x14.12x0.20 = **2.20 mm/day**

Rn = Rns - Rnl = 6.17 - 2.20 = 3.97 mm/ day

Wind velocity(w) = 37.64 km/day = (37.64x1000)/(24x60x60) = **0.44 m/sec.**

Using Table No. - 26

Taking ratio of u_{day}/u_{night} = 1.0,

Here, RH = 48.22%, **Rs** = Rns/0.75 = 6.17/0.75 = **8.227 mm/day**

C = 1.00 at 30% RH

= 1.05 at 60% RH

so, **C** = 1.00 + (0.05/30)x18.22 = **1.03** at 48.22% Humidity

ETo = C [WRn + (1 - W).f(u).(e_a - e_d)]

= 1.03[0.665x3.97 + 0.335x1.05x10.43] = 6.50 mm/day

ETo(March) = 6.50 mm/day

Month : April

Monthly Mean Min^{m} Temp. : 18.06^{0}C

Monthly Mean Max.^{m} Temp. : 29.14^{0}C

Monthly Average Temp. :**23.6^{0}C**

Monthly Average Relative Humidity (RH) =**40.05%**, Monthly Average Wind Velocity(w) =**37.27 km./day**

Monthly Daily Sunshine Hours(n) = **10.37 hours/day**

Reference Evapotranspiration (ETo) is given by the formula:

ETo = C [WRn + (1 - W).f(u).(e_a - e_d)]

Here, e_a = Mean Saturation Vapour Pressure = 28.1 + (29.8-28.1)x0.60 = **29.12 mbar.** (From Table No.- 18)

RH = e_d/e_a, e_d = RHxe_a = 0.4005x29.12 = **11.66 mbar**

e_a - e_d = Vapour Pressure Deficit = 29.12 - 11.66 = **17.46 mbar.**

f(u) = Value of wind function = 0.27(1+ u_s/100)

For wind velocity (w) = 37.27 km./day and altitude = 250m.

At 200 m.altitude, f(u) = 0.89 + {(0.92-0.89)/10}x7.27 = 0.91 (From Table No.- 19)

At 300 m.altitude, f(u) = 1.16 + {(1.19-1.16)/10}x7.27 = 1.18

so, at 250 m. altitude, **f(u)** = (0.91+1.18)/2 = **1.046 km./day**

(1-W) = Value of weighting factor for the effect of wind and humidity on ETo at different temp. and altitude

= 0.29 - (0.02/2)x1.6 = 0.275 at 0 m. altitude and 23.6^{o}c temp. (From Table No.- 20)

= 0.28 - (0.02/2)x1.6 = 0.265 at 500 m. altitude and 23.6^{o}c temp.

so, at 250 m. altitude, **(1-W)** = (0.275+0.265)/2 = **0.27**

W = 1 - 0.27 = **0.73**

Rn = Rns - Rnl

where, Rn = Total net radiation in mm./day

Rns = The net incoming shortwave radiation in mm./day

Rnl = The net long wave radiation in mm./day

Rns = 0.75Ra(0.25+0.50n/N)

where, Ra = Extra terrestrial radiation in mm/day

= 15.2 + {(15.3-15.2)/2}x0.5 = **15.225 mm/day** (From Table No.- 17)

N = Maximum possible sunshine hour = 12.9 hours (From Table No.- 16)

n = Actual sunshine hour = 10.37 hours

n/N = 10.37/12.9 = **0.8**

Rns = 0.75x15.225(0.25+0.50x0.80) = **7.42 mm/day**

Rnl = f(n/N).f(T).f(e_d)

f(n/N) = function of the ratio of the sunshine durations = f(0.80) = **0.82** (From Table No.- 25)

f(T) = function of temperature = f(23.6) = 15.0 + (0.4/2)x1.60 = **15.3** (From Table No.- 23)

f(e_d) = function of actual vapour pressure = f(11.66) = **0.19** (From Table No.- 24)

Rnl = 0.82x15.3x0.19 = **2.38 mm/day**

Rn = Rns - Rnl = 7.42 - 2.38 = 5.04 mm/ day

Wind velocity(w) = 37.27 km/day = (37.27x1000)/(24x60x60) = **0.43 m/sec.**

Using Table No. - 26

Taking ratio of u_{day}/u_{night} = 1.0,

Here, RH = 40.05%, **Rs** = Rns/0.75 = 7.42/0.75 = **9.89 mm/day**

C = 1.00 at 30% RH

= 1.05 at 60% RH

so, C = 1.00 + (0.05/30)x10.05 = **1.02** at 40.05% Humidity

ETo = C [WRn + (1 - W).f(u).(e_a - e_d)]

= 1.02[0.73x5.04 + 0.27x1.046x17.46] = 8.80 mm/day

ETo(April) = 8.80 mm/day

Month : May

Monthly Mean Min^m Temp. : 23.38^{0}C

Monthly Mean Max.^{m} Temp. : 32.14^{0}C

Monthly Average Temp. :**27.8^{0}C**

Monthly Average Relative Humidity (RH) =**47.2%**, Monthly Average Wind Velocity(w) =**51.75 km./day**

Monthly Daily Sunshine Hours(n) = **10.70 hours/day**

Reference Evapotranspiration (ETo) is given by the formula:

ETo = C [WRn + (1 - W).f(u).(e_a - e_d)]

Here, e_a = Mean Saturation Vapour Pressure = 35.7 + (37.8-35.7)x0.80 = **37.4 mbar.** (From Table No.- 18)

RH = e_d/e_a, e_d = RHxe_a = 0.472x37.4 = **17.64 mbar**

e_a - e_d = Vapour Pressure Deficit = 37.4 - 17.6 = **19.8 mbar.**

f(u) = Value of wind function = 0.27(1+ u_2/100)

For wind velocity (w) = 51.75 km./day and altitude = 250m.

At 200 m.altitude, f(u) = 0.94 + {(0.97-0.94)/10}x1.75 = 0.945 (From Table No.- 19)

At 300 m.altitude, f(u) = 1.21 + {(1.24-1.21)/10}x1.75 = 1.215

so, at 250 m. altitude, **f(u)** = (0.945+1.215)/2 = **1.08 km./day**

(1-W) = Value of weighting factor for the effect of wind and humidity on ETo at different temp. and altitude

= 0.25 - (0.02/2)x1.8 = 0.232 at 0 m. altitude and 27.8^{o}c temp. (From Table No.- 20)

= 0.24 - (0.02/2)x1.8 = 0.222 at 500 m. altitude and 27.8^{o}c temp.

so, at 250 m. altitude, **(1-W)** = (0.232+0.222)/2 = **0.227**

W = 1 - 0.227 = **0.773**

Rn = Rns - Rnl

where, Rn = Total net radiation in mm./day

Rns = The net incoming shortwave radiation in mm./day

Rnl = The net long wave radiation in mm./day

Rns = 0.75Ra(0.25+0.50n/N)

where, **Ra** = Extra terrestrial radiation in mm/day

= 16.5 + {(16.5-16.5)/2}x0.5 = **16.5 mm/day** (From Table No.- 17)

N = Maximum possible sunshine hour = 13.6 hours (From Table No.- 16)

n = Actual sunshine hour = 10.7 hours

n/N = 10.7/13.6 = **0.79**

Rns = 0.75x16.5(0.25+0.50x0.79) = **7.96 mm/day**

Rnl = f(n/N).f(T).f(e_d)

f(n/N) = function of the ratio of the sunshine durations = f(0.79) = **0.81** (From Table No.- 25)

f(T) = function of temperature = f(27.8) = 15.9 + (0.4/2)x1.8 = **16.22** (From Table No.- 23)

f(e_d) = function of actual vapour pressure = f(17.64) = **0.152** (From Table No.- 24)

Rnl = 0.81x16.22x0.152 = **2.00 mm/day**

Rn = Rns - Rnl = 7.96 - 2.00 = 5.96 mm/ day

Wind velocity(w) = 51.75 km/day = (51.75x1000)/(24x60x60) = **0.60 m/sec.**

Using Table No. - 26

Taking ratio of u_{day}/u_{night} = 1.0,

Here, RH = 47.2%, **Rs** = Rns/0.75 = 7.96/0.75 = **10.61 mm/day**

C = 1.00 at 30% RH

= 1.05 at 60% RH

so, C = 1.00 + (0.05/30)x17.2 = **1.029** at 47.2% Humidity

ETo = C [WRn + (1 - W).f(u).(e_a - e_d)]

= 1.029[0.773x5.96 + 0.227x1.08x19.8] = 9.73 mm/day

ETo(May) = 9.73 mm/day

Month : June

Monthly Mean Min^m Temp.°C = 24.53 Monthly Mean Max.^{m} Temp.°C= 31.18

Monthly Average Temp. °C = 27.86

Monthly Average Relative Humidity(RH)%= 62.5

Monthly average wind velocity(w)km./day = 40.35

Monthly daily sunshine hours(n)hours/day = 10.70

Reference Evapotranspiration (ETo) is given by the formula:

ETo = C [WRn + (1 - W).f(u).(e_a - e_d)]

e_a = Mean Saturation Vapour Pressure = 35.7 + (37.8-35.7)x0.85 = **37.5 mbar**

(From Table No.- 18)

RH = e_d/e_a, e_d = RHxea = **23.4 mbar**

$e_a - e_d$ = Vapour Pressure Deficit = **14.1 mbar**

f(u) = Value of wind function = 0.27(1+ u_s/100)

For wind velocity (w) = . 40.35 km./day and altitude = 250m

At 200 m.altitude, f(u) = 0.92 (From Table No.- 19)

At 300 m.altitude, f(u) = 1.19

so, at 250 m. altitude, **f(u)** = **1.055** km/day

(1-W) = Value of weighting factor for the effect of wind and humidity on ETo at different temp. and altitude

= 0.25 - (0.02/2)x1.86 = 0.23 at 0 m. altitude (From Table No.- 20)

= 0.24 - (0.02/2)x1.86 = 0.22 at 500 m. altitude

(1-W) = **0.225** at 250 m. altitude

W = **0.775**

Rn = Rns - Rnl

where, Rn = Total net radiation in mm./day

Rns = The net incoming shortwave radiation in mm./day

Rnl = The net long wave radiation in mm./day

Rns = 0.75Ra(0.25+0.50n/N)

where, Ra = Extra terrestrial radiation in mm/day

= 17.0 - {(17.0-16.8)/2}x0.5 = **16.95 mm/day** (From Table No.- 17)

N = Maximum possible sunshine hour = 14.0 hours (From Table No.- 16)

n = Actual sunshine hour = 8.55 hours

n/N = 0.61

Rns = 7.06 mm/day

Rnl = f(n/N).f(T).f(e_d)

f(n/N) = function of the ratio of the sunshine durations = f(0.61) = **0.65** (From Table No.- 25)

f(T) = function of temperature = f(27.86) = 15.9 + (0.4/2)x1.86 = **16.27** (From Table No.- 23)

f(e_d) = function of actual vapour pressure = f(23.4) = **0.12** (From Table No.- 24)

Rnl = 1.27 mm/day

Rn = Rns - Rnl = 5.79 mm/ day

Wind velocity(w) = 40.35 km/day = **0.47 m/sec**

Using Table No. - 26

Taking ratio of u_{day}/u_{night} = 1.0,

Here, RH(%) = 62.5 Rs = **9.41 mm/day**

C = 1.05 at 60% RH

= 1.10 at 90% RH

C = 1.05 + (0.05/30)x2.5 = **1.054** at 62.5% Humidity

ETo = C [WRn + (1 - W).f(u).(e_a - e_d)]

= **8.25 mm/day**

ETo(June) = 8.25 mm/day

Month : July

Monthly Mean Min[m] Temp.°C = 26.06 Monthly Mean Max.[m] Temp.°C= 30.38

Monthly Average Temp. °C = 28.22

Monthly Average Relative Humidity(RH)%= 72.7

Monthly average wind velocity(w)km./day = 34.3

Monthly daily sunshine hours(n)hours/day = 6.94

Reference Evapotranspiration (ETo) is given by the formula:

$ETo = C [WRn + (1 - W).f(u).(e_a - e_d)]$

e_a = Mean saturation vapour pressure = 37.8 + (40.1-37.8)x0.22 = **38.31 mbar**

(From Table No.- 18)

$RH = e_d/e_a$, e_d = RHxea = **27.85 mbar**

$e_a - e_d$ = Vapour Pressure Deficit = **10.46 mbar**

f(u) = Value of wind function = $0.27(1+ u_s/100)$

For wind velocity (w) = 34.3 km./day and altitude = . 250m

At 200 m.altitude, f(u) = 0.9 (From Table No.- 19)

At 300 m.altitude, f(u) = 1.17

so, at 250 m. altitude, f(u) = **1.035 km/day**

(1-W) = Value of weighting factor for the effect of wind and humidity on ETo at different temp. and altitude

= 0.23 - (0.01/2)x0.22 = 0.229 at 0 m. altitude (From Table No.- 20)

= 0.22 - (0.01/2)x0.22 = 0.219 at 500 m. altitude

(1-W) = **0.224** at 250 m. altitude

W = **0.776**

Rn = Rns - Rnl

where, Rn = Total net radiation in mm./day

Rns = The net incoming shortwave radiation in mm./day

Rnl = The net long wave radiation in mm./day

Rns = 0.75Ra(0.25+0.50n/N)

where, Ra = Extra terrestrial radiation in mm/day

= 16.80 - {(16.80-16.70)/2}x0.5 = **16.775 mm/day** (From Table No.- 17)

N = Maximum possible sunshine hour = 13.9 hours (From Table No.- 16)

n = Actual sunshine hour = 6.94 hours

n/N = **0.50**

Rns = 6.30 mm/day

$Rnl = f(n/N).f(T).f(e_d)$

f(n/N) = function of the ratio of the sunshine durations = f(0.50) = **0.55** (From Table No.- 25)

f(T) = function of temperature = f(28.22) = 16.3 + (0.4/2)x0.22 = **16.34** (From Table No.- 23)

$f(e_d)$ = function of actual vapour pressure = f(27.85) = **0.11** (From Table No.- 24)

Rnl = 0.99 mm/day

Rn = Rns - Rnl = 5.31 mm/ day

Wind velocity(w) = 34.3 km/day = 0.40 m/sec

Using Table No. - 26

Taking ratio of u_{day}/u_{night} = 1.0,

Here, RH(%) = 72.7 **Rs = 8.39 mm/day**

C = 1.05 at 60% RH

= 1.10 at 90% RH

C = 1.05 + (0.05/30)x12.7 = **1.07** at 72.7% Humidity

$ETo = C [WRn + (1 - W).f(u).(e_a - e_d)]$

= **7.00 mm/day**

ETo(July) = 7.00 mm/day

Month : August

Monthly Mean Min^m Temp.°C = 25.26 Monthly Mean Max.^{m} Temp.°C= 29.72

Monthly Average Temp. °C = 27.49

Monthly Average Relative Humidity(RH)%= 73.1

Monthly average wind velocity(w)km./day = 24.91

Monthly daily sunshine hours(n)hours/day = 7.40

Reference Evapotranspiration (ETo) is given by the formula:

ETo = C [WRn + (1 - W).f(u).(e_a - e_d)]

e_a = Mean saturation vapour pressure = 35.7 + (37.8-35.7)x0.49 = 36.73 mbar

(From Table No.- 18)

RH = e_d/e_a, e_d = RHxea = 26.85 mbar

e_a - e_d = Vapour Pressure Deficit = 9.88 mbar

f(u) = Value of wind function = 0.27(1+ u_s/100)

For wind velocity (w) = 24.91 km./day and altitude = 250m

At 200 m.altitude, f(u) = 0.875 (From Table No.- 19)

At 300 m.altitude, f(u) = 1.145

so, at 250 m. altitude, f(u) = **1.010** km/day

(1-W) = Value of weighting factor for the effect of wind and humidity on ETo at different temp. and altitude

= 0.25 - (0.02/2)x1.49 = 0.235 at 0 m. altitude (From Table No.- 20)

= 0.24 - (0.02/2)x1.49 = 0.225 at 500 m. altitude

(1-W) = **0.230** at 250 m. altitude

W = **0.770**

Rn = Rns - Rnl

where, Rn = Total net radiation in mm./day

Rns = The net incoming shortwave radiation in mm./day

Rnl = The net long wave radiation in mm./day

Rns = 0.75Ra(0.25+0.50n/N)

where, Ra = Extra terrestrial radiation in mm/day

= 15.7 + {(15.7-15.7)/2}x0.5 = **15.70 mm/day** (From Table No.- 17)

N = Maximum possible sunshine hour = 13.2 hours (From Table No.- 16)

n = Actual sunshine hour = 7.40 hours

n/N = 0.56

Rns = 6.24 **mm/day**

Rnl = f(n/N).f(T).f(e_d)

f(n/N) = function of the ratio of the sunshine durations = f(0.56) = **0.61** (From Table No.- 25)

f(T) = function of temperature = f(27.49) = 15.9 + (0.4/2)x1.49 = **16.20** (From Table No.- 23)

f(e_d) = function of actual vapour pressure = f(26.85) = **0.115** (From Table No.- 24)

Rnl = 1.14 mm/day

Rn = Rns - Rnl = 5.11 mm/ day

Wind velocity(w) = 24.91 km/day = **0.29** m/sec

Using Table No. - 26

Taking ratio of u_{day}/u_{night} = 1.0,

Here, RH(%) = 73.1 **Rs =** 8.33 mm/day

C = 1.034 at 60% RH

= 1.091 at 90% RH

C = 1.034 + {(1.091-1.034)/30} x 13.1= 1.059 at 73.1% Humidity

ETo = C [WRn + (1 - W).f(u).(e_a - e_d)]

= 6.60 mm/day

ETo(August) = 6.60 mm/day

Month : September

Monthly Mean Min^m Temp.°C = 23.3 Monthly Mean Max.^{m} Temp.°C= 28.6

Monthly Average Temp. °C = 25.95

Monthly Average Relative Humidity(RH)%= 69.50

Monthly average wind velocity(w)km./day = 20.41

Monthly daily sunshine hours(n)hours/day = 7.28

Reference Evapotranspiration (ETo) is given by the formula:

ETo = C [WRn + (1 - W).f(u).(e_a - e_d)]

e_a = Mean saturation vapour pressure = 31.7 + (33.6-31.7)x0.95 = **33.51 mbar**

(From Table No.- 18)

RH = e_d/e_a, e_d = RHxea = **23.29 mbar**

e_a - e_d = Vapour Pressure Deficit = **10.22 mbar**

f(u) = Value of wind function = 0.27(1+ u_2/100)

For wind velocity (w) = 20.41 km./day and altitude = . 250m

At 200 m.altitude, f(u) = 0.86 (From Table No.- 19)

At 300 m.altitude, f(u) = 1.13

so, at 250 m. altitude, f(u) = ***0.995 km/day***

(1-W) = Value of weighting factor for the effect of wind and humidity on ETo at different temp. and altitude

= 0.27 - (0.02/2)x1.95 = 0.2505 at 0 m. altitude (From Table No.- 20)

= 0.26 - (0.02/2)x1.95 = 0.2405 at 500 m. altitude

(1-W) = 0.246 at 250 m. altitude

W = 0.755

Rn = Rns - Rnl

where, *Rn = Total net radiation in mm./day*

Rns = The net incoming shortwave radiation in mm./day

Rnl = The net long wave radiation in mm./day

Rns = 0.75Ra(0.25+0.50n/N)

where, **Ra** = Extra terrestrial radiation in mm/day

= 13.9 + {(14.1-13.9)/2}x0.5 = **13.95 mm/day** (From Table No.- 17)

N = Maximum possible sunshine hour = 12.4 hours (From Table No.- 16)

n = Actual sunshine hour = 7.28 hours

n/N = 0.59

Rns = 5.69 mm/day

Rnl = f(n/N).f(T).f(e_d)

f(n/N) = function of the ratio of the sunshine durations = f(0.59) = **0.63** (From Table No.- 25)

f(T) = function of temperature = f(25.95) = 15.4 + (0.5/2)x1.95 = **15.89** (From Table No.- 23)

f(e_d) = function of actual vapour pressure=f(23.29)=.13-.01/2x1.29= **0.124** (From Table No.- 24)

Rnl = 1.24 mm/day

Rn = Rns - Rnl = 4.45 mm/ day

Wind velocity(w) = 20.41 **km/day = 0.24 m/sec**

Using Table No. - 26

Taking ratio of u_{day}/u_{night} = 1.0,

Here, RH(%) = 69.5 **Rs = 7.58 mm/day**

C = 0.98+{(1.05-0.98)/3}x1.58 = 1.017 at 60% RH

= 1.06+{(1.10-1.06)/3}x1.58 = 1.081 at 90% RH

C = 1.017 + {(1.081-1.017)/30} x 9.5= **1.037** at 69.5% Humidity

ETo = C [WRn + (1 - W).f(u).(e_a - e_d)]

= **6.07 mm/day**

ETo(September) = 6.07 mm/day

Month : October

Monthly Mean Min^m Temp.°C = 18.2 Monthly Mean Max.^{m} Temp.°C= 26.2

Monthly Average Temp. °C = 22.20

Monthly Average Relative Humidity(RH)%= 60.00

Monthly average wind velocity(w)km./day = 12.40

Monthly daily sunshine hours(n)hours/day = 9.20

Reference Evapotranspiration (ETo) is given by the formula:

ETo = C [WRn + (1 - W).f(u).(e_a - e_d)]

e_a = Mean saturation vapour pressure = 26.4+ (28.1-26.4)x0.2 = **26.74 mbar**

(From Table No.- 18)

RH = e_d/e_a, e_d = RHxea = **16.04 mbar**

e_a - e_d = Vapour Pressure Deficit = **10.70 mbar**

f(u) = Value of wind function = 0.27(1+ u_s/100)

For wind velocity (w) = 12.4 km./day and altitude = 250m

At 200 m.altitude, f(u) = 0.845 (From Table No.- 19)

At 300 m.altitude, f(u) = 1.115

so, at 250 m. altitude, f(u) = **0.980 km/day**

(1-W) = Value of weighting factor for the effect of wind and humidity on ETo at different temp. and altitude

= 0.29 - (0.02/2)x0.2 = 0.288 at 0 m. altitude (From Table No.- 20)

= 0.28 - (0.02/2)x0.2 = 0.278 at 500 m. altitude

(1-W) = 0.283 at 250 m. altitude

W = 0.717

Rn = Rns - Rnl

where, Rn = Total net radiation in mm./day

Rns = The net incoming shortwave radiation in mm./day

Rnl = The net long wave radiation in mm./day

Rns = 0.75Ra(0.25+0.50n/N)

where, Ra = Extra terrestrial radiation in mm/day

= 11.6 + {(12.0-11.6)/2}x0.5 = **11.70 mm/day** (From Table No.- 17)

N = Maximum possible sunshine hour = 11.5 hours (From Table No.- 16)

n = Actual sunshine hour = 9.20 hours

n/N = 0.80

Rns = 5.70 mm/day

Rnl = f(n/N).f(T).f(e_d)

f(n/N) = function of the ratio of the sunshine durations = f(0.80) = **0.82** (From Table No.- 25)

f(T) = function of temperature = f(22.20) = 15.0 + (0.4/2)x0.20 = **15.04** (From Table No.- 23)

f(e_d) = function of actual vapour pressure=f(16.04)=.16-.01/2x0.04= **0.160** (From Table No.- 24)

Rnl = 1.97 mm/day

Rn = Rns - Rnl = 3.73 mm/ day

Wind velocity(w) = 12.4 km/day = 0.14 m/sec

Using Table No. - 26

Taking ratio of u_{day}/u_{night} = 1.0,

Here, RH(%) = 60 Rs = **7.61 mm/day**

C = 0.98+{(1.05-0.98)/3}x1.61 = 1.017 at 60% RH

= 1.06+{(1.10-1.06)/3}x1.61 = 1.081 at 90% RH

C = 1.017 + {(1.081-1.017)/30} x 0.0= **1.017** at 60.0% Humidity

ETo = C [WRn + (1 - W).f(u).(e_a - e_d)]

= **5.74 mm/day**

ETo(October) = 5.74 mm/day

Month : November

Monthly Mean Min^{m} Temp.°C = 12.30 Monthly Mean Max.^{m} Temp.°C= 20.64

Monthly Average Temp. °C = 16.47

Monthly Average Relative Humidity(RH)%= 60.70

Monthly average wind velocity(w)km./day = 9.40

Monthly daily sunshine hours(n)hours/day = 8.40

Reference Evapotranspiration (ETo) is given by the formula:

ETo = C [WRn + (1 - W).f(u).(e_a - e_d)]

e_a = Mean saturation vapour pressure = 18.2+ (19.4-18.2)x0.47 = **18.76 mbar**

(From Table No.- 18)

RH = e_d/e_a, e_d = RHxea = **11.39 mbar**

e_a - e_d = Vapour Pressure Deficit = **7.37 mbar**

f(u) = Value of wind function = 0.27(1+ u_2/100)

For wind velocity (w) = 9.40 km./day and altitude = . 250m

At 200 m.altitude, f(u) = 0.84 (From Table No.- 19)

At 300 m.altitude, f(u) = 1.11

so, at 250 m. altitude, f(u) = **0.975 km/day**

(1-W) = Value of weighting factor for the effect of wind and humidity on ETo at different temp. and altitude

= 0.36 - (0.02/2)x0.47 = 0.355 at 0 m. altitude (From Table No.- 20)

= 0.35 - (0.02/2)x0.47= 0.345 at 500 m. altitude

(1-W) = **0.350** at 250 m. altitude

W = **0.650**

Rn = Rns - Rnl

where, Rn = Total net radiation in mm./day

Rns = The net incoming shortwave radiation in mm./day

Rnl = The net long wave radiation in mm./day

Rns = 0.75Ra(0.25+0.50n/N)

where, Ra = Extra terrestrial radiation in mm/day

= 9.50 + {(9.90-9.50)/2}x0.5 = **9.60** mm/day (From Table No.- 17)

N = Maximum possible sunshine hour = 10.6 hours (From Table No.- 16)

n = Actual sunshine hour = 8.40 hours

n/N = **0.79**

Rns = 4.65 mm/day

Rnl = f(n/N).f(T).f(e_d)

f(n/N) = function of the ratio of the sunshine durations = f(0.79) = **0.81** (From Table No.- 25)

f(T) = function of temperature = f(16.47) = 13.8 + (0.4/2)x0.47 = **13.89** (From Table No.- 23)

f(e_d) = function of actual vapour pressure=f(11.39)=.20-.01/2x1.39= **0.193** (From Table No.- 24)

Rnl = 2.17 mm/day

Rn = Rns - Rnl = 2.48 mm/ day

Wind velocity(w) = 9.4 km/day = **0.11 m/sec**

Using Table No. - 26

Taking ratio of u_{day}/u_{night} = 1.0,

Here, RH(%) = 60.7 **Rs = 6.20 mm/day**

C = 0.98+{(1.05-0.98)/3}x0.20 = 0.9847 at 60% RH

= 1.06+{(1.10-1.06)/3}x0.20 = 1.0627 at 90% RH

C = 0.9847 + {(1.0627-0.9847)/30} x 0.70= **0.986** at 60.7% Humidity

ETo = C [WRn + (1 - W).f(u).(e_a - e_d)]

= 4.07 mm/day

ETo(November) = 4.07 mm/day

Month : December

Monthly Mean Min^{m} Temp.°C = 8.00 Monthly Mean Max.^{m} Temp.°C= 15.65

.Monthly Average Temp. °C = 11.83

Monthly Average Relative Humidity(RH)%= 63.30

Monthly average wind velocity(w)km./day = 10.12

Monthly daily sunshine hours(n)hours/day = 7.26

Reference Evapotranspiration (ETo) is given by the formula:

ETo = C [WRn + (1 - W).f(u).(e_a - e_d)]

e_a = Mean saturation vapour pressure = 13.1+ (14.0-13.1)x0.83 = **13.85 mbar**

(From Table No.- 18)

RH = e_d/e_a, e_d = RHxea = **8.77 mbar**

e_a - e_d = Vapour Pressure Deficit = **5.08 mbar**

f(u) = Value of wind function = 0.27(1+ u_d/100)

For wind velocity (w) = 10.12 km./day and altitude = . 250m

At 200 m.altitude, f(u) = 0.84 (From Table No.- 19)

At 300 m.altitude, f(u) = 1.11

so, at 250 m. altitude, f(u) = **0.975 km/day**

(1-W) = Value of weighting factor for the effect of wind and humidity on ETo at different temp. and altitude

= 0.45 - (0.03/2)x1.83 = 0.423 at 0 m. altitude (From Table No.- 20)

= 0.43 - (0.03/2)x1.83= 0.403 at 500 m. altitude

(1-W) = 0.413 at 250 m. altitude

W = 0.587

Rn = Rns - Rnl

where, Rn = Total net radiation in mm./day

Rns = The net incoming shortwave radiation in mm./day

Rnl = The net long wave radiation in mm./day

Rns = 0.75Ra(0.25+0.50n/N)

where, **Ra** = Extra terrestrial radiation in mm/day

= 8.30 + {(8.80-8.30)/2}x0.5 = 8.43 **mm/day** (From Table No.- 17)

N = Maximum possible sunshine hour = 10.2 hours (From Table No.- 16)

n = Actual sunshine hour = 7.26 hours

n/N = 0.71

Rns = 3.83 mm/day

Rnl = f(n/N).f(T).f(e_d)

f(n/N) = function of the ratio of the sunshine durations = f(0.71) = **0.74** (From Table No.- 25)

f(T) = function of temperature = f(11.83) = 12.7 + (0.4/2)x1.83 = **13.07** (From Table No.- 23)

f(e_d) = function of actual vapour pressure=f(8.77)=.22-.02/2x0.77= **0.212** (From Table No.- 24)

Rnl = 2.05 mm/day

Rn = Rns - Rnl = 1.78 mm/ day

Wind velocity(w) = 10.12 km/day = **0.12 m/sec**

Using Table No. - 26

Taking ratio of u_{day}/u_{night} = 1.0,

Here, RH(%) = 63.3 **Rs = 5.10 mm/day**

C = 0.96+{(0.98-0.96)/3}x2.10 = 0.974 at 60% RH

= 1.02+{(1.06-1.02)/3}x2.10 = 1.048 at 90% RH

C = 0.974 + {(1.048-0.974)/30} x 3.30= **0.982** at 63.3% Humidity

ETo = C [WRn + (1 - W).f(u).(e_a - e_d)]

= **3.03 mm/day**

ETo(December) = **3.03 mm/day**

Annexure :2

Table No:1

SALIENT FEATURES OF DISTRIBUTARY/MINORS UNDER CASE STUDY

S.No.	Name of canal	Off-Take Points (Km.)	Length (Km.)	CCA (Ha)	PPA (Rabi)	PPA (Kharif)	Authorised Discharge in Cumecs	No of direct outlets including tail cluster	Remarks
1	2	3	4	5	6	7	8	9	10
1	Right Main Dy	7.26 km. Of Deoband Branch	17.70	2111	866	1393	2.69	54	2111 Ha direct irrigation
2	Bhaisani Dy	16.40 km. Of Right Main Dy	13.75	2237	917	1476	1.22	65	
(a)	Khoja Nagla Mr.	5.60 km. Of Bhaisani Dy	4.02	568	233	375	0.25	17	
(b)	Bijopura Mr.	10.32 km. Of Bhaisani Dy	2.41	138	56.5	91	0.085	4	
(c)	Khampur Mr.	10.69 km. Of Bhaisani Dy	2.61	128	52.5	85	0.085	2	
3	Barla Dy	17.70 km. Of Right Main Dy	7.25	708	290	467	0.339	32	
Total			**47.74**	**5890**	**2415**	**3887**		**174**	

Annexure: 2

Table No. 2

DETAILS OF INFRASTRUCTURES OF DISTRIBUTARY AND MINORS

S.No.	Name of Canal	Road communication length (km) for inspection by vehicle	Number of Structures												
			Head Regulator Open/ gated	Canal syphon/ Road Syphon	Drainage syphon	Fall	No. of Dy/Minors takes off	Surplus Escape	Aqua duct	Cross Regulator	V.R.B./ Skew bridge	Culvert	Foot bridge	Inlets	Outlets
1	Right Main Dy	17.70	1	-	-	1	1	-	-	-	10	-	1	-	54
2	Bhaisani Dy	13.75	1	3	1	5	2	1	1	-	4	-	-	-	65
3	Barla Dy	7.25	1	1	1	6	-	1	-	-	1	3	-	-	32
4	Khoja Nagla Mr.	0.00	1	-	-	-	-	-	-	-	3	-	-	-	17
5	Bijopura Mr.	0.00	1	-	-	-	-	-	-	-	2	-	-	-	4
6	Khampur Mr.	0.00	1	-	-	-	-	-	-	-	-	-	-	-	2

TABLE NO.-3
ANNEXURE-2

MONTHLY RAINFALL AT ROORKEE (WRDTC DEMONSTRATION FARM) STATION

UNIT: mm

Year\Month	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Novem	Decem	Annual Total	Remarks
1986	20.0	58.0	19.2	8.5	50.8	48.4	94.0	91.3	43.3	8.0	10.4	18.6	**470.5**	
1987	33.0	33.0	17.4	5.4	108.8	92.6	33.6	206.4	27.2	5.0	0.0	10.2	**572.6**	
1988	1.0	20.3	63.3	11.4	5.0	59.8	481.0	439.1	261.4	0.0	0.0	14.2	**1356.5**	
1989	112.2	4.4	1.8	2.2	34.8	37.2	260.4	274.1	255.8	0.0	11.0	34.0	**1027.9**	
1990	1.0	100.5	24.0	3.0	56.0	22.6	343.1	332.7	202.4	2.0	14.2	70.4	**1171.9**	
1991	0.0	23.4	15.4	2.0	2.0	123.2	252.4	172.1	221.1	0.0	N.A.	N.A.	**811.6**	
1992	N.A.	N.A.	N.A.	0.0	107.0	43.8	151.8	457.4	160.2	0.0	2.6	0.0	**922.8**	
1993	9.0	29.1	110.6	N.A.	23.8	41.7	177.6	131.0	300.4	0.0	0.0	0.0	**823.2**	
1994	29.0	57.4	0.0	31.3	29.6	35.0	633.2	348.0	11.0	0.0	0.0	0.0	**1174.5**	
1995	57.2	45.4	6.0	N.A.	0.0	128.2	356.0	446.5	116.4	2.8	0.0	1.3	**1159.8**	
1996	33.8	93.6	8.4	N.A.	0.0	61.0	158.0	434.6	354.0	60.0	0.0	0.0	**1203.4**	
1997	20.0	3.0	5.8	66.4	20.0	34.0	328.2	242.5	68.8	64.4	36.0	86.2	**975.3**	
1998	0.0	28.9	82.0	80.0	31.0	74.4	250.6	405.9	192.0	149.5	0.0	0.0	**1294.3**	
1999	74.4	0.0	0.0	0.0	33.0	245.2	245.2	182.6	101.2	4.6	0.0	3.4	**889.6**	
2000	50.2	74.8	9.6	0.0	101.2	358.6	380.0	463.0	91.0	0.0	0.0	0.0	**1528.4**	
2001	13.8	5.0	19.4	11.6	42.4	222.0	289.4	159.8	0.0	2.6	1.8	0.6	**768.4**	
2002	16.7	79.7	12.2	15.6	45.2	91.8	39.4	258.2	403.6	18.6	0.0	16.0	**997.0**	
2003	18.6	84.0	17.4	3.6	11.8	58.4	224.0	282.8	139.3	0.0	3.0	15.0	**857.9**	
Average	**28.8**	**43.6**	**24.3**	**16.1**	**39.0**	**98.8**	**261.0**	**296.0**	**163.8**	**17.6**	**4.6**	**15.9**	**1000.3**	

TABLE NO.-4
ANNEXURE -2

CLIMATIC DATA AT ROORKEE (WRDTC DEMONSTRATION FARM) STATION

Month	Year	Monthly Mean Min. Temp. in °c	Monthly Mean Max. Temp. in °c	Monthly Mean Temp. in °c	Monthly mean relative humidity RH (percent)			Monthly mean wind velocity(w) in km./day	Monthly mean sun shine hour in hours/day	Monthly rainfall (mm)	No. of rainy days in a month
					Morning	Afternoon	Average				
January	1999	8.30	12.60	10.45	74.85	64.54	69.695	16.13	3.70	74.4	4
	2000	8.10	12.70	10.40	78.90	66.97	72.935	12.45	5.70	50.2	4
	2001	6.00	12.40	9.20	71.60	59.32	65.46	17.16	4.36	13.8	3
	2002	6.30	12.10	9.20	72.43	53.93	63.18	14.94	6.64	16.7	3
	2003	6.40	10.00	8.20	83.94	68.65	76.295	6.65	3.00	18.6	2
Average		**7.02**	**11.96**	**9.49**	**76.344**	**62.682**	**69.513**	**13.466**	**4.68**	**34.7**	**3.2**
February	1999	9.80	15.40	12.60	73.96	49.13	61.545	18.07	6.90	0.00	0
	2000	7.90	15.40	11.65	67.89	48.32	58.105	25.48	6.93	74.8	5
	2001	8.90	17.12	13.01	58.14	39.30	48.72	33.75	7.70	5.0	2
	2002	9.2	16	12.6	71.15	50.38	60.765	27.39	6.9	79.7	6
	2003	9.6	15.4	12.5	77.1	46.5	61.8	21.89	6.83	84	3
Average		**9.08**	**15.864**	**12.472**	**69.648**	**46.726**	**58.187**	**25.316**	**7.052**	**48.7**	**3.2**
March	1999	12.9	23.8	18.35	46.73	31.8	39.265	39.35	9.5	0	0
	2000	12.3	22.4	17.35	52.99	38.62	45.805	39.13	9.23	9.6	3
	2001	12.8	22.4	17.6	51.63	35.93	43.78	42.74	8.5	19.4	4
	2002	14.1	22	18.05	66.77	42.33	54.55	33.61	8.9	12.2	1
	2003	13.4	20.1	16.75	70.3	45.09	57.695	33.35	8.81	17.4	3
Average		**13.1**	**22.14**	**17.62**	**57.684**	**38.754**	**48.219**	**37.636**	**8.988**	**11.72**	**2.2**
April	1999	17.8	30.9	24.35	37.24	12.33	24.785	30.77	11.6	0	0
	2000	18.1	29.6	23.85	41.12	39.97	40.545	40.9	11.12	0	0
	2001	17.7	28.5	23.1	44.97	39.07	42.02	39.87	9.13	11.6	2
	2002	18.6	28.6	23.6	52.69	31.24	41.965	43.1	10.2	15.6	3
	2003	18.1	28.1	23.1	60.52	41.32	50.92	31.73	9.8	3.6	1
Average		**18.06**	**29.14**	**23.6**	**47.308**	**32.786**	**40.047**	**37.274**	**10.37**	**6.16**	**1.2**
May	1999	23.1	33	28.05	43.05	32.94	37.995	47.97	10.97	33	4
	2000	24.1	31.6	27.85	57.68	47.34	52.51	33.32	9.48	101.2	6
	2001	24.1	32.3	28.2	50.77	38.25	44.51	67.45	10.35	42.4	3
	2002	24.2	31.8	28	56.15	39.98	48.065	69.42	11.37	45.2	4
	2003	21.4	32	26.7	60.44	45.59	53.015	40.58	11.21	11.8	2
Average		**23.38**	**32.14**	**27.76**	**53.618**	**40.82**	**47.219**	**51.748**	**10.676**	**46.72**	**3.8**

CLIMATIC DATA AT ROORKEE (WRDTC DEMONSTRATION FARM) STATION

Month	Year	Monthly Mean Min. Temp. in °c	Monthly Mean Max. Temp. in °c	Monthly Mean Temp. in °c	Monthly mean relative humidity			Monthly mean wind velocity(w) in km./day	Monthly mean sun shine hour in hours/day	Monthly rainfall (mm)	No. of rainy days in a month
					Morning	Afternoon	Average				
June	1999	24.80	31.90	28.35	57.91	43.54	50.73	26.32	4.70	245.20	14.00
	2000	23.75	28.80	26.28	71.48	67.91	69.70	42.63	8.83	358.60	10.00
	2001	24.30	31.30	27.80	69.34	64.28	66.81	37.77	8.25	222.00	13.00
	2002	24.30	31.80	28.05	64.57	55.07	59.82	45.97	10.60	91.80	7.00
	2003	25.50	32.10	28.80	69.95	61.10	65.53	49.07	10.38	58.40	5.00
Average		**24.53**	**31.18**	**27.855**	**66.65**	**58.38**	**62.515**	**40.352**	**8.552**	**195.2**	**9.8**
July	1999	25.90	29.70	27.80	75.50	70.38	72.94	26.32	4.70	245.20	14.00
	2000	25.50	29.50	27.50	79.00	76.62	77.81	46.19	6.24	380.00	20.00
	2001	25.80	30.50	28.15	77.39	72.01	74.70	27.97	7.64	289.40	14.00
	2002	27.00	32.00	29.50	73.50	59.52	66.51	32.00	8.63	39.4	2.00
	2003	26.10	30.20	28.15	77.24	65.88	71.56	39.19	7.48	224.00	13.00
Average		**26.06**	**30.38**	**28.22**	**76.526**	**68.882**	**72.704**	**34.334**	**6.938**	**235.6**	**12.6**
August	1999	24.70	29.70	27.20	76.89	67.26	72.08	16.61	5.80	182.60	17.00
	2000	25.10	29.70	27.40	79.45	76.67	78.06	27.58	6.87	463.00	15.00
	2001	25.90	30.70	28.30	75.13	68.42	71.78	24.68	8.92	159.80	7.00
	2002	25.30	29.50	27.40	77.10	64.10	70.60	30.06	7.50	258.20	12.00
	2003	25.30	29.00	27.15	79.77	66.33	73.05	25.61	7.69	282.80	15.00
Average		**25.26**	**29.72**	**27.49**	**77.668**	**68.556**	**73.112**	**24.908**	**7.356**	**269.28**	**13.2**
September	1999	24.10	29.00	26.55	75.28	68.32	71.80	14.57	5.40	101.20	7.00
	2000	23.50	28.80	26.15	72.11	66.03	69.07	24.17	8.11	91.00	6.00
	2001	23.10	30.40	26.75	67.85	56.24	62.05	22.77	9.65	0.00	0.00
	2002	21.70	27.20	24.45	77.20	65.53	71.37	19.23	7.05	403.60	14.00
	2003	24.20	27.50	25.85	78.41	68.04	73.23	21.30	6.19	139.30	10.00
Average		**23.32**	**28.58**	**25.95**	**74.17**	**64.832**	**69.501**	**20.408**	**7.28**	**147.02**	**7.4**
October	1999	18.50	27.10	22.80	62.58	54.37	58.48	7.61	9.10	4.60	1.00
	2000	19.10	27.40	23.25	63.76	54.73	59.25	16.06	9.50	0.00	0.00
	2001	19.00	26.80	22.90	67.49	52.87	60.18	14.90	8.70	2.60	1.00
	2002	18.10	25.30	21.70	70.73	47.71	59.22	9.48	9.40	18.60	1.00
	2003	16.50	24.50	20.50	72.35	54.82	63.59	13.81	9.14	0.00	0.00
Average		**18.24**	**26.22**	**22.23**	**67.382**	**52.9**	**60.141**	**12.372**	**9.168**	**5.16**	**0.6**

CLIMATIC DATA AT ROORKEE (WRDTC DEMONSTRATION FARM) STATION

Month	Year	Monthly Mean Min. Temp. in °c	Monthly Mean Max. Temp. in °c	Monthly Mean Temp. in °c	Monthly mean relative humidity			Monthly mean wind velocity(w) in km./day	Monthly mean sun shine hour in hours/day	Monthly rainfall (mm)	No. of rainy days in a month
					Morning	Afternoon	Average				
November	1999	11.70	21.90	16.80	58.63	47.50	53.07	5.63	9.40	0.00	0.00
	2000	13.40	21.90	17.65	64.74	54.71	59.73	10.83	7.60	0.00	0.00
	2001	12.10	21.20	16.65	63.70	57.21	60.46	13.43	8.84	1.80	1.00
	2002	12.10	19.10	15.60	75.43	48.81	62.12	4.23	8.80	0.00	0.00
	2003	12.20	19.10	15.65	76.42	60.08	68.25	12.87	7.23	3.00	1.00
Average		**12.3**	**20.64**	**16.47**	**67.784**	**53.662**	**60.723**	**9.398**	**8.374**	**0.96**	**0.4**
December	1999	7.80	17.20	12.50	66.06	49.07	57.57	0.10	8.60	3.40	1.00
	2000	6.40	15.75	11.08	63.78	46.97	55.38	10.81	7.83	0.00	0.00
	2001	8.50	15.60	12.05	71.96	59.94	65.95	12.45	7.27	0.60	1.00
	2002	8.60	14.90	11.75	76.30	52.33	64.32	7.23	7.63	16.00	1.00
	2003	8.70	14.80	11.75	85.40	61.50	73.45	20.00	4.95	15.00	1.00
Average		**8.00**	**15.65**	**11.83**	**72.70**	**53.96**	**63.33**	**10.12**	**7.26**	**7.00**	**0.80**
Annual Average		**17.36**	**24.47**	**20.92**	**67.29**	**53.58**	**60.43**	**26.44**	**8.06**	**84.02**	**4.87**

Annexure-2

Table:5

Sheet-1

PROBABILITY AND RETURN PERIOD CALCULATION OF MONTHLY RAINFALL

Month - January

m	N = 17	P = m/(N+1)	T = 1/P
1	112.2	0.056	18.00
2	74.4	0.111	9.00
3	57.2	0.167	6.00
4	50.2	0.222	4.50
5	33.8	0.278	3.60
6	33.2	0.333	3.00
7	29.0	0.389	2.57
8	20.0	0.444	2.25
9	20.0	0.500	2.00
10	18.6	0.556	1.80
11	16.7	0.611	1.64
12	13.8	0.667	1.50
13	9.0	0.722	1.38
14	1.0	0.778	1.29
15	1.0	0.833	1.20
16	0.0	0.889	1.13
17	0.0	0.944	1.06

Month - February

m	N = 17	P = m/(N+1)	T = 1/P
1	100.5	0.056	18.00
2	93.6	0.111	9.00
3	84.0	0.167	6.00
4	79.7	0.222	4.50
5	74.8	0.278	3.60
6	58.0	0.333	3.00
7	57.4	0.389	2.57
8	45.4	0.444	2.25
9	33.0	0.500	2.00
10	29.1	0.556	1.80
11	28.9	0.611	1.64
12	23.4	0.667	1.50
13	20.3	0.722	1.38
14	5.0	0.778	1.29
15	4.4	0.833	1.20
16	3.0	0.889	1.13
17	0.0	0.944	1.06

Month - March

m	N = 17	P = m/(N+1)	T = 1/P
1	110.6	0.056	18.00
2	82.0	0.111	9.00
3	63.3	0.167	6.00
4	24.0	0.222	4.50
5	19.2	0.278	3.60
6	17.4	0.333	3.00
7	15.4	0.389	2.57
8	9.5	0.444	2.25
9	9.2	0.500	2.00
10	8.9	0.556	1.80
11	8.8	0.611	1.64
12	8.5	0.667	1.50
13	8.4	0.722	1.38
14	6.0	0.778	1.29
15	5.8	0.833	1.20
16	1.8	0.889	1.13
17	0.0	0.944	1.06

Month - April

m	N = 15	P = m/(N+1)	T = 1/P
1	80.0	0.063	16.00
2	66.4	0.125	8.00
3	31.3	0.188	5.33
4	15.6	0.250	4.00
5	11.6	0.313	3.20
6	11.4	0.375	2.67
7	8.5	0.438	2.29
8	5.4	0.500	2.00
9	3.6	0.563	1.78
10	3.0	0.625	1.60
11	2.2	0.688	1.45
12	2.0	0.750	1.33
13	0.0	0.813	1.23
14	0.0	0.875	1.14
15	0.0	0.938	1.07

Sheet-2

PROBABILITY AND RETURN PERIOD CALCULATION OF MONTHLY RAINFALL

Month	May	June	July	August	Septem.	Octob.	P = m/(N+1)	T = 1/P
m	N = 18	N = 18	N = 18	N = 18	N = 18	N = 18		
1	108.8	358.6	633.2	463.0	403.6	149.5	0.053	19.00
2	107.0	245.2	481.0	457.4	354.0	64.4	0.105	9.50
3	101.2	222.0	380.0	446.5	300.4	60.0	0.158	6.33
4	56.0	128.2	356.0	439.1	261.4	18.6	0.211	4.75
5	50.8	123.2	343.1	434.6	255.8	8.0	0.263	3.80
6	45.2	92.6	328.2	405.9	221.1	5.0	0.316	3.17
7	42.4	91.8	289.4	348.0	202.4	4.6	0.368	2.71
8	34.8	74.4	260.4	332.7	192.0	2.8	0.421	2.38
9	33.0	61.0	252.4	282.8	160.2	2.6	0.474	2.11
10	31.0	59.8	250.6	274.1	139.3	2.0	0.526	1.90
11	29.6	58.4	245.2	258.2	116.4	0.0	0.579	1.73
12	23.8	48.4	224.0	242.5	101.2	0.0	0.632	1.58
13	20.0	43.8	177.6	206.4	91.0	0.0	0.684	1.46
14	11.8	41.7	158.0	182.6	68.8	0.0	0.737	1.36
15	5.0	37.2	151.8	172.1	43.3	0.0	0.789	1.27
16	2.0	35.0	94.0	159.8	27.2	0.0	0.842	1.19
17	0.0	34.0	39.4	131.0	11.0	0.0	0.895	1.12
18	0.0	22.6	33.6	91.3	0.0	0.0	0.947	1.06

Month	November	December	P = m/(N+1)	T = 1/P
m	N = 17	N = 17		
1	36.0	86.2	0.056	18.00
2	14.2	70.4	0.111	9.00
3	11.0	34.0	0.167	6.00
4	10.4	18.6	0.222	4.50
5	3.0	16.0	0.278	3.60
6	2.6	15.0	0.333	3.00
7	1.8	14.2	0.389	2.57
8	0.0	10.2	0.444	2.25
9	0.0	3.4	0.500	2.00
10	0.0	1.3	0.556	1.80
11	0.0	0.6	0.611	1.64
12	0.0	0.0	0.667	1.50
13	0.0	0.0	0.722	1.38
14	0.0	0.0	0.778	1.29
15	0.0	0.0	0.833	1.20
16	0.0	0.0	0.889	1.13
17	0.0	0.0	0.944	1.06

Annexure:2
Table-6

RAINFALL DATA OF VARIOUS MONTHS USING 75% RELIABLE RAINFALL FOR DIFFERENT MONTHS

S.No.	Month	75% Reliable Rainfall in mm.	Effective Rainfall	
			Using FAO method	Using USDA method
1	January	4.0	0.0	0.0
2	February	13.0	0.0	0.0
3	March	7.5	0.0	0.0
4	April	2.0	0.0	0.0
5	May	8.5	0.0	0.0
6	June	40.0	14.0	29.8
7	July	150.0	95.0	104.0
8	August	187.0	124.6	125.3
9	September	60.0	26.0	44.6
10	October	0.0	0.0	0.0
11	November	0.0	0.0	0.0
12	December	0.0	0.0	0.0

Annexure:2

Table-7

VALUES OF REFERENCE CROP EVAPOTRANSPIRATION(ETo) BY MODIFIED PENMAN METHOD AT WRDTC FARM ROORKEE

S.No.	MONTH	ETo mm/day	ETo mm/month
1	January	2.55	79.05
2	February	3.99	111.72
3	March	6.50	201.50
4	April	8.80	264.00
5	May	9.73	301.63
6	June	8.25	247.50
7	July	7.00	217.00
8	August	6.60	204.60
9	September	6.07	182.10
10	October	5.74	177.94
11	November	4.07	122.10
12	December	3.03	93.93

TABLE NO :-8
ANNEXURE :-2

Reference Evapotranspiration ETo according Penman-Monteith

Country : India				Meteo Station : Roorkee			
Altitude : 252 meter				Coordinates : 29.50 N.L. 77.50 E.L.			
Month	Max. Temp.°c	Min. Temp.°c	Humid %	Wind km/day	Sunshine hours	Sol. Radio. MJ/m²/day	ETo-PenMon mm/day
January	12.0	7.0	70.0	14.0	4.7	10.1	**1.0**
February	15.9	9.1	58.0	25.0	7.1	14.8	**1.7**
March	22.1	13.1	48.0	38.0	9.0	20.1	**2.8**
April	29.1	18.1	40.0	37.0	10.4	24.3	**4.1**
May	32.1	23.4	47.0	52.0	10.7	25.9	**5.1**
June	31.2	24.5	63.0	40.0	8.6	22.9	**4.8**
July	30.4	26.1	73.0	34.0	6.9	20.4	**4.4**
August	29.7	25.3	73.0	25.0	7.4	20.2	**4.2**
September	28.6	23.3	70.0	20.0	7.3	18.3	**3.5**
October	26.2	18.2	60.0	12.0	9.2	18.2	**2.8**
November	20.6	12.3	61.0	9.0	8.4	14.5	**1.8**
December	15.7	8.0	63.0	10.0	7.3	12.1	**1.2**
YEAR	**24.5**	**17.4**	**60.0**	**26.0**	**8.1**	**18.5**	**1142**

Annexure: 2
Table- 9

Sheet-1

CALCULATION OF CROP COEFFICIENT (Kc)

Name of crop : **Sugarcane**

Crop period : **March to February (12 months)**

Number of growth stage : **5**

Total no. of days : **365**

Number of days per growth stage : **73**

Crop Development Stage	Value of Crop Coefficient (Kc)	Average value of Kc
Initial stage	0.4 -0.5	0.45
Crop development	0.7 -1.0	0.85
Mid season	1.0 -1.3	1.15
Late season	0.75 -0.80	0.78
At harvest	0.5 -0.6	0.55

Month	No. of days	Growth stage	Crop coefficient		Kc
			As per G.S.	As per month	
March	31	1	0.45	31x0.45/31	0.45
April	30	1	0.45	30x0.45/30	0.45
May	12	1	0.45	(12x0.45+19x0.85)/31	0.7
	19	2	0.85		
June	30	2	0.85	30x0.85/30	0.85
July	24	2	0.85	(24x0.85+7x1.15)/31	0.92
	7	3	1.15		
August	31	3	1.15	31x1.15/31	1.15
September	30	3	1.15	30x1.15/30	1.15
October	5	3	1.15	(5x1.15+26x0.78)/31	0.84
	26	4	0.78		
November	30	4	0.78	30x0.78/30	0.78
December	17	4	0.78	(17x0.78+14x0.55)/31	0.68
	14	5	0.55		
January	31	5	0.55	31x0.55/31	0.55
February	28	5	0.55	28x0.55/28	0.55

CALCULATION OF CROP COEFFICIENT (Kc)

Name of crop : **Paddy** Crop period : **15th June to 19th October**

Number of growth stage : **5** Total no. of days : **126**

Number of days per growth stage : **25.2**

Crop Development Stage	Value of Crop Coefficient (Kc)	Average value of Kc
Initial stage	1.10 -1.15	1.12
Crop development	1.10 -1.50	1.30
Mid season	1.10 -1.30	1.20
Late season	0.95 -1.05	1.00
At harvest	0.95 -1.05	1.00

Month	No. of days	Growth stage	Crop coefficient		Kc
			As per G.S.	As per month	
June	16	1	1.12	16x1.12/16	1.12
July	9	1	1.12	(9x1.12+22x1.30)/31	1.25
	22	2	1.30		
August	4	2	1.30	(4x1.3+25x1.2+2x1)/31	1.20
	25	3	1.20		
	2	4	1.00		
September	24	4	1.00	(24x1.0+6x1.0)/30	1.00
	6	5	1.00		
October	19	5	1.00	19x1.0/19	1.00

CALCULATION OF CROP COEFFICIENT (Kc)

Name of crop : **Wheat**

Crop period : **20th November to 3rd April**

Number of growth stage : **5**

Total no. of days : **135**

Number of days per growth stage : **27**

Crop Development Stage	Value of Crop Coefficient (Kc)	Average value of Kc
Initial stage	0.3 -0.4	0.35
Crop development	0.7 -0.8	0.75
Mid season	1.05 -1.2	1.15
Late season	0.85 -0.75	0.80
At harvest	0.2 -0.25	0.22

Month	No. of days	Growth stage	Crop coefficient		Kc
			As per G.S.	As per month	
November	11	1	0.35	11x0.35/11	0.35
December	16	1	0.35	(16x0.35+15x0.75)/31	0.54
	15	2	0.75		
January	12	2	0.75	(12x0.75+19x1.15)/31	1.00
	19	3	1.15		
February	8	3	1.15	(8x1.15+20x0.80)/28	0.90
	20	4	0.80		
March	7	4	0.80	(7x0.80+24x0.22)/31	0.35
	24	5	0.22		
April	3	5	0.22	3x0.22/3	0.22

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CALCULATION OF CROP COEFFICIENT (Kc)

Name of crop : **Sorghum**

Crop period : **1st July to 30th Sept. as a fodder**
1st July to 28th Oct. as a food crop

Number of growth stage : **5**

Number of days per growth stage : **24** Total no. of days : **120**

Crop Development Stage	Value of Crop Coefficient (Kc)	Average value of Kc
Initial stage	0.3 -0.4	0.35
Crop development	0.7 -0.75	0.725
Mid season	1.0 -1.15	1.075
Late season	0.75 -0.80	0.775
At harvest	0.50 -0.55	0.525

Month	No. of days	Growth stage	Crop coefficient		Kc
			As per G.S.	As per month	
July	24	1	0.35	(24x0.35+7x0.725)/31	0.43
	7	2	0.725		
August	17	2	0.725	(17x.725+14x1.075)/31	0.88
	14	3	1.075		
September	10	3	1.075	(10x1.075+20x.775)/30	0.88
	20	4	0.775		
October	4	4	0.775	(4x0.775+24x0.525)/28	0.56
	24	5	0.525		

CALCULATION OF CROP COEFFICIENT (Kc)

Name of crop : **Berseem**

Crop period : **1st November to 15th April**

Number of growth stage : **5**

Number of days per growth stage : **33.2**

Total no. of days : **166**

Crop Development Stage	Value of Crop Coefficient (Kc)	Average value of Kc
Initial stage	0.3 -0.4	0.35
Crop development	1.05 -1.20	1.125
Mid season	1.05 -1.20	1.125
Late season	1.05 -1.20	1.125
At harvest	1.05 -1.20	1.125

Month	No. of days	Growth stage	Crop coefficient		Kc
			As per G.S.	As per month	
November	30	1	0.35	30x0.35/30	0.35
December	3	1	0.35	(3x0.35+28x1.125)/31	1.05
	28	2	1.125		
January	5	2	1.125	(5x1.125+26x1.125)/31	1.125
	26	3	1.125		
February	7	3	1.125	(7x1.125+21x1.125)/28	1.125
	21	4	1.125		
March	12	4	1.125	(12x1.125+19x1.125)/31	1.125
	19	5	1.125		
April	15	5	1.125	15x1.125/15	1.125

CROP WATER REQUIREMENT CALCULATION SHEET

Crop : Sugarcane		Date of sowing : March						Crop Period :- 12 months(365 days)						Soil type : Sandy loam		
S.No.	Particulars	Unit	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	Remarks
1	75% Reliable rainfall (P)	mm.	4.0	13.0	7.5	2.0	8.5	40.0	150.0	187.0	60.0	0.0	0.0	0.0	472.0	
2	Effective rainfall (Pe)	mm.	0.0	0.0	0.0	0.0	0.0	29.8	104.0	125.3	44.6	0.0	0.0	0.0	303.7	
3	ETo/day	mm.	2.55	3.99	6.50	8.80	9.73	8.25	7.00	6.60	6.07	5.74	4.07	3.03	-	
4	ETo/month	mm.	79.1	111.7	201.5	264.0	301.6	247.5	217.0	204.6	182.1	177.9	122.1	93.9	-	
5	No. of days in month for water requirement by crop	Days	31	28	31	30	31	30	31	31	30	31	30	31	365	From crop duration mentioned at top
6	Days of growth upto mid of month	Days	322	350	16	46	77	107	138	169	199	230	260	291	-	Cumulative days from start upto mid of current month
7	Percentage of growth upto mid of month	%	88	96	4	12	21	29	38	46	55	63	71	80	-	(Sl. No. 6/Crop period)x100
8	Crop coefficient (Kc)	-	0.55	0.55	0.45	0.45	0.70	0.85	0.92	1.15	1.15	0.84	0.78	0.68	-	
9	Consumptive use (ETc)	mm.	43.48	61.45	90.68	118.8	211.1	210.4	199.6	235.29	209.42	149.5	95.24	63.87	1688.8	Sl.No.3xSl.No.5xSl.No.8
10	Requirement for land preparation	mm.	-	-	100.0	-	-	-	-	-	-	-	-	-	100.0	
11	Seepage and percolation @ 3mm./day	mm.	-	-	-	-	-	90.0	93.0	93.0	90.0	-	-	-	366.0	During major part of monsoon only i.e. June to September.
12	Total requirement	mm.	43.48	61.45	190.7	118.8	211.1	300.4	292.6	328.29	299.42	149.5	95.24	63.87	**2154.8**	Sl.No.9+Sl.No.10+Sl.No.11
13	Net Irrigation Requirement (NIR)	mm.	43.48	61.45	100.0	118.8	211.1	270.6	188.6	202.99	254.82	149.5	95.24	63.87	**1760.5**	Sl.No.12-Sl.No.2
14	Field Irrigation Requirement (FIR)	mm.	57.97	81.93	133.3	158.4	281.5	360.8	251.5	270.65	339.75	199.3	127.0	85.16	**2347.3**	Sl.No. 13/0.75
15	Gross Irrigation Requirement (GIR)	mm.	72.46	102.4	166.7	198.0	351.9	451.0	314.4	338.32	424.69	249.1	158.7	106.5	**2934.1**	Sl.No.14/0.80

CROP WATER REQUIREMENT CALCULATION SHEET - 2

Crop : Wheat		Crop Period:- 20th Nov. to 3rd April (135 days)												Soil type : Sandy loam		
S.No.	Particulars	Unit	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	Remarks
1	75% Reliable rainfall (P)	mm.	4.0	13.0	7.5	2.0	-	-	-	-	-	-	0.0	0.0	26.5	
2	Effective rainfall (Pe)	mm.	0.0	0.0	0.0	0.0	-	-	-	-	-	-	0.0	0.0	0.0	
3	ETo/day	mm.	2.55	3.99	6.50	8.80	-	-	-	-	-	-	4.07	3.03	-	
4	ETo/month	mm.	79.1	111.7	201.5	264.0	-	-	-	-	-	-	122.1	93.9	-	
5	No. of days in month for water requirement by crop	Days	31	28	31	3	-	-	-	-	-	-	11	31	135	From crop duration mentioned at top
6	Days of growth upto mid of month	Days	58	87	117	134	-	-	-	-	-	-	6	27	-	Cumulative days from start upto mid of current month
7	Percentage of growth upto mid of month	%	43	64.4	86.6	99	-	-	-	-	-	-	4.4	20	-	(Sl. No. 6/Crop period)x100
8	Crop coefficient (Kc)	-	1.00	0.90	0.35	0.22	-	-	-	-	-	-	0.35	0.54	-	
9	Consumptive use (ETc)	mm.	79.05	100.5	70.53	5.81	-	-	-	-	-	-	15.67	50.72	322.3	Sl.No.3xSl.No.5xSl.No.8
10	Requirement for land preparation	mm.	-	-	-	-	-	-	-	-	-	-	75.0	-	75.0	
11	Seepage and percolation	mm.	-	-	-	-	-	-	-	-	-	-	-	-	0.0	
12	Total requirement	mm.	79.05	100.5	70.53	5.8	-	-	-	-	-	-	90.67	50.72	**397.3**	Sl.No.9+Sl.No.10+Sl.No.11
13	Net Irrigation Requirement (NIR)	mm.	79.05	100.5	70.53	5.8	-	-	-	-	-	-	90.67	50.72	**397.3**	Sl.No.12-Sl.No.2
14	Field Irrigation Requirement (FIR)	mm.	105.4	134.1	94.03	7.7	-	-	-	-	-	-	120.9	67.63	**529.8**	Sl.No. 13/0.75
15	Gross Irrigation Requirement (GIR)	mm.	131.8	167.6	117.5	9.7	-	-	-	-	-	-	151.1	84.5	**662.2**	Sl.No.14/0.80

CROP-WATER REQUIREMENT CALCULATION SHEET - 3

Crop : Sorghum		Crop Period:-1st July to 30th Sept.(92 days) as a fodder crop and 1st July to 28th Oct.(120 days) as a food crop												Soil type : Sandy loam		
S.No.	**Particulars**	**Unit**	**Jan.**	**Feb.**	**Mar.**	**Apr.**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**	**Total**	**Remarks**
1	75% Reliable rainfall (P)	mm.	-	-	-	-	-	-	150.0	187.0	60.0	0.0	-	-	397.0	
2	Effective rainfall (Pe)	mm.	-	-	-	-	-	-	104.0	125.3	44.6	0.0	-	-	273.9	
3	ETo/day	mm.	-	-	-	-	-	-	7.00	6.60	6.07	5.74	-	-	-	
4	ETo/month	mm.	-	-	-	-	-	-	217.0	204.6	182.1	177.9	-	-	-	
5	No. of days in month for water requirement by crop	Days	-	-	-	-	-	-	31	31	30	28	-	-	120	From crop duration mentioned at top
6	Days of growth upto mid of month	Days	-	-	-	-	-	-	16	47	77	106	-	-	-	Cumulative days from start upto mid of current month
7	Percentage of growth upto mid of month	%	-	-	-	-	-	-	13.3	39.2	64.2	88.3	-	-	-	(Sl. No. 6/Crop period)x100
8	Crop coefficient (Kc)	-	-	-	-	-	-	-	0.43	0.88	0.88	0.56	-	-	-	
9	Consumptive use (ETc)	mm.	-	-	-	-	-	-	93.31	180.05	160.25	90.0	-	-	523.6	Sl.No.3xSl.No.5xSl.No.8
10	Requirement for land preparation	mm.	-	-	-	-	-	-	75.00	-	-	-	-	-	75.0	
11	Seepage and percolation	mm.	-	-	-	-	-	-	-	-	-	-	-	-	0.0	
12	Total requirement	mm.	-	-	-	-	-	-	168.3	180.05	160.25	90.0	-	-	**598.6**	Sl.No.9+Sl.No.10+Sl.No.11
13	Net Irrigation Requirement (NIR)	mm.	-	-	-	-	-	-	64.31	54.75	115.65	90.0	-	-	**324.7**	Sl.No.12-Sl.No.2
14	Field Irrigation Requirement (FIR)	mm.	-	-	-	-	-	-	85.75	73.0	154.2	120.0	-	-	**432.9**	Sl.No. 13/0.75
15	Gross Irrigation Requirement (GIR)	mm.	-	-	-	-	-	-	107.2	91.25	192.75	150.0	-	-	**541.2**	Sl.No.14/0.80

CROP WATER REQUIREMENT CALCULATION SHEET - 4

Crop : Berseem		Crop Period :- 1st November to 15th April (166 days)												Soil type : Sandy loam		
S.No.	Particulars	Unit	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	Remarks
1	75% Reliable rainfall (P)	mm.	4.0	13.0	7.5	2.0	-	-	-	-	-	-	0.0	0.0	26.5	
2	Effective rainfall (Pe)	mm.	0.0	0.0	0.0	0.0	-	-	-	-	-	-	0.0	0.0	0.0	
3	ETo/day	mm.	2.55	3.99	6.50	8.80	-	-	-	-	-	-	4.07	3.03	-	
4	ETo/month	mm.	79.1	111.7	201.5	264.0	-	-	-	-	-	-	122.1	93.9	-	
5	No. of days in month for water requirement by crop	Days	31	28	31	15	-	-	-	-	-	-	30	31	166	From crop duration mentioned at top
6	Days of growth upto mid of month	Days	77	106	136	159	-	-	-	-	-	-	15	46	-	Cumulative days from start upto mid of current month
7	Percentage of growth upto mid of month	%	46.4	63.8	81.9	95.8	-	-	-	-	-	-	9.0	27.7	-	(Sl. No. 6/Crop period)x100
8	Crop coefficient (Kc)	-	1.125	1.125	1.125	1.125	-	-	-	-	-	-	0.35	1.05	-	
9	Consumptive use (ETc)	mm.	88.9	125.7	226.7	148.5	-	-	-	-	-	-	42.74	98.63	731.2	Sl.No.3xSl.No.5xSl.No.8
10	Requirement for land preparation	mm.	-	-	-	-	-	-	-	-	-	-	75.0	-	75.0	
11	Seepage and percolation	mm.	-	-	-	-	-	-	-	-	-	-	-	-	0.0	
12	Total requirement	mm.	88.93	125.7	226.7	148.5	-	-	-	-	-	-	117.7	98.63	**806.2**	Sl.No.9+Sl.No.10+Sl.No.11
13	Net Irrigation Requirement (NIR)	mm.	88.93	125.7	226.7	148.5	-	-	-	-	-	-	117.7	98.63	**806.2**	Sl.No.12-Sl.No.2
14	Field Irrigation Requirement (FIR)	mm.	118.6	167.6	302.3	198.0	-	-	-	-	-	-	157.0	131.5	**1074.9**	Sl.No. 13/0.75
15	Gross Irrigation Requirement (GIR)	mm.	148.2	209.5	377.8	247.5	-	-	-	-	-	-	196.2	164.4	**1343.6**	Sl.No.14/0.80

CROP WATER REQUIREMENT CALCULATION SHEET - 5

Crop : Paddy		Crop Period :- 15th June to 19th October (127 days)																Soil type : Sandy loam	
S.No.	Particulars	Unit	J.	F.	M.	A.	M.	June		July			Aug.	Sept.	Oct.	N.	D.	Total	Remarks
1	75% Reliable rainfall (P)	mm.	-	-	-	-	-	40.0		150.0			187.0	60.0	0.0	-	-	437.0	
2	Effective rainfall (Pe)	mm.	-	-	-	-	-	29.8		104.0			125.3	44.6	0.0	-	-	303.7	
3	ETo/day	mm.	-	-	-	-	-	8.25		7.00			6.60	6.07	5.74	-	-	-	
4	ETo/month	mm.	-	-	-	-	-	247.5		217.0			204.6	182.1	177.9	-	-	-	
								NURSERY			FIELD								
5	No. of days in month for water requirement by crop	Days	-	-	-	-	-	15 -19 5 days	20-30 11 days	1 -23 23 days	19 -23 5 days	24 -31 8 days	31	30	19	-	-	132	From crop duration mentioned at top
6	Days of growth upto mid of month	Days	-	-	-	-	-	-	6	23	-	4	24	54	79	-	-	-	Cumulative days from start upto mid of current month
7	Percentage of growth upto mid of month	%	-	-	-	-	-	-	-	-	-	3.175	19.05	42.86	62.7	-	-	-	(Sl. No. 6/Crop period)x100
8	Crop coefficient (Kc)	-	-	-	-	-	-	0.85		0.92			1.15	1.15	0.84	-	-	-	
9	Consumptive use (ETc)	mm.	-	-	-	-	-	35.06	77.14	148.1	32.20	51.52	235.3	209.4	91.61	-	-	880.4	Sl.No.3xSl.No.5xSl.No.8
10	Requirement for land preparation	mm.	-	-	-	-	-	400.0	-	-	400.0	-	-	-	-	-	-	800.0	
11	Seepage and percolation @ 5mm./day	mm.	-	-	-	-	-	25.0	55.0	115.0	25.0	40.0	155.0	150.0	95.0	-	-	660.0	
12	Total requirement	mm.	-	-	-	-	-	460.1	132.1	263.1	457.2	91.52	390.3	359.4	186.6	-	-	**2340.4**	Sl.No.9+Sl.No.10+Sl.No.11
13	Net Irrigation Requirement (NIR)	mm.	-	-	-	-	-	(460.1+132.1-29.8)/20=28.1		263.1/20+457.2+91.52 -104=457.9			265.0	314.8	186.6	-	-	**1252.4**	Sl.No.12-Sl.No.2
14	Field Irrigation Requirement (FIR)	mm.	-	-	-	-	-	37.47		610.50			353.32	419.8	248.8	-	-	**1669.9**	Sl.No. 13/0.75
15	Gross Irrigation Requirement (GIR)	mm.	-	-	-	-	-	46.84		763.13			441.7	524.7	311.0	-	-	**2087.3**	Sl.No.14/0.80

Annexure:3

Table-1 Sheet-1

DAILY DISCHARGE OF RIGHT MAIN DISTRIBUTARY SEASON -- 1998/1999

MONTH	APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER	
DATE	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs
1	-	-	-	-	1.8	73.5	-	-	1.3	52.3	-	-
2	-	-	-	-	1.8	73.5	0.8	38.0	1.3	52.3	-	-
3	1.0	43.0	-	-	1.8	73.5	0.8	38.0	1.3	52.3	-	-
4	1.2	48.8	-	-	1.8	73.5	1.0	43.0	1.2	48.8	-	-
5	1.2	48.8	-	-	1.8	73.5	1.2	48.8	1.2	48.8	-	-
6	-	-	-	-	1.6	64.5	1.3	52.3	1.0	43.0	-	-
7	-	-	0.6	32.0	1.6	64.5	1.0	43.0	1.0	43.0	-	-
8	-	-	0.6	32.0	1.6	64.5	1.0	43.0	-	-	-	-
9	-	-	0.4	25.0	1.6	64.5	1.0	43.0	-	-	-	-
10	-	-	0.4	25.0	1.6	64.5	1.2	48.8	-	-	-	-
11	-	-	0.4	25.0	1.8	73.5	1.2	48.8	0.8	38.0	-	-
12	-	-	0.4	25.0	1.8	73.5	0.8	38.0	1.0	43.0	-	-
13	-	-	0.4	25.0	1.5	60.0	0.7	35.0	-	-	0.5	28.0
14	-	-	1.3	52.3	1.5	60.0	1.0	43.0	0.7	35.0	0.5	28.0
15	-	-	1.5	60.0	1.5	60.0	1.0	43.0	0.5	28.0	-	-
16	1.3	52.3	1.6	64.5	1.5	60.0	0.8	38.0	-	-	-	-
17	1.2	48.8	-	-	1.2	48.8	0.8	38.0	-	-	-	-
18	1.5	60.0	-	-	1.0	43.0	0.8	38.0	-	-	0.7	35.0
19	1.5	60.0	-	-	-	-	0.8	38.0	-	-	1.0	43.0
20	1.5	60.0	-	-	0.5	28.0	-	-	-	-	1.0	43.0
21	1.5	60.0	-	-	0.5	28.0	-	-	-	-	-	-
22	1.5	60.0	1.0	43.0	0.5	28.0	-	-	-	-	1.0	43.0
23	1.5	60.0	1.8	73.5	0.5	28.0	-	-	-	-	1.0	43.0
24	1.5	60.0	1.8	73.5	0.5	28.0	0.7	35.0	-	-	0.8	38.0
25	1.5	60.0	1.8	73.5	-	-	0.8	38.0	-	-	-	-
26	1.5	60.0	1.8	73.5	-	-	0.8	38.0	-	-	-	-
27	1.5	60.0	1.8	73.5	-	-	0.8	38.0	-	-	-	-
28	-	-	1.8	73.5	-	-	1.2	48.8	-	-	-	-
29	-	-	1.8	73.5	-	-	1.2	48.8	-	-	-	-
30	-	-	1.8	73.5	-	-	1.3	52.3	-	-	-	-
31			1.8	73.5			1.3	52.3	-	-		
Total in Cusec-day		**841.7**		**1070**		**1309**		**1108.9**		**484.5**		**301.0**
Total in Ha-m.		**205.932**		**261.86**		**320.214**		**271.31**		**118.539**		**73.6433**

Sheet-2

DAILY DISCHARGE OF RIGHT MAIN DISTRIBUTARY SEASON -- 1998/1999

MONTH	OCTOBER		NOVEMBER		DECEMBER		JANUARUY		FEBRUARY		MARCH	
DATE	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs
1	-	-	-	-	-	-	1.6	64.5	-	-	-	-
2	-	-	-	-	1.2	48.8	1.8	73.5	-	-	-	-
3	-	-	-	-	1.5	60.0	1.8	73.5	-	-	-	-
4	-	-	-	-	1.5	60.0	1.8	73.5	-	-	-	-
5	-	-	-	-	-	-	1.8	73.5	-	-	-	-
6	-	-	-	-	-	-	1.8	73.5	-	-	-	-
7	-	-	-	-	-	-	1.5	60.0	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-	-	-	-	-	-
20	-	-	1..5	60.0	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	1.5	60.0	-	-
22	-	-	1.5	60.0	-	-	-	-	1.5	60.0	-	-
23	-	-	1.5	60.0	-	-	-	-	1.5	60.0	-	-
24	-	-	-	-	-	-	-	-	1.5	60.0	-	-
25	-	-	-	-	-	-	-	-	-	-	1.0	43.0
26	-	-	1.5	60.0	-	-	-	-	-	-	1.0	43.0
27	-	-	1.6	64.5	-	-	-	-	-	-	1.0	43.0
28	-	-	1.5	60.0	-	-	-	-	-	-	1.0	43.0
29	-	-	1.5	60.0	-	-	-	-			1.0	43.0
30	-	-	1.5	60.0	-	-	-	-			1.0	43.0
31	-	-			1.0	43.0	-	-			1.0	43.0
Total in Cusec-day		0.0		484.5		211.8		492.0		240.0		301.0
Total in Ha-m.		0		118.54		51.8194		120.37		58.7189		73.6433

DAILY DISCHARGE OF RIGHT MAIN DISTRIBUTARY SEASON -- 1999/2000

MONTH	APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER	
DATE	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs
1	1.5	60.0	-	-	1.8	73.5	0.8	38.0	-	-	-	-
2	1.5	60.0	-	-	1.8	73.5	0.8	38.0	-	-	1.0	43.0
3	1.5	60.0	-	-	1.8	73.5	1.4	56.0	1.0	43.0	1.0	43.0
4	1.5	60.0	-	-	1.8	73.5	-	-	-	-	1.3	52.3
5	1.5	60.0	-	-	1.8	73.5	1.0	43.0	1.0	43.0	1.3	52.3
6	1.5	60.0	-	-	-	-	1.2	48.8	1.0	43.0	1.3	52.3
7	1.5	60.0	1.8	73.5	1.8	73.5	1.2	48.8	1.0	43.0	1.2	48.8
8	1.6	64.5	1.8	73.5	1.8	73.5	1.0	43.0	1.0	43.0	1.2	48.8
9	1.6	64.5	1.8	73.5	1.8	73.5	1.0	43.0	1.0	43.0	1.0	43.0
10	1.8	73.5	1.8	73.5	-	-	1.0	43.0	1.0	43.0	1.0	43.0
11	1.8	73.5	1.8	73.5	-	-	1.0	43.0	1.0	43.0	1.0	43.0
12	1.8	73.5	1.8	73.5	-	-	1.3	52.3	1.2	48.8	1.0	43.0
13	1.8	73.5	1.8	73.5	-	-	1.3	52.3	1.0	43.0	-	-
14	1.8	73.5	1.8	73.5	-	-	1.3	52.3	1.2	48.8	-	-
15	1.0	43.0	1.8	73.5	-	-	1.8	73.5	1.2	48.8	-	-
16	1.8	73.5	1.8	73.5	-	-	1.5	60.0	1.2	48.8	-	-
17	1.0	43.0	1.8	73.5	1.8	73.5	1.5	60.0	1.2	48.8	-	-
18	1.5	60.0	1.8	73.5	1.4	56.0	1.5	60.0	1.3	52.3	-	-
19	1.6	64.5	1.6	64.5	1.0	43.0	1.3	52.3	1.3	52.3	-	-
20	1.8	73.5	1.0	43.0	1.0	43.0	1.3	52.3	1.2	48.8	-	-
21	1.8	73.5	-	-	0.7	35.0	1.3	52.3	-	-	-	-
22	2.0	85.0	-	-	-	-	1.0	43.0	-	-	-	-
23	2.0	85.0	-	-	-	-	1.0	43.0	-	-	1.0	43.0
24	2.0	85.0	-	-	1.6	64.5	0.4	20.0	1.0	43.0	1.0	43.0
25	2.0	85.0	-	-	1.8	73.5	0.4	20.0	1.0	43.0	1.0	43.0
26	2.0	85.0	1.6	64.5	1.8	73.5	0.4	20.0	1.0	43.0	0.8	38.0
27	1.0	43.0	1.5	60.0	1.8	73.5	0.4	20.0	1.0	43.0	0.8	38.0
28	-	-	1.6	64.5	1.5	60.0	0.4	20.0	1.2	48.8	0.8	38.0
29	1.0	43.0	1.8	73.5	1.5	60.0	-	-	-	-	-	-
30	1.0	43.0	1.8	73.5	1.3	52.3	-	-	-	-	-	-
31			1.8	73.5			-	-	-	-		
Total in Cusec-day		1901.5		1399		1296		1197.9		1005.2		755.5
Total in Ha-m.		465.225		342.28		317.033		293.08		245.934		184.842

Sheet-4

DAILY DISCHARGE OF RIGHT MAIN DISTRIBUTARY SEASON -- 1999/2000

MONTH	OCTOBER		NOVEMBER		DECEMBER		JANUARUY		FEBRUARY		MARCH	
DATE	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs
1	1.0	43.0	-	-	1.2	48.8	0.5	30.0	-	-	-	-
2	1.0	43.0	-	-	1.2	48.8	0.5	30.0	-	-	-	-
3	1.0	43.0	-	-	-	-	0.5	30.0	-	-	-	-
4	1.0	43.0	-	-	-	-	0.6	32.0	-	-	-	-
5	1.0	43.0	-	-	-	-	0.6	32.0	-	-	-	-
6	1.0	43.0	-	-	-	-	0.5	30.0	-	-	-	-
7	1.0	43.0	-	-	-	-	1.2	48.8	-	-	-	-
8	1.0	43.0	-	-	-	-	1.2	48.8	-	-	-	-
9	1.0	43.0	-	-	-	-	1.2	48.8	Deoband Branch closed	-	1.8	73.5
10	1.0	43.0	-	-	-	-	1.2	48.8		-	1.5	60.0
11	1.0	43.0	0.5	30.0	-	-	1.2	48.8		-	1.5	60.0
12	1.0	43.0	1.5	60.0	-	-	1.2	48.8		-	1.5	60.0
13	1.0	43.0	1.5	60.0	-	-	0.8	38.0		-	1.5	60.0
14	1.3	52.3	1.5	60.0	-	-	0.8	38.0		-	1.5	60.0
15	1.3	52.3	1.5	60.0	-	-	-	-		-	1.5	60.0
16	1.5	60.0	1.4	56.0	-	-	-	-		-	-	-
17	1.5	60.0	1.4	56.0	-	-	-	-		-	-	-
18	1.5	60.0	1.4	56.0	-	-	-	-		-	-	-
19	1.4	56.0	1.4	56.0	-	-	-	-		-	-	-
20	1.0	43.0	1.2	48.8	-	-	-	-		-	-	-
21	-	-	-	-	-	-	-	-		-	-	-
22	-	-	-	-	-	-	-	-		-	-	-
23	-	-	-	-	-	-	-	-		-	-	-
24	-	-	-	-	-	-	-	-		-	-	-
25	-	-	1.3	52.3	-	-	-	-		-	-	-
26	-	-	1.3	52.3	1.3	52.3	-	-		-	-	-
27	-	-	1.2	48.8	1.3	52.3	-	-		-	-	-
28	-	-	1.3	52.3	1.3	52.3	-	-		-	-	-
29	-	-	1.3	52.3	1.3	52.3	-	-		-	-	-
30	-	-	1.3	52.3	1.0	43.0	-	-			-	-
31	-	-			1.0	43.0	-	-			1.0	43.0
Total in Cusec-day		942.6		853.1		392.8		552.8		0.0		476.5
Total in Ha-m.		230.619		208.72		96.1033		135.25		0		116.582

DAILY DISCHARGE OF RIGHT MAIN DISTRIBUTARY SEASON -- 2000/2001

MONTH	APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER	
DATE	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs
1	1.0	43.0	1.2	48.8	1.4	56.0	1.0	43.0	-	-	0.5	30.0
2	1.0	43.0	1.2	48.8	1.4	56.0	1.0	43.0	-	-	0.6	32.0
3	1.0	43.0	1.4	56.0	1.4	56.0	1.0	43.0	-	-	0.5	30.0
4	0.5	30.0	1.4	56.0	1.1	45.0	0.8	38.0	0.4	25.0	-	-
5	1.5	60.0	1.4	56.0	1.1	45.0	0.8	38.0	0.4	25.0	-	-
6	1.0	43.0	1.3	52.3	1.0	43.0	1.0	43.0	-	-	-	-
7	1.0	43.0	1.3	52.3	-	-	1.0	43.0	-	-	-	-
8	1.0	43.0	0.5	30.0	-	-	1.0	43.0	-	-	-	-
9	1.0	43.0	0.5	30.0	-	-	1.0	43.0	-	-	-	-
10	1.0	43.0	0.4	25.0	-	-	1.0	43.0	-	-	-	-
11	1.4	56.0	-	-	-	-	-	-	1.0	38.0	-	-
12	1.4	56.0	-	-	-	-	-	-	1.0	38.0	-	-
13	1.0	43.0	-	-	-	-	0.8	38.0	1.0	38.0	-	-
14	1.2	48.8	-	-	-	-	1.0	43.0	1.0	38.0	-	-
15	1.2	48.8	-	-	-	-	1.0	43.0	1.0	38.0	-	-
16	1.2	48.8	-	-	-	-	1.0	43.0	-	-	-	-
17	1.2	48.8	-	-	-	-	1.0	43.0	-	-	-	-
18	1.2	48.8	-	-	-	-	1.0	43.0	0.5	30.0	-	-
19	1.2	48.8	-	-	-	-	0.5	30.0	0.5	30.0	-	-
20	0.8	38.0	-	-	-	-	0.5	30.0	0.5	30.0	-	-
21	0.4	25.0	1.0	43.0	-	-	0.5	30.0	0.5	30.0	0.5	30.0
22	0.8	38.0	1.4	56.0	1.0	43.0	0.5	30.0	0.5	30.0	0.5	30.0
23	1.0	43.0	1.4	56.0	1.0	43.0	0.5	30.0	0.5	30.0	1.0	43.0
24	1.0	43.0	1.4	56.0	1.0	43.0	0.5	30.0	0.5	30.0	1.0	43.0
25	1.8	73.5	1.4	56.0	1.0	43.0	0.5	30.0	0.5	30.0	1.0	43.0
26	1.8	73.5	1.4	56.0	1.0	43.0	0.5	30.0	0.5	30.0	1.0	43.0
27	1.8	73.5	1.4	56.0	1.0	43.0	0.5	30.0	0.5	30.0	1.0	43.0
28	1.4	56.0	1.4	56.0	1.0	43.0	-	-	0.5	30.0	1.0	43.0
29	1.4	56.0	1.4	56.0	1.0	43.0	-	-	0.5	30.0	1.0	43.0
30	1.2	48.8	1.4	56.0	1.0	43.0	-	-	0.5	30.0	1.0	43.0
31			1.4	56.0			-	-	0.5	30.0		
Total in Cusec-day		**1450.1**		**1058**		**688.0**		**943.0**		**660.0**		**496.0**
Total in Ha-m.		354.785		258.9		168.328		230.72		161.477		121.352

Sheet-6

DAILY DISCHARGE OF RIGHT MAIN DISTRIBUTARY SEASON -- 2000/2001

MONTH	OCTOBER		NOVEMBER		DECEMBER		JANUARUY		FEBRUARY		MARCH	
DATE	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs
1	-	-	-	-	-	-	Deoband Branch closed		-	-	Deoband Branch closed	
2	-	-	-	-	-	-			-	-		
3	-	-	-	-	-	-			-	-		
4	-	-	-	-	-	-			-	-		
5	2.0	85.0	-	-	-	-			-	-		
6	2.0	85.0	-	-	-	-			-	-		
7	1.0	43.0	-	-	-	-			-	-		
8	1.0	43.0	-	-	-	-			-	-		
9	1.0	43.0	1.2	48.8	-	-			-	-		
10	1.0	43.0	1.8	73.5	-	-			-	-	-	-
11	1.0	43.0	1.8	73.5	-	-			-	-	-	-
12	-	-	1.8	73.5	-	-			-	-	-	-
13	-	-	1.8	73.5	-	-			-	-	-	-
14	-	-	1.8	73.5	1.5	60.0			-	-	-	-
15	-	-	-	-	1.0	43.0			-	-	-	-
16	-	-	1.8	73.5	1.0	43.0			-	-	-	-
17	-	-	1.8	73.5	1.0	43.0	-	-	-	-	-	-
18	-	-	1.8	73.5	1.0	43.0	1.5	60.0	-	-	-	-
19	-	-	1.8	73.5	1.0	43.0	1.5	60.0	-	-	-	-
20	-	-	1.8	73.5	1.0	43.0	1.5	60.0	-	-	-	-
21	-	-	1.8	73.5	1.0	43.0	1.5	60.0	-	-	-	-
22	-	-	1.8	73.5	1.0	43.0	1.7	69.0	1.7	69.0	-	-
23	-	-	-	-	1.5	60.0	1.4	56.0	1.7	69.0	-	-
24	-	-	-	-	1.5	60.0	1.4	56.0	1.7	69.0	-	-
25	-	-	-	-	1.5	60.0	-	-	1.7	69.0	-	-
26	-	-	-	-	1.5	60.0	-	-	1.8	73.5	-	-
27	-	-	-	-	1.5	60.0	-	-	1.8	73.5	-	-
28	-	-	-	-	-	-	-	-	1.8	73.5	-	-
29	-	-	-	-	-	-	-	-			0.9	41.0
30	-	-	-	-	-	-	-	-			2.0	85.0
31	-	-			-	-	-	-			-	-
Total in Cusec-day		**385.0**		**930.8**		**704.0**		**421.0**		**496.5**		**126.0**
Total in Ha-m.		94.1949		227.73		172.242		103.0		121.475		30.8274

Sheet-7

DAILY DISCHARGE OF RIGHT MAIN DISTRIBUTARY SEASON -- 2001/2002

MONTH	APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER	
DATE	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs
1	2.0	85.0	1.6	64.5	-	-	0.5	29.0	-	-	2.2	97.0
2	1.5	60.0	1.6	64.5	-	-	0.5	29.0	-	-	2.2	97.0
3	1.6	64.5	1.6	64.5	-	-	0.8	38.0	1.6	64.5	2.2	97.0
4	1.9	79.0	1.6	64.5	-	-	1.0	43.0	1.0	43.0	2.2	97.0
5	1.9	79.0	1.6	64.5	-	-	1.0	43.0	-	-	2.2	97.0
6	1.9	79.0	1.5	60.0	-	-	1.6	64.5	0.7	35.0	2.2	97.0
7	1.9	79.0	1.5	60.0	-	-	1.6	64.5	1.3	52.3	2.2	97.0
8	1.8	73.5	1.5	60.0	-	-	0.8	38.0	1.5	60.0	2.2	97.0
9	1.8	73.5	1.5	60.0	-	-	1.2	48.8	0.7	35.0	2.2	97.0
10	1.8	73.5	1.5	60.0	-	-	1.6	64.5	1.6	64.5	2.2	97.0
11	1.8	73.5	1.6	64.5	-	-	1.6	64.5	1.6	64.5	2.2	97.0
12	-	-	1.6	64.5	-	-	1.6	64.5	-	-	2.2	97.0
13	-	-	1.6	64.5	-	-	1.4	56.0	1.6	64.5	2.2	97.0
14	-	-	1.6	64.5	-	-	0.7	35.0	1.6	64.5	2.2	97.0
15	-	-	1.6	64.5	1.6	64.5	0.5	29.0	1.6	64.5	2.2	97.0
16	-	-	1.5	60.0	1.5	60.0	0.6	32.0	0.4	26.0	2.2	97.0
17	-	-	1.6	64.5	0.5	29.0	-	-	1.6	64.5	2.2	97.0
18	-	-	1.4	56.0	-	-	-	-	1.6	64.5	2.2	97.0
19	-	-	-	-	-	-	-	-	1.6	64.5	2.2	97.0
20	-	-	1.0	43.0	-	-	-	-	1.6	64.5	2.2	97.0
21	-	-	0.5	29.0	-	-	-	-	1.7	69.0	2.2	97.0
22	-	-	0.5	29.0	-	-	-	-	1.7	69.0	2.2	97.0
23	-	-	0.6	32.0	-	-	-	-	1.7	69.0	2.2	97.0
24	-	-	1.0	43.0	-	-	-	-	1.8	73.5	2.2	97.0
25	-	-	1.2	48.8	-	-	-	-	1.8	73.5	2.2	97.0
26	2.0	85.0	1.5	60.0	-	-	0.6	32.0	1.8	73.5	2.7	132.0
27	1.8	73.5	1.5	60.0	-	-	-	-	1.8	73.5	2.7	132.0
28	2.0	85.0	1.5	60.0	1.6	64.5	-	-	1.8	73.5	-	-
29	2.0	85.0	1.5	60.0	0.6	32.0	-	-	1.8	73.5	-	-
30	2.0	85.0	1.5	60.0	0.5	29.0	-	-	2.2	97.0	-	-
31			-	-			-	-	2.2	97.0	-	
Total in Cusec-day		1233.0		1650		279.0		775.3		1738.3		2689
Total in Ha-m.		301.668		403.77		68.2607		189.69		425.296		657.897

Sheet-8

DAILY DISCHARGE OF RIGHT MAIN DISTRIBUTARY SEASON -- 2001/2002

MONTH	OCTOBER		NOVEMBER		DECEMBER		JANUARUY		FEBRUARY		MARCH	
DATE	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs
1	-	-	-	-	2.2	97.0	2.7	132.0	2.7	132.0	2.7	132.0
2	-	-	-	-	-	-	2.8	140.0	2.7	132.0	0.5	29.0
3	-	-	-	-	-	-	2.7	132.0	2.7	132.0	-	-
4	2.0	85.0	-	-	-	-	2.8	140.0	2.7	132.0	-	-
5	2.0	85.0	-	-	-	-	2.5	117.0	2.7	132.0	1.0	43.0
6	2.0	85.0	2.0	85.0	-	-	2.6	125.0	2.7	132.0	-	-
7	2.0	85.0	2.0	85.0	-	-	2.7	132.0	-	-	-	-
8	2.5	117.0	2.0	85.0	-	-	2.7	132.0	-	-	-	-
9	2.5	117.0	2.5	117.0	-	-	2.7	132.0	-	-	-	-
10	2.5	117.0	2.5	117.0	-	-	-	-	-	-	-	-
11	2.5	117.0	2.5	117.0	-	-	-	-	-	-	-	-
12	2.5	117.0	2.5	117.0	-	-	-	-	-	-	-	-
13	2.7	132.0	2.5	117.0	-	-	-	-	-	-	-	-
14	2.7	132.0	2.5	117.0	-	-	-	-	-	-	2.7	132.0
15	2.5	117.0	2.5	117.0	-	-	-	-	-	-	2.7	132.0
16	2.5	117.0	-	-	-	-	-	-	-	-	2.7	132.0
17	-	-	-	-	-	-	-	-	-	-	2.0	85.0
18	-	-	-	-	-	-	-	-	-	-	2.5	117.0
19	-	-	-	-	-	-	-	-	-	-	2.7	132.0
20	-	-	-	-	-	-	-	-	-	-	2.7	132.0
21	-	-	-	-	-	-	-	-	2.1	91.0	-	-
22	-	-	2.5	117.0	-	-	-	-	2.1	91.0	-	-
23	-	-	2.5	117.0	-	-	-	-	2.3	103.0	-	-
24	-	-	-	-	-	-	-	-	2.0	85.0	-	-
25	-	-	-	-	-	-	-	-	2.0	85.0	-	-
26	-	-	2.5	117.0	-	-	-	-	2.0	85.0	-	-
27	-	-	2.8	140.0	2.5	117.0	-	-	2.0	85.0	-	-
28	-	-	2.8	140.0	2.5	117.0	-	-	2.0	85.0	2.7	132.0
29	-	-	2.5	117.0	2.7	132.0	-	-			2.7	132.0
30	-	-	2.5	117.0	2.7	132.0	-	-			2.7	132.0
31	-	-			2.5	117.0	2.7	132.0			1.0	43.0
Total in Cusec-day		**1423.0**		**1939**		**712.0**		**1314.0**		**1502.0**		**1505.0**
Total in Ha-m.		348.154		474.4		174.199		321.49		367.483		368.217

DAILY DISCHARGE OF RIGHT MAIN DISTRIBUTARY SEASON -- 2002/2003

MONTH	APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER	
DATE	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs
1	2.8	140.0	2.5	117.0	1.0	43.0	2.5	117.0	-	-	2.6	125.0
2	2.7	132.0	2.5	117.0	1.0	43.0	2.5	117.0	-	-	2.6	125.0
3	2.7	132.0	2.7	132.0	1.0	43.0	2.5	117.0	-	-	2.6	125.0
4	2.7	132.0	2.7	132.0	1.5	60.0	2.2	97.0	2.5	117.0	2.0	85.0
5	2.7	132.0	2.7	132.0	2.5	117.0	2.7	132.0	2.5	117.0	-	-
6	2.7	132.0	2.7	132.0	2.3	103.0	2.2	97.0	-	-	1.5	60.0
7	2.7	132.0	2.7	132.0	2.3	103.0	2.2	97.0	-	-	-	-
8	2.7	132.0	2.7	132.0	1.5	60.0	2.0	85.0	2.5	117.0	-	-
9	2.7	132.0	2.7	132.0	2.3	103.0	2.0	85.0	2.5	117.0	-	-
10	2.0	85.0	-	-	2.3	103.0	2.0	85.0	2.5	117.0	-	-
11	1.0	43.0	2.8	140.0	2.3	103.0	2.5	117.0	2.5	117.0	-	-
12	2.0	85.0	2.8	140.0	2.3	103.0	2.2	97.0	2.0	85.0	-	-
13	2.0	85.0	2.8	140.0	1.5	60.0	2.2	97.0	-	-	-	-
14	2.0	85.0	2.8	140.0	2.0	85.0	2.2	97.0	-	-	-	-
15	-	-	2.8	140.0	2.0	85.0	2.5	117.0	-	-	-	-
16	2.0	85.0	2.8	140.0	-	-	2.2	97.0	-	-	-	-
17	2.0	85.0	2.8	140.0	-	-	2.2	97.0	-	-	-	-
18	2.5	117.0	2.8	140.0	1.0	43.0	2.5	117.0	-	-	-	-
19	2.5	117.0	2.8	140.0	1.0	43.0	2.2	97.0	-	-	-	-
20	2.5	117.0	2.8	140.0	1.0	43.0	2.5	117.0	-	-	-	-
21	-	-	2.8	140.0	1.0	43.0	2.5	117.0	-	-	-	-
22	2.5	117.0	2.8	140.0	2.0	85.0	2.8	140.0	2.0	85.0	-	-
23	2.5	117.0	2.8	140.0	2.5	117.0	2.6	125.0	2.0	85.0	-	-
24	2.5	117.0	2.5	117.0	1.5	60.0	2.6	125.0	2.5	117.0	-	-
25	2.5	117.0	1.5	60.0	2.2	97.0	2.6	125.0	2.5	117.0	-	-
26	-	-	1.5	60.0	2.2	97.0	2.6	125.0	2.5	117.0	-	-
27	-	-	1.5	60.0	2.0	85.0	2.6	125.0	2.6	125.0	-	-
28	-	-	-	-	2.0	85.0	2.5	117.0	2.6	125.0	-	-
29	-	-	1.5	60.0	2.0	85.0	2.5	117.0	2.6	125.0	-	-
30	-	-	1.0	43.0	1.5	60.0	2.7	132.0	2.6	125.0	-	-
31			1.0	43.0			2.7	132.0	2.5	117.0	-	-
Total in Cusec-day		2568		3421		2157		3459		1925.0		520.0
Total in Ha-m.		628.292		836.99		527.736		846.29		470.975		127.224

Sheet-10

DAILY DISCHARGE OF RIGHT MAIN DISTRIBUTARY SEASON -- 2002/2003

MONTH	OCTOBER		NOVEMBER		DECEMBER		JANUARUY		FEBRUARY		MARCH	
DATE	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs
1	-	-	-	-	2.7	132.0	-	-	-	-	1.8	73.5
2	-	-	-	-	2.7	132.0	-	-	-	-	1.0	43.0
3	-	-	-	-	2.7	132.0	2.5	117.0	-	-	1.0	43.0
4	2.0	85.0	-	-	2.7	132.0	2.5	117.0	-	-	-	-
5	2.7	132.0	-	-	-	-	2.5	117.0	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-
8	2.5	117.0	-	-	-	-	-	-	-	-	1.8	73.5
9	-	-	-	-	-	-	2.5	117.0	-	-	1:8	73.5
10	2.6	125.0	-	-	-	-	2.5	117.0	-	-	1.8	73.5
11	2.6	125.0	-	-	-	-	2.5	117.0	-	-	2.8	140.0
12	2.5	117.0	-	-	-	-	2.5	117.0	-	-	2.8	140.0
13	2.0	85.0	-	-	-	-	2.5	117.0	-	-	2.8	140.0
14	2.6	125.0	2.7	132.0	-	-	2.7	132.0	-	-	2.8	140.0
15	2.6	125.0	2.7	132.0	-	-	2.7	132.0	-	-	2.8	140.0
16	2.6	125.0	2.7	132.0	-	-	2.7	132.0	-	-	2.8	140.0
17	-	-	2.7	132.0	-	-	2.7	132.0	-	-	2.8	140.0
18	-	-	2.8	140.0	-	-	2.7	132.0	-	-	2.8	140.0
19	1.0	43.0	2.8	140.0	-	-	2.6	125.0	-	-	2.8	140.0
20	-	-	2.8	140.0	-	-	2.6	125.0	-	-	-	-
21	2.6	125.0	-	-	-	-	2.6	125.0	-	-	-	-
22	-	-	-	-	-	-	2.0	85.0	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	2.8	140.0
25	-	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	2.7	132.0	-	-	2.7	132.0	2.8	140.0
27	-	-	-	-	2.7	132.0	-	-	2.7	132.0	2.8	140.0
28	-	-	2.7	132.0	2.7	132.0	-	-	1.8	73.5	2.0	85.0
29	-	-	2.7	132.0	2.7	132.0	-	-			2.8	140.0
30	-	-	2.7	132.0	2.7	132.0	-	-			2.8	140.0
31	-	-			-	-	-	-			2.8	140.0
Total in Cusec-day		**1329.0**		**1344**		**1188.0**		**2056**		**337.5**		**2565**
Total in Ha-m.		325.156		328.83		290.659		503.03		82.5735		627.558

Sheet-11

DAILY DISCHARGE OF RIGHT MAIN DISTRIBUTARY SEASON -- 2003/2004

MONTH	APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER	
DATE	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs
1	2.8	140.0	-	-	3.2	140.0	2.8	140.0	2.5	117.0	2.0	85.0
2	2.0	85.0	-	-	3.2	140.0	2.5	117.0	2.0	85.0	2.0	85.0
3	2.5	117.0	-	-	3.2	140.0	2.5	117.0	2.0	85.0	2.0	85.0
4	2.8	140.0	2.8	140.0	3.2	140.0	2.5	117.0	2.0	85.0	-	-
5	2.8	140.0	3.2	140.0	3.2	140.0	2.8	140.0	2.0	85.0	-	-
6	2.8	140.0	3.2	140.0	3.2	140.0	2.5	117.0	2.0	85.0	-	-
7	3.0	140.0	3.2	140.0	3.2	140.0	2.0	85.0	2.5	117.0	-	-
8	3.0	140.0	3.2	140.0	3.2	140.0	2.0	85.0	2.5	117.0	-	-
9	3.0	140.0	3.2	140.0	3.2	140.0	2.0	85.0	2.5	117.0	-	-
10	2.8	140.0	3.2	140.0	3.2	140.0	2.0	85.0	2.5	117.0	-	-
11	2.8	140.0	3.2	140.0	3.2	140.0	1.8	73.5	2.8	140.0	-	-
12	2.8	140.0	3.2	140.0	2.8	140.0	1.5	60.0	2.8	140.0	-	-
13	2.8	140.0	3.2	140.0	3.0	140.0	-	-	2.8	140.0	-	-
14	2.8	140.0	3.2	140.0	3.2	140.0	-	-	cut	-	-	-
15	2.8	140.0	3.2	140.0	3.2	140.0	-	-	2.8	140.0	-	-
16	2.8	140.0	3.2	140.0	3.0	140.0	-	-	2.0	85.0	-	-
17	-	-	3.2	140.0	3.0	140.0	-	-	2.5	117.0	-	-
18	-	-	3.2	140.0	2.8	140.0	1.5	60.0	2.8	140.0	2.5	117.0
19	-	-	3.2	140.0	2.8	140.0	-	-	2.8	140.0	2.5	117.0
20	-	-	3.2	140.0	2.8	140.0	2.0	85.0	2.8	140.0	2.5	117.0
21	-	-	3.2	140.0	2.8	140.0	1.8	73.5	2.8	140.0	2.5	117.0
22	-	-	3.2	140.0	2.8	140.0	1.5	60.0	2.8	140.0	2.5	117.0
23	-	-	3.2	140.0	2.8	140.0	1.0	43.0	2.8	140.0	2.5	117.0
24	-	-	3.2	140.0	2.8	140.0	1.5	60.0	2.8	140.0	2.5	117.0
25	-	-	3.2	140.0	2.8	140.0	2.5	117.0	-	-	-	-
26	-	-	3.2	140.0	2.8	140.0	2.8	140.0	-	-	2.0	85.0
27	-	-	3.2	140.0	3.0	140.0	2.8	140.0	-	-	2.5	117.0
28	-	-	3.2	140.0	3.0	140.0	2.5	117.0	-	-	3.0	140.0
29	-	-	3.2	140.0	3.0	140.0	2.5	117.0	-	-	3.0	140.0
30	-	-	3.2	140.0	2.8	140.0	2.8	140.0	2.8	140.0	3.0	140.0
31			3.2	140.0			2.5	117.0	2.8	140.0		
Total in Cusec-day		**2162.0**		**3920**		**4200**		**2491**		**3032**		**1696.0**
Total in Ha-m.		528.96		959.08		1027.58		609.45		741.816		414.947

DAILY DISCHARGE OF RIGHT MAIN DISTRIBUTARY SEASON -- 2003/2004

MONTH	OCTOBER		NOVEMBER		DECEMBER		JANUARUY		FEBRUARY		MARCH	
DATE	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs
1	3.0	140.0	2.8	140.0	-	-						
2	3.0	140.0	2.8	140.0	-	-						
3	-	-	2.8	140.0	-	-						
4	-	-	2.8	140.0	-	-						
5	2.0	85.0	3.0	140.0	-	-						
6	-	-	3.0	140.0	-	-						
7	-	-	3.0	140.0	-	-						
8	-	-	3.0	140.0	-	-						
9	-	-	3.0	140.0	-	-						
10	-	-	3.0	140.0	-	-						
11	-	-	3.0	140.0	2.0	85.0						
12	-	-	3.0	140.0	1.5	60.0						
13	-	-	3.0	140.0	-	-						
14	-	-	3.0	140.0	-	-						
15	-	-	3.0	140.0	-	-						
16	-	-	2.8	140.0	-	-						
17	-	-	-	-	-	-						
18	-	-	-	-	-	-						
19	-	-	-	-	-	-						
20	-	-	-	-	-	-						
21	-	-	-	-	-	-						
22	-	-	-	-	-	-						
23	-	-	-	-	-	-						
24	-	-	-	-	-	-						
25	-	-	-	-	-	-						
26	3.0	140.0	-	-	-	-						
27	2.5	117.0	-	-	-	-						
28	2.5	117.0	-	-	-	-						
29	2.5	117.0	-	-	-	-						
30	2.8	140.0	-	-	-	-						
31	2.8	140.0			-	-						
Total in Cusec-day		1136.0		2240		145.0						
Total in Ha-m.		277.936		548.04		35.476						

Annexure:3
Table-2

Sheet-1

GAUGE-DISCHARGE OF BHAISANI DY (HEAD)

S.No.	Bed Width(ft.)	Water Depth(ft)	Flow Area (sq.ft.)	Wetted Perimeter(ft.)	R=A/P (ft.)	V=1.486/0.0225(R)3/2(S)1/2ft./sec	Discharge(Q) cusecs
1	6.0	3.3	25.25	13.39	1.89	1.52	38.36
2	6.0	3.2	24.32	13.17	1.85	1.50	36.46
3	6.0	3.1	23.41	12.94	1.81	1.48	34.59
4	6.0	3.0	22.50	12.72	1.77	1.46	32.77
5	6.0	2.9	21.61	12.50	1.73	1.43	30.99
6	6.0	2.8	20.72	12.27	1.69	1.41	29.26
7	6.0	2.7	19.85	12.05	1.65	1.39	27.56
8	6.0	2.6	18.98	11.82	1.61	1.37	25.91
9	6.0	2.5	18.13	11.60	1.56	1.34	24.30
10	6.0	2.4	17.28	11.38	1.52	1.32	22.74
11	6.0	2.3	16.45	11.15	1.47	1.29	21.22
12	6.0	2.2	15.62	10.93	1.43	1.26	19.74
13	6.0	2.1	14.81	10.70	1.38	1.24	18.30
14	6.0	2.0	14.00	10.48	1.34	1.21	16.91
15	6.0	1.9	13.21	10.26	1.29	1.18	15.56
16	6.0	1.8	12.42	10.03	1.24	1.15	14.26
17	6.0	1.7	11.65	9.81	1.19	1.12	13.00
18	6.0	1.6	10.88	9.58	1.14	1.08	11.79
19	6.0	1.5	10.13	9.36	1.08	1.05	10.62
20	6.0	1.4	9.38	9.14	1.03	1.01	9.50
21	6.0	1.3	8.64	8.91	0.97	0.98	8.43
22	6.0	1.2	7.92	8.69	0.91	0.94	7.41
23	6.0	1.1	7.20	8.46	0.85	0.89	6.44
24	6.0	1.0	6.50	8.24	0.79	0.85	5.52
25	6.0	0.9	5.80	8.02	0.72	0.80	4.66
26	6.0	0.8	5.12	7.79	0.66	0.75	3.85
27	6.0	0.7	4.44	7.57	0.59	0.70	3.10
28	6.0	0.6	3.78	7.34	0.51	0.64	2.42
29	6.0	0.5	3.12	7.12	0.44	0.57	1.80
30	6.0	0.4	2.48	6.90	0.36	0.50	1.25
31	6.0	0.3	1.84	6.67	0.28	0.42	0.78
32	6.0	0.2	1.22	6.45	0.19	0.33	0.40

GAUGE-DISCHARGE OF BHAISANI DY (TAIL) Sheet-2

S.No.	Bed Width(ft.)	Water Depth(ft)	Flow Area (sq.ft.)	Wetted Perimeter(ft.)	R=A/P (ft.)	V=1.486/0.0225(R)3/2(S)1/2ft./sec	Discharge(Q) cusecs
1	1.5	2.0	5.00	5.98	0.84	0.72	3.61
2	1.5	1.9	4.66	5.76	0.81	0.71	3.28
3	1.5	1.8	4.32	5.53	0.78	0.69	2.98
4	1.5	1.7	4.00	5.31	0.75	0.67	2.69
5	1.5	1.6	3.68	5.08	0.72	0.66	2.41
6	1.5	1.5	3.38	4.86	0.69	0.64	2.15
7	1.5	1.4	3.08	4.64	0.66	0.62	1.91
8	1.5	1.3	2.80	4.41	0.63	0.60	1.68
9	1.5	1.2	2.52	4.19	0.60	0.58	1.46
10	1.5	1.1	2.26	3.96	0.57	0.56	1.26
11	1.5	1.0	2.00	3.74	0.53	0.54	1.07
12	1.5	0.9	1.76	3.52	0.50	0.51	0.90
13	1.5	0.8	1.52	3.29	0.46	0.49	0.74
14	1.5	0.7	1.30	3.07	0.42	0.46	0.59
15	1.5	0.6	1.08	2.84	0.38	0.43	0.46
16	1.5	0.5	0.87	2.62	0.33	0.39	0.34
17	1.5	0.4	0.68	2.40	0.28	0.35	0.24
18	1.5	0.3	0.49	2.17	0.23	0.30	0.15
19	1.5	0.2	0.32	1.95	0.16	0.24	0.08

GAUGE-DISCHARGE OF BARLA DY (HEAD) Sheet-3

S.No.	Bed Width(ft.)	Water Depth(ft)	Flow Area (sq.ft.)	Wetted Perimeter(ft.)	R=A/P (ft.)	V=1.486/0.0225(R)3/2(S)1/2ft./sec	Discharge(Q) cusecs
1	3.0	3.0	13.50	9.72	1.39	1.43	19.32
2	3.0	2.9	12.91	9.50	1.36	1.41	18.21
3	3.0	2.8	12.32	9.27	1.33	1.39	17.12
4	3.0	2.7	11.75	9.05	1.30	1.37	16.07
5	3.0	2.6	11.18	8.82	1.27	1.35	15.05
6	3.0	2.5	10.63	8.60	1.24	1.32	14.07
7	3.0	2.4	10.08	8.38	1.20	1.30	13.11
8	3.0	2.3	9.55	8.15	1.17	1.28	12.19
9	3.0	2.2	9.02	7.93	1.14	1.25	11.30
10	3.0	2.1	8.51	7.70	1.10	1.23	10.44
11	3.0	2.0	8.00	7.48	1.07	1.04	8.33
12	3.0	1.9	7.51	7.26	1.03	1.02	7.64
13	3.0	1.8	7.02	7.03	1.00	0.99	6.98
14	3.0	1.7	6.55	6.81	0.96	0.97	6.35
15	3.0	1.6	6.08	6.58	0.92	0.94	5.74
16	3.0	1.5	5.63	6.36	0.88	0.92	5.16
17	3.0	1.4	5.18	6.14	0.84	0.89	4.61
18	3.0	1.3	4.75	5.91	0.80	0.86	4.08
19	3.0	1.2	4.32	5.69	0.76	0.83	3.58
20	3.0	1.1	3.90	5.46	0.71	0.80	3.11
21	3.0	1.0	3.50	5.24	0.67	0.76	2.66
22	3.0	0.9	3.11	5.02	0.62	0.72	2.25
23	3.0	0.8	2.72	4.79	0.57	0.68	1.86
24	3.0	0.7	2.35	4.57	0.51	0.64	1.50
25	3.0	0.6	1.98	4.34	0.46	0.59	1.17
26	3.0	0.5	1.63	4.12	0.39	0.54	0.87
27	3.0	0.4	1.28	3.90	0.33	0.47	0.61
28	3.0	0.3	0.94	3.67	0.26	0.40	0.38
29	3.0	0.2	0.62	3.45	0.18	0.32	0.20

GAUGE-DISCHARGE OF BARLA DY (TAIL)   Sheet-4

S.No.	Bed Width(ft.)	Water Depth(ft)	Flow Area (sq.ft.)	Wetted Perimeter(ft.)	R=A/P (ft.)	V=1.486/0.0225(R)3/2(S)1/2ft./sec	Discharge(Q) cusecs
1	2.0	2.0	6.00	6.48	0.93	0.77	4.63
2	2.0	1.9	5.61	6.26	0.90	0.76	4.23
3	2.0	1.8	5.22	6.03	0.87	0.74	3.85
4	2.0	1.7	4.85	5.81	0.83	0.72	3.49
5	2.0	1.6	4.48	5.58	0.80	0.70	3.14
6	2.0	1.5	4.13	5.36	0.77	0.68	2.82
7	2.0	1.4	3.78	5.14	0.74	0.66	2.50
8	2.0	1.3	3.45	4.91	0.70	0.64	2.21
9	2.0	1.2	3.12	4.69	0.67	0.62	1.93
10	2.0	1.1	2.81	4.46	0.63	0.60	1.67
11	2.0	1.0	2.50	4.24	0.59	0.57	1.43
12	2.0	0.9	2.21	4.02	0.55	0.54	1.20
13	2.0	0.8	1.92	3.79	0.51	0.52	0.99
14	2.0	0.7	1.65	3.57	0.46	0.49	0.80
15	2.0	0.6	1.38	3.34	0.41	0.45	0.62
16	2.0	0.5	1.13	3.12	0.36	0.41	0.46
17	2.0	0.4	0.88	2.90	0.30	0.37	0.32
18	2.0	0.3	0.64	2.67	0.24	0.32	0.20
19	2.0	0.2	0.42	2.45	0.17	0.25	0.11

GAUGE-DISCHARGE OF KHAMPUR MINOR (HEAD) Sheet-5

S.No.	Bed Width(ft.)	Water Depth(ft)	Flow Area (sq.ft.)	Wetted Perimeter(ft.)	R=A/P (ft.)	V=1.486/0.0225(R)3/2(S)1/2ft./sec	Discharge(Q) cusecs
1	2.0	2.0	6.00	6.48	0.93	0.77	4.63
2	2.0	1.9	5.61	6.26	0.90	0.76	4.23
3	2.0	1.8	5.22	6.03	0.87	0.74	3.85
4	2.0	1.7	4.85	5.81	0.83	0.72	3.49
5	2.0	1.6	4.48	5.58	0.80	0.70	3.14
6	2.0	1.5	4.13	5.36	0.77	0.68	2.82
7	2.0	1.4	3.78	5.14	0.74	0.66	2.50
8	2.0	1.3	3.45	4.91	0.70	0.64	2.21
9	2.0	1.2	3.12	4.69	0.67	0.62	1.93
10	2.0	1.1	2.81	4.46	0.63	0.60	1.67
11	2.0	1.0	2.50	4.24	0.59	0.57	1.43
12	2.0	0.9	2.21	4.02	0.55	0.54	1.20
13	2.0	0.8	1.92	3.79	0.51	0.52	0.99
14	2.0	0.7	1.65	3.57	0.46	0.49	0.80
15	2.0	0.6	1.38	3.34	0.41	0.45	0.62
16	2.0	0.5	1.13	3.12	0.36	0.41	0.46
17	2.0	0.4	0.88	2.90	0.30	0.37	0.32
18	2.0	0.3	0.64	2.67	0.24	0.32	0.20
19	2.0	0.2	0.42	2.45	0.17	0.25	0.11
20	2	0.1	0.21	2.22	0.09	0.17	0.03

GAUGE-DISCHARGE OF KHAMPUR MINOR (TAIL) Sheet-6

S.No.	Bed Width(ft.)	Water Depth(ft)	Flow Area (sq.ft.)	Wetted Perimeter(ft.)	R=A/P (ft.)	V=1.486/0.0225(R)3/2(S)1/2ft./sec	Discharge(Q) cusecs
1	1.0	2.0	4.00	5.48	0.73	0.66	2.64
2	1.0	1.9	3.71	5.26	0.70	0.64	2.39
3	1.0	1.8	3.42	5.03	0.68	0.63	2.15
4	1.0	1.7	3.15	4.81	0.65	0.61	1.93
5	1.0	1.6	2.88	4.58	0.63	0.60	1.72
6	1.0	1.5	2.63	4.36	0.60	0.58	1.52
7	1.0	1.4	2.38	4.14	0.58	0.56	1.34
8	1.0	1.3	2.15	3.91	0.55	0.54	1.17
9	1.0	1.2	1.92	3.69	0.52	0.53	1.01
10	1.0	1.1	1.71	3.46	0.49	0.51	0.86
11	1.0	1.0	1.50	3.24	0.46	0.49	0.73
12	1.0	0.9	1.31	3.02	0.43	0.46	0.61
13	1.0	0.8	1.12	2.79	0.40	0.44	0.50
14	1.0	0.7	0.94	2.57	0.37	0.42	0.39
15	1.0	0.6	0.78	2.34	0.33	0.39	0.30
16	1.0	0.5	0.62	2.12	0.29	0.36	0.22
17	1.0	0.4	0.48	1.90	0.25	0.33	0.16
18	1.0	0.3	0.34	1.67	0.21	0.28	0.10
19	1.0	0.2	0.22	1.45	0.15	0.23	0.05
20	1.0	0.1	0.11	1.22	0.09	0.16	0.02

Annexure:3
Table-3

Sheet-1

DAILY DISCHARGE OF BARLA DISTRIBUTARY SEASON -- 1998/1999

MONTH	DECEMBER				JANUARY				FEBRUARY				MARCH			
	Head		Tail		Head		Tail		Head		Tail		Head		Tail	
DATE	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs
1	-	-	-	-	0.8	1.86	0.4	0.32	-	-	-	-	-	-	-	-
2	1.5	5.16	-	-	1.0	2.66	0.4	0.32	-	-	-	-	-	-	-	-
3	2.5	14.07	-	-	1.5	5.16	0.4	0.32	-	-	-	-	-	-	-	-
4	2.5	14.07	-	-	2.0	8.33	0.4	0.32	-	-	-	-	-	-	-	-
5	2.5	14.07	-	-	2.0	8.33	0.4	0.32	-	-	-	-	-	-	-	-
6	-	-	-	-	2.0	8.33	0.4	0.32	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	0.5	0.87	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	2.5	14.07	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	2.5	14.07	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	2.5	14.07	0.4	0.32	-	-	-	-
17	-	-	-	-	-	-	-	-	2.5	14.07	0.5	0.46	-	-	-	-
18	-	-	-	-	-	-	-	-	2.5	14.07	0.5	0.46	-	-	-	-
19	-	-	-	-	-	-	-	-	2.5	14.07	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	2.5	14.07	0.6	0.62	-	-	-	-
21	-	-	-	-	-	-	-	-	2.5	14.07	0.6	0.62	-	-	-	-
22	-	-	-	-	-	-	-	-	2.5	14.07	0.6	0.62	-	-	-	-
23	-	-	-	-	-	-	-	-	1.8	6.98	0.6	0.62	-	-	-	-
24	-	-	-	-	-	-	-	-	1.5	5.16	0.6	0.62	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-	-	1.5	5.16	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-	1.5	5.16	-	-
27	-	-	-	-	-	-	-	-	-	-	-	-	1.5	5.16	-	-
28	-	-	-	-	-	-	-	-	-	-	-	-	2.0	8.33	0.5	0.46
29	-	-	-	-	-	-	-	-	-	-	-	-	2.0	8.33	0.5	0.46
30	-	-	-	-	-	-	-	-	-	-	-	-	2.0	8.33	0.5	0.46
31	-	-	-	-	-	-	-	-	-	-	-	-	2.0	8.33	0.5	0.46
Total in Cusec-day		47.4		0.0		34.7		1.92		139.6		4.34		48.8		1.8
Total in Ha-m.		11.6		0.0		8.5		0.47		34.2		1.06		11.9		0.5

DAILY DISCHARGE OF BARLA DISTRIBUTARY SEASON -- 2000/2001 Sheet-2

MONTH	NOVEMBER				DECEMBER				JANUARY				FEBRUARY			
	Head		Tail		Head		Tail		Head		Tail		Head		Tail	
DATE	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs
1	Canal closed				Canal closed				Canal closed				Canal closed			
2	"				"				"				"			
3	"				"				"				"			
4	"				"				"				"			
5	"				"				"				"			
6	"				"				"				"			
7	"				"				"				"			
8	"				"				"				"			
9	2.0	8.33	-	-	"				"				"			
10	1.5	5.16	-	-	"				"				"			
11	-		-	-	"				"				"			
12	-		-	-	"				"				"			
13	-		-	-	"				"				"			
14	-		-	-	2.3	12.19	-	-	"				"			
15	-		-	-	2.3	12.19	-	-	"				"			
16	2.0	8.33	-	-	2.3	12.19	-	-	"				"			
17	2.5	14.07	-	-	2.3	12.19	-	-	"				"			
18	2.5	14.07	-	-	2.2	11.30	-	-	2.5	14.07	-	-	"			
19	2.5	14.07	-	-	2.2	11.30	-	-	2.5	14.07	-	-	"			
20	2.5	14.07	-	-	2.2	11.30	-	-	2.5	14.07	-	-	"			
21	2.5	14.07	-	-	2.2	11.30	-	-	1.5	5.16	-	-	"			
22	2.3	12.19	-	-	2.2	11.30	-	-	1.5	5.16	-	-	2.3	12.19	-	-
23	2.3	12.19	-	-	2.2	11.30	-	-	1.5	5.16	-	-	2.3	12.19	-	-
24	-	-	-	-	2.2	11.30	-	-	1.5	5.16	-	-	2.3	12.19	-	-
25	-	-	-	-	2.2	11.30	-	-	1.5	5.16	-	-	2.3	12.19	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-	2.3	12.19	-	-
27	-	-	-	-	-	-	-	-	-	-	-	-	2.3	12.19	-	-
28	-	-	-	-	-	-	-	-	-	-	-	-	1.3	4.08	-	-
29	-	-	-	-	-	-	-	-	-	-	-	-			-	-
30	-	-	-	-	-	-	-	-	-	-	-	-			-	-
31	-	-	-	-	-	-	-	-	-	-	-	-			-	-
Total in Cusec-day	116.6		0.0		139.2		0.0		68.01		0.0		77.2		0.0	
Total in Ha-m.	28.52	-	0.0		34.05		0.0		16.64		0.0		18.9		0.0	

DAILY DISCHARGE OF BARLA DISTRIBUTARY SEASON -- 2000/2001 Sheet-3

MONTH	MARCH															
DATE	Head		Tail		Head		Tail		Head		Tail		Head		Tail	
	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs
1	1.5	5.16	-	-	Readings are not available				Readings are not available				Readings are not available			
2	2.5	14.07	-	-	"				"				"			
3	1.5	5.16	-	-	"				"				"			
4	1.5	5.16	-	-	"				"				"			
5	1.5	5.16	-	-	"				"				"			
6	-	-	-	-	"				"				"			
7	-	-	-	-	"				"				"			
8	-	-	-	-	"				"				"			
9	-	-	-	-	"				"				"			
10	-	-	-	-	"				"				"			
11	-	-	-	-	"				"				"			
12	-	-	-	-	"				"				"			
13	-	-	-	-	"				"				"			
14	-	-	-	-	"				"				"			
15	-	-	-	-	"				"				"			
16	-	-	-	-	"				"				"			
17	-	-	-	-	"				"				"			
18	-	-	-	-	"				"				"			
19	-	-	-	-	"				"				"			
20	-	-	-	-	"				"				"			
21	-	-	-	-	"				"				"			
22	-	-	-	-	"				"				"			
23	-	-	-	-	"				"				"			
24	-	-	-	-	"				"				"			
25	-	-	-	-	"				"				"			
26	-	-	-	-	"				"				"			
27	-	-	-	-	"				"				"			
28	-	-	-	-	"				"				"			
29	2.8	17.12	-	-	"				"				"			
30	2.8	17.12	-	-	"				"				"			
31	-	-	-	-	"				"				"			
Total in Cusec-day		68.95		0.0												
Total in Ha-m.		16.87		0.0												

DAILY DISCHARGE OF BARLA DISTRIBUTARY SEASON -- 2001/2002 Sheet-4

MONTH	APRIL				MAY				JUNE				JULY			
	Head		Tail		Head		Tail		Head		Tail		Head		Tail	
DATE	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs
1	2.8	17.12	-	-	2.5	14.07	-	-	Canal closed				1.9	7.64	0.8	0.99
2	2.8	17.12	-	-	2.5	14.07	-	-	"				1.9	7.64	1.0	1.43
3	2.8	17.12	-	-	2.5	14.07	-	-	"				1.9	7.64	1.0	1.43
4	2.8	17.12	-	-	2.5	14.07	-	-	"				1.9	7.64	1.0	1.43
5	2.8	17.12	-	-	2.5	14.07	-	-	"				1.9	7.64	1.0	1.43
6	2.8	17.12	-	-	2.5	14.07	-	-	"				1.9	7.64	1.0	1.43
7	2.8	17.12	-	-	2.5	14.07	-	-	"				1.9	7.64	1.0	1.43
8	2.8	17.12	-	-	2.5	14.07	-	-	"				1.9	7.64	1.0	1.43
9	2.8	17.12	-	-	2.5	14.07	-	-	"				1.9	7.64	1.0	1.43
10	2.8	17.12	-	-	2.5	14.07	-	-	"				1.9	7.64	1.0	1.43
11	2.8	17.12	-	-	2.5	14.07	-	-	"				1.9	7.64	1.0	1.43
12	-	-	-	-	2.5	14.07	-	-	"				1.9	7.64	1.0	1.43
13	-	-	-	-	2.5	14.07	-	-	"				1.9	7.64	1.0	1.43
14	-	-	-	-	2.5	14.07	-	-	"				1.9	7.64	1.0	1.43
15	-	-	-	-	2.5	14.07	-	-	2.6	15.05	-	-	1.9	7.64	1.0	1.43
16	-	-	-	-	2.5	14.07	-	-	2.6	15.05	-	-	Canal closed			
17	-	-	-	-	2.7	16.07	-	-	2.6	15.05	-	-	"			
18	-	-	-	-	2.7	16.07	-	-	Canal closed				"			
19	-	-	-	-	1.5	5.16	-	-	"				"			
20	-	-	-	-	2.7	16.07	-	-	"				"			
21	-	-	-	-	1.3	4.08	-	-	"				"			
22	-	-	-	-	1.3	4.08	-	-	"				"			
23	-	-	-	-	1.3	4.08	-	-	"				"			
24	-	-	-	-	1.3	4.08	-	-	"				"			
25	-	-	-	-	2.6	15.05	-	-	"				"			
26	2.8	17.12	-	-	2.6	15.05	-	-	"				"			
27	2.8	17.12	-	-	2.6	15.05	-	-	"				"			
28	2.8	17.12	-	-	2.6	15.05	-	-	1.9	7.64	-	-	"			
29	2.8	17.12	-	-	2.6	15.05	-	-	1.9	7.64	-	-	"			
30	2.8	17.12	-	-	2.6	15.05	-	-	1.9	7.64	-	-	"			
31			-	-	-	-	-	-	-	-	-	-	"			
Total in Cusec-day		273.9		0.0		385.1		0.0		68.07		0.0		114.6		21.01
Total in Ha-m.		67.0		0.0		94.2		0.0		16.65		0.0		28.04		5.14

DAILY DISCHARGE OF BARLA DISTRIBUTARY SEASON -- 2001/2002 Sheet-5

MONTH	AUGUST				SEPTEMBER				OCTOBER				NOVEMBER			
	Head		Tail		Head		Tail		Head		Tail		Head		Tail	
DATE	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs
1	-	-	-	-	1.9	7.64	upto o.n.-24		-	-	-	-	-	-	-	-
2	1.9	7.64	1.0	1.43	1.9	7.64	"		-	-	-	-	-	-	-	-
3	1.9	7.64	1.0	1.43	1.9	7.64	upto o.n.-23		-	-	-	-	-	-	-	-
4	1.9	7.64	1.0	1.43	1.9	7.64	"		-	-	-	-	-	-	-	-
5	1.9	7.64	1.0	1.43	1.9	7.64	upto o.n.-26		2.5	14.07	0.6	0.62	-	-	-	-
6	1.9	7.64	1.0	1.43	2.2	11.30	upto o.n.-21		2.5	14.07	0.6	0.62	2.5	14.07	0.6	0.62
7	1.9	7.64	1.0	1.43	2.2	11.30	"		2.5	14.07	0.6	0.62	2.5	14.07	0.6	0.62
8	1.9	7.64	1.0	1.43	2.2	11.30	"		2.5	14.07	0.6	0.62	2.5	14.07	0.6	0.62
9	1.9	7.64	1.0	1.43	2.2	11.30	"		2.5	14.07	upto o.n.-26		2.5	14.07	0.6	0.62
10	1.9	7.64	1.0	1.43	2.2	11.30	"		2.5	14.07	"		2.5	14.07	0.6	0.62
11	-	-	-	-	2.2	11.30	upto o.n.-25		2.5	14.07	"		2.5	14.07	0.6	0.62
12	1.9	7.64	1.0	1.43	2.2	11.30	upto o.n.-21		2.5	14.07	"		2.5	14.07	0.6	0.62
13	1.9	7.64	1.0	1.43	2.2	11.30	0.6	0.62	2.5	14.07	0.6	0.62	2.5	14.07	0.6	0.62
14	1.9	7.64	1.0	1.43	2.2	11.30	0.6	0.62	2.5	14.07	0.6	0.62	2.5	14.07	0.6	0.62
15	1.9	7.64	1.0	1.43	2.2	11.30	0.8	0.99	2.5	14.07	0.6	0.62	-	-	-	-
16	1.9	7.64	1.0	1.43	2.2	11.30	0.6	0.62	2.5	14.07	0.6	0.62	-	-	-	-
17	1.9	7.64	1.0	1.43	2.2	11.30	0.6	0.62	2.5	14.07	0.6	0.62	-	-	-	-
18	1.9	7.64	1.0	1.43	2.2	11.30	0.6	0.62	2.5	14.07	0.6	0.62	-	-	-	-
19	1.9	7.64	1.0	1.43	2.2	11.30	0.6	0.62	-	-	-	-	-	-	-	-
20	1.9	7.64	1.0	1.43	2.2	11.30	0.6	0.62	-	-	-	-	-	-	-	-
21	1.9	7.64	1.0	1.43	2.2	11.30	0.7	0.80	-	-	-	-	-	-	-	-
22	1.9	7.64	1.0	1.43	2.2	11.30	0.6	0.62	-	-	-	-	2.5	14.07	0.6	0.62
23	1.9	7.64	1.0	1.43	2.2	11.30	0.6	0.62	-	-	-	-	1.5	5.16	0.6	0.62
24	1.9	7.64	1.0	1.43	2.2	11.30	0.6	0.62	-	-	-	-	1.5	5.16	0.6	0.62
25	1.9	7.64	1.0	1.43	2.2	11.30	0.5	0.46	-	-	-	-	1.0	2.66	0.6	0.62
26	1.9	7.64	1.0	1.43	2.2	11.30	upto o.n.-25		-	-	-	-	1.8	6.98	0.6	0.62
27	1.9	7.64	1.0	1.43	2.2	11.30	"		-	-	-	-	1.8	6.98	0.6	0.62
28	1.9	7.64	-	-	2.2	11.30	-	-	-	-	-	-	1.8	6.98	0.6	0.62
29	1.9	7.64	-	-	-	-	-	-	-	-	-	-	2.7	16.07	0.6	0.62
30	1.9	7.64	-	-	-	-	-	-	-	-	-	-	2.7	16.07	0.6	0.62
31	1.9	7.64	-	-	-	-			-	-	-	-				
Total in Cusec-day		221.6		35.75		298.1		8.5		197.0		6.20		206.8		11.16
Total in Ha-m.		54.2		8.75		72.93		2.1		48.2		1.52		50.6		2.73

DAILY DISCHARGE OF BARLA DISTRIBUTARY SEASON -- 2001/2002 Sheet-6

MONTH	DECEMBER				JANUARY				FEBRUARY				MARCH			
	Head		Tail		Head		Tail		Head		Tail		Head		Tail	
DATE	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs
1	2.5	14.07	1.0	1.43	2.5	14.07	0.5	0.46	2.6	15.05	upto o.n.28=0.4		2.7	16.07	upto o.n.28=0.4	
2	2.5	14.07	1.0	1.43	2.5	14.07	0.5	0.46	2.6	15.05	"		2.7	16.07	"	
3	2.5	14.07	1.0	1.43	2.5	14.07	0.5	0.46	2.6	15.05	"		2.7	16.07	"	
4	-	-	-	-	2.5	14.07	0.5	0.46	2.6	15.05	"		2.7	16.07	"	
5	-	-	-	-	2.5	14.07	0.5	0.46	2.6	15.05	"		2.7	16.07	"	
6	-	-	-	-	2.5	14.07	0.5	0.46	2.6	15.05	"		2.7	16.07	"	
7	-	-	-	-	1.5	5.16	0.6	0.62	-	-	-	-	2.7	16.07	"	
8	-	-	-	-	1.5	5.16	0.6	0.62	-	-	-	-	2.7	16.07	"	
9	-	-	-	-	1.5	5.16	0.6	0.62	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-	2.7	16.07	1.5	2.82
15	-	-	-	-	-	-	-	-	-	-	-	-	2.7	16.07	1.5	2.82
16	-	-	-	-	-	-	-	-	-	-	-	-	2.7	16.07	1.5	2.82
17	-	-	-	-	-	-	-	-	-	-	-	-	2.7	16.07	1.5	2.82
18	-	-	-	-	-	-	-	-	-	-	-	-	2.7	16.07	1.5	2.82
19	-	-	-	-	-	-	-	-	-	-	-	-	2.7	16.07	1.5	2.82
20	-	-	-	-	-	-	-	-	-	-	-	-	2.7	16.07	1.5	2.82
21	-	-	-	-	-	-	-	-	2.6	15.05	upto o.n.28=0.4		-	-	-	-
22	-	-	-	-	-	-	-	-	2.6	15.05	"		-	-	-	-
23	-	-	-	-	-	-	-	-	2.6	15.05	"		-	-	-	-
24	-	-	-	-	-	-	-	-	2.6	15.05	"		-	-	-	-
25	-	-	-	-	-	-	-	-	2.6	15.05	"		-	-	-	-
26	-	-	-	-	-	-	-	-	2.6	15.05	"		-	-	-	-
27	2.2	11.30	0.5	0.46	-	-	-	-	2.6	15.05	"		-	-	-	-
28	1.5	5.16	0.5	0.46	-	-	-	-	2.6	15.05	"		2.8	17.12	-	-
29	2.4	13.11	0.5	0.46	-	-	-	-					2.8	17.12	1.0	1.43
30	2.4	13.11	0.5	0.46	-	-	-	-					2.8	17.12	1.0	1.43
31	2.4	13.11	0.5	0.46	2.0	8.33	upto o.n.28=0.4						-	-	-	-
Total in Cusec-day		98.0		6.6		108.2		4.6		210.7		0.0		292.4		22.60
Total in Ha-m.		24.0		1.6		26.5		1.1		51.6		0.0		71.54		5.53

DAILY DISCHARGE OF BARLA DISTRIBUTARY SEASON – 2002/2003 Sheet-7

MONTH	APRIL				MAY				JUNE				JULY			
	Head		Tail		Head		Tail		Head		Tail		Head		Tail	
DATE	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs
1	2.9	18.21	1.0	1.43	-	-	-	-	2.8	17.12	1.5	2.82	-	-	-	-
2	2.9	18.21	1.0	1.43	2.0	8.33	upto o.n.-26=0.4		2.8	17.12	2.0	4.63	1.0	2.66	1.0	1.43
3	2.9	18.21	1.0	1.43	2.0	8.33	"		2.8	17.12	2.0	4.63	2.0	8.33	-	-
4	2.9	18.21	1.5	2.82	2.0	8.33	"		2.8	17.12	2.0	4.63	2.5	14.07	-	-
5	2.9	18.21	1.5	2.82	2.0	8.33	"		2.8	17.12	2.0	4.63	2.8	17.12	-	-
6	2.9	18.21	1.5	2.82	2.0	8.33	"		2.8	17.12	2.0	4.63	2.8	17.12	-	-
7	2.9	18.21	1.5	2.82	2.0	8.33	"		2.8	17.12	2.0	4.63	2.5	14.07	-	-
8	2.9	18.21	1.5	2.82	2.0	8.33	"		1.0	2.66	2.0	4.63	1.5	5.16	-	-
9	2.9	18.21	1.5	2.82	2.0	8.33	"		2.8	17.12	2.0	4.63	1.5	5.16	-	-
10	2.9	18.21	1.5	2.82	2.0	8.33	"		2.8	17.12	2.0	4.63	1.5	5.16	-	-
11	2.8	17.12	0.8	0.99	2.0	8.33	"		2.8	17.12	1.5	2.82	2.5	14.07	-	-
12	2.8	17.12	0.8	0.99	-	-	-	-	2.8	17.12	1.5	2.82	2.5	14.07	-	-
13	1.0	2.66	-	-	2.5	14.07	upto o.n.-26=0.4		2.8	17.12	1.5	2.82	2.5	14.07	-	-
14	1.0	2.66	-	-	2.5	14.07	"		2.0	8.33	1.5	2.82	2.5	14.07	-	-
15	1.0	2.66	-	-	2.5	14.07	0.4	0.32	-	-	-	-	2.5	14.07	-	-
16	2.6	15.05	0.8	0.99	2.5	14.07	0.4	0.32	-	-	-	-	2.6	15.05	-	-
17	2.6	15.05	0.8	0.99	2.5	14.07	upto o.n.-26=0.4		-	-	-	-	2.6	15.05	-	-
18	2.6	15.05	0.8	0.99	2.5	14.07	"		2.5	14.07	1.5	2.82	2.6	15.05	-	-
19	2.6	15.05	0.8	0.99	2.5	14.07	"		2.5	14.07	1.5	2.82	2.6	15.05	-	-
20	-	-	-	-	2.5	14.07	"		2.5	14.07	1.5	2.82	2.6	15.05	-	-
21	-	-	-	-	2.8	17.12	0.4	0.32	1.5	5.16	-	-	2.5	14.07	-	-
22	2.6	15.05	0.8	0.99	2.8	17.12	0.4	0.32	1.5	5.16	-	-	2.5	14.07	-	-
23	2.6	15.05	0.8	0.99	2.8	17.12	0.4	0.32	1.5	5.16	-	-	2.5	14.07	-	-
24	2.6	15.05	0.8	0.99	2.8	17.12	1.4	2.50	2.9	18.21	1.0	1.43	2.8	17.12	-	-
25	2.6	15.05	0.4	0.32	2.5	14.07	upto o.n.-24=0.4		2.9	18.21	1.0	1.43	2.8	17.12	-	-
26	-	-	-	-	2.5	14.07	"		2.6	15.05	1.0	1.43	2.8	17.12	-	-
27	-	-	-	-	2.5	14.07	"		2.6	15.05	1.0	1.43	2.7	16.07	-	-
28	-	-	-	-	2.9	18.21	1.0	1.43	2.6	15.05	0.8	0.99	2.7	16.07	-	-
29	-	-	-	-	2.9	18.21	1.0	1.43	-	-	-	-	2.7	16.07	-	-
30	-	-	-	-	1.0	2.66	-	-	2.0	8.33	0.8	0.99	2.7	16.07	-	-
31					1.0	2.66	1.0	1.43					2.7	16.07	-	-
Total in Cusec-day		344.7		33.26		348.3		8.39		364.0		71.9		408.4		1.43
Total in Ha-m.		84.34		8.14		85.21		2.05		89.06		0.99		99.91		0.35

DAILY DISCHARGE OF BARLA DISTRIBUTARY SEASON -- 2002/2003 Sheet-8

MONTH	AUGUST				SEPTEMBER				OCTOBER				NOVEMBER			
	Head		Tail		Head		Tail		Head		Tail		Head		Tail	
DATE	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs
1	-	-	-	-	2.8	17.12	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	2.8	17.12	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	2.8	17.12	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	1.5	5.16	-	-	-	-	-	-	-	-	-	-
5	2.8	17.12	-	-	1.5	5.16	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	2.0	8.33	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	2.0	8.33	-	-	-	-	-	-
8	2.8	17.12	-	-	-	-	-	-	2.0	8.33	-	-	-	-	-	-
9	2.8	17.12	-	-	-	-	-	-	2.0	8.33	-	-	-	-	-	-
10	2.8	17.12	-	-	-	-	-	-	2.0	8.33	-	-	-	-	-	-
11	2.7	16.07	-	-	-	-	-	-	2.0	8.33	-	-	-	-	-	-
12	2.8	17.12	-	-	-	-	-	-	2.0	8.33	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	2.0	8.33	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	2.0	8.33	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	2.0	8.33	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	2.0	8.33	-	-	2.60	15.05	-	-
17	-	-	-	-	-	-	-	-	2.0	8.33	-	-	2.50	14.07	-	-
18	-	-	-	-	-	-	-	-	2.0	8.33	-	-	2.50	14.07	-	-
19	-	-	-	-	-	-	-	-	2.4	13.11	-	-	2.40	13.11	-	-
20	-	-	-	-	-	-	-	-	2.4	13.11	-	-	2.40	13.11	-	-
21	-	-	-	-	-	-	-	-	2.3	12.19	-	-	-	-	-	-
22	2.7	16.07	-	-	-	-	-	-	2.2	11.30	-	-	-	-	-	-
23	2.7	16.07	-	-	-	-	-	-	2.2	11.30	-	-	-	-	-	-
24	2.8	17.12	-	-	-	-	-	-	2.2	11.30	-	-	-	-	-	-
25	2.8	17.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	2.8	17.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	2.0	8.33	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-	-	-	-	-	-	2.2	11.30	-	-
30	-	-	-	-	-	-	-	-	-	-	-	-	2.2	11.30	-	-
31	-	-	-	-	-	-	-	-	-	-	-	-				
Total in Cusec-day		193.5		0.0		61.68		0.0		180.6		0.0		92.01		0.0
Total in Ha-m.		47.3		0.0		15.09		0.0		44.19		0.0		22.51		0.0

DAILY DISCHARGE OF BARLA DISTRIBUTARY SEASON – 2002/2003 Sheet-9

MONTH	DECEMBER				JANUARY				FEBRUARY				MARCH			
	Head		Tail		Head		Tail		Head		Tail		Head		Tail	
DATE	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs
1	2.6	15.05	-	-	-	-	-	-	-	-	-	-	2.8	17.12	1.5	2.82
2	2.6	15.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	2.6	15.05	-	-	1.5	5.16	-	-	-	-	-	-	-	-	-	-
4	2.6	15.05	-	-	1.5	5.16	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	2.8	17.12	1.5	2.82
9	-	-	-	-	1.8	6.98	-	-	-	-	-	-	1.0	2.66	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	2.5	14.07	1.0	1.43
11	-	-	-	-	-	-	-	-	-	-	-	-	2.8	17.12	1.5	2.82
12	-	-	-	-	-	-	-	-	-	-	-	-	2.8	17.12	1.5	2.82
13	-	-	-	-	-	-	-	-	-	-	-	-	2.8	17.12	1.5	2.82
14	-	-	-	-	-	-	-	-	-	-	-	-	2.0	8.33	1.0	1.43
15	-	-	-	-	-	-	-	-	-	-	-	-	2.0	8.33	1.0	1.43
16	-	-	-	-	2.6	15.05	-	-	-	-	-	-	2.0	8.33	1.0	1.43
17	-	-	-	-	2.6	15.05	-	-	-	-	-	-	2.0	8.33	1.0	1.43
18	-	-	-	-	2.8	17.12	0.5	0.46	-	-	-	-	2.0	8.33	1.0	1.43
19	-	-	-	-	2.8	17.12	0.5	0.46	-	-	-	-	0.5	0.87	-	-
20	-	-	-	-	2.8	17.12	0.5	0.46	-	-	-	-	-	-	-	-
21	-	-	-	-	2.5	14.07	0.5	0.46	-	-	-	-	-	-	-	-
22	-	-	-	-	2.5	14.07	0.5	0.46	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	2.0	8.33	-	-	-	-	-	-	2.8	17.12	1.5	2.82	2.0	8.33	1.0	1.43
27	2.0	8.33	-	-	-	-	-	-	2.8	17.12	1.5	2.82	2.0	8.33	1.0	1.43
28	1.8	6.98	-	-	-	-	-	-	2.8	17.12	1.5	2.82	1.0	2.66	-	-
29	1.8	6.98	-	-	-	-	-	-					2.0	8.33	1.0	1.43
30	-	-	-	-	-	-	-	-					2.0	8.33	1.0	1.43
31	-	-	-	-	-	-	-	-					2.0	8.33	1.0	1.43
Total in Cusec-day		90.82		0.0		126.9		2.30		51.36		8.46		189.2		29.8
Total in Ha-m.		22.22		0.0		31.05		0.56		12.57		2.07		46.28		7.30

DAILY DISCHARGE OF BARLA DISTRIBUTARY SEASON -- 2003/2004 sheet-10

MONTH	APRIL				MAY				JUNE				JULY			
	Head		Tail		Head		Tail		Head		Tail		Head		Tail	
DATE	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in_Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs
1	2.0	8.33	1.0	1.43	-	-	-	-	1.0	2.66	-	-	2.9	18.21	2.0	4.63
2	2.0	8.33	1.0	1.43	-	-	-	-	1.0	2.66	-	-	1.0	2.66	-	-
3	1.8	6.98	0.5	0.46	-	-	-	-	1.0	2.66	-	-	2.8	17..12	1.5	2.82
4	1.0	2.66	-	-	1.0	2.66	-	-	1.0	2.66	-	-	2.8	17..13	1.5	2.82
5	0.5	0.87	-	-	2.0	8.33	0.5	0.46	2.0	8.33	0.5	0.46	2.8	17..14	1.5	2.82
6	-	-	-	-	2.0	8.33	0.5	0.46	2.0	8.33	0.5	0.46	2.8	17..15	1.5	2.82
7	2.5	14.07	1.0	1.43	2.0	8.33	0.5	0.46	2.0	8.33	0.5	0.46	2.0	8.33	1.0	1.43
8	2.0	8.33	1.0	1.43	1.0	2.66	-	-	2.0	8.33	0.5	0.46	2.0	8.33	1.0	1.43
9	2.0	8.33	1.0	1.43	2.0	8.33	0.5	0.46	2.5	14.07	1.0	1.43	2.0	8.33	1.0	1.43
10	2.0	8.33	1.0	1.43	2.0	8.33	0.5	0.46	2.5	14.07	1.0	1.43	2.0	8.33	1.0	1.43
11	1.0	2.66	-	-	2.0	8.33	0.5	0.46	2.5	14.07	0.5	0.46	2.0	8.33	1.0	1.43
12	1.0	2.66	-	-	2.0	8.33	0.5	0.46	1.0	2.66	0.5	0.46	-	-	-	-
13	2.0	8.33	1.0	1.43	2.0	8.33	0.5	0.46	2.5	14.07	0.5	0.46	-	-	-	-
14	2.0	8.33	1.0	1.43	2.0	8.33	0.5	0.46	2.5	14.07	0.5	0.46	-	-	-	-
15	1.0	2.66	-	-	2.0	8.33	0.5	0.46	2.5	14.07	0.5	0.46	-	-	-	-
16	1.0	2.66	-	-	2.5	14.07	1.0	1.43	2.5	14.07	1.0	1.43	-	-	-	-
17	1.0	2.66	-	-	2.5	14.07	1.0	1.43	2.5	14.07	1.0	1.43	1.0	2.66	0.5	0.46
18	-	-	-	-	2.0	8.33	0.5	0.46	2.8	17.12	1.5	2.82	1.0	2.66	0.5	0.46
19	-	-	-	-	2.0	8.33	0.5	0.46	2.8	17.12	1.5	2.82	1.0	2.66	0.5	0.46
20	-	-	-	-	1.5	5.16	-	-	2.8	17.12	1.5	2.82	1.0	2.66	0.5	0.46
21	-	-	-	-	2.0	8.33	0.5	0.46	2.5	14.07	1.0	1.43	1.0	2.66	0.5	0.46
22	-	-	-	-	2.6	15.05	1.0	1.43	2.8	17.12	1.5	2.82	1.0	2.66	0.5	0.46
23	-	-	-	-	2.6	15.05	1.0	1.43	2.8	17.12	1.5	2.82	1.0	2.66	0.5	0.46
24	-	-	-	-	2.6	15.05	1.0	1.43	2.8	17.12	1.5	2.82	2.0	8.33	1.0	1.43
25	-	-	-	-	2.6	15.05	1.0	1.43	2.8	17.12	1.5	2.82	2.0	8.33	1.0	1.43
26	-	-	-	-	2.6	15.05	1.0	1.43	2.9	18.21	2.0	4.63	2.0	8.33	1.0	1.43
27	-	-	-	-	2.6	15.05	1.0	1.43	2.9	18.21	2.0	4.63	2.0	8.33	1.0	1.43
28	-	-	-	-	2.6	15.05	1.0	1.43	2.9	18.21	2.0	4.63	1.5	5.16	0.5	0.46
29	-	-	-	-	1.0	2.66	-	-	2.9	18.21	2.0	4.63	1.5	5.16	0.5	0.46
30	-	-	-	-	1.0	2.66	-	-	2.9	18.21	2.0	4.63	1.0	2.66	-	-
31	-	-	-	-	1.0	2.66	-	-					1.0	2.66	-	-
Total in Cusec-day		96.2		11.90		260.2		18.85		384.1		54.18		130.1		32.92
Total in Ha-m.		23.53		2.91		63.7		4.61		94.0		13.26		31.83		8.05

DAILY DISCHARGE OF BARLA DISTRIBUTARY SEASON -- 2003/2004 sheet-11

MONTH	AUGUST				SEPTEMBER				OCTOBER				NOVEMBER			
	Head		Tail		Head		Tail		Head		Tail		Head		Tail	
DATE	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs
1	2.0	8.33	1.0	1.43	2.0	8.33	1.0	1.43	2.0	8.33	1.0	1.43	Canal closed			
2	2.0	8.33	1.0	1.43	2.0	8.33	1.0	1.43	-	-	-	-	"			
3	2.0	8.33	1.0	1.43	2.0	8.33	1.0	1.43	-	-	-	-	"			
4	2.0	8.33	1.0	1.43	-	-	-	-	-	-	-	-	"			
5	1.0	2.66	0.5	0.46	-	-	-	-	2.0	8.33	0.5	0.46	"			
6	1.0	2.66	0.5	0.46	-	-	-	-	-	-	-	-	"			
7	1.0	2.66	0.5	0.46	-	-	-	-	-	-	-	-	"			
8	1.0	2.66	0.5	0.46	-	-	-	-	-	-	-	-	"			
9	1.0	2.66	-	-	-	-	-	-	-	-	-	-	"			
10	1.0	2.66	-	-	-	-	-	-	-	-	-	-	"			
11	1.0	2.66	-	-	-	-	-	-	-	-	-	-	"			
12	1.0	2.66	-	-	-	-	-	-	-	-	-	-	"			
13	-	-	-	-	-	-	-	-	-	-	-	-	"			
14	-	-	-	-	-	-	-	-	-	-	-	-	"			
15	-	-	-	-	-	-	-	-	-	-	-	-	"			
16	1.5	5.16	0.5	0.46	-	-	-	-	-	-	-	-	"			
17	1.5	5.16	0.5	0.46	-	-	-	-	-	-	-	-	"			
18	2.0	8.33	1.0	1.43	2.0	8.33	1.0	1.43	-	-	-	-	"			
19	2.0	8.33	1.0	1.43	2.0	8.33	1.0	1.43	-	-	-	-	"			
20	2.0	8.33	1.0	1.43	2.0	8.33	1.0	1.43	-	-	-	-	"			
21	2.0	8.33	1.0	1.43	2.0	8.33	1.0	1.43	-	-	-	-	"			
22	2.0	8.33	1.0	1.43	2.0	8.33	1.0	1.43	-	-	-	-	"			
23	2.0	8.33	1.0	1.43	2.8	17.12	2.0	4.63	-	-	-	-	"			
24	2.0	8.33	1.0	1.43	2.8	17.12	2.0	4.63	-	-	-	-	"			
25	-	-	-	-	2.8	17.12	2.0	4.63	-	-	-	-	"			
26	-	-	-	-	2.8	17.12	2.0	4.63	-	-	-	-	"			
27	-	-	-	-	2.0	8.33	1.0	1.43	-	-	-	-	"			
28	2.0	8.33	1.0	1.43	2.0	8.33	1.0	1.43	-	-	-	-	"			
29	2.0	8.33	1.0	1.43	2.0	8.33	1.0	1.43	-	-	-	-	"			
30	2.0	8.33	1.0	1.43	2.0	8.33	1.0	1.43	-	-	-	-	"			
31	2.0	8.33	1.0	1.43					-	-	-	-				
Total in Cusec-day		156.6		24.21		168.4		35.7		16.66		1.89		0.0		0.0
Total in Ha-m.		38.30		5.92		41.2		8.7		4.08		0.46		0.0		0.0

DAILY DISCHARGE OF BARLA DISTRIBUTARY SEASON -- 2003/2004 Sheet-12

MONTH	DECEMBER				JANUARY				FEBRUARY				MARCH			
	Head		Tail		Head		Tail		Head		Tail		Head		Tail	
DATE	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs
1	Canal closed				Readings are not taken				Readings are not taken				Readings are not taken			
2	"				"				"				"			
3	"				"				"				"			
4	"				"				"				"			
5	"				"				"				"			
6	"				"				"				"			
7	"				"				"				"			
8	"				"				"				"			
9	"				"				"				"			
10	"				"				"				"			
11	2.0	8.33	1.0	1.43	"				"				"			
12	2.0	8.33	1.0	1.43	"				"				"			
13	Canal closed				"				"				"			
14	"				"				"				"			
15	"				"				"				"			
16	"				"				"				"			
17	"				"				"				"			
18	"				"				"				"			
19	"				"				"				"			
20	"				"				"				"			
21	"				"				"				"			
22	"				"				"				"			
23	"				"				"				"			
24	"				"				"				"			
25	"				"				"				"			
26	"				"				"				"			
27	"				"				"				"			
28	"				"				"				"			
29	"				"				"				"			
30	"				"				"				"			
31	"				"				"				"			
Total in Cusec-day		16.66		2.86												
Total in Ha-m.		4.08		0.70												

Annexure:3
Table-4

Sheet-1

DAILY DISCHARGE OF BHAISANI DISTRIBUTARY SEASON -- 1998/1999

MONTH	DECEMBER				JANUARY				FEBRUARY				MARCH			
	Head		Tail		Head		Tail		Head		Tail		Head		Tail	
DATE	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs	Gauge in Feet	Discharge in Cusecs
1	-	-	-	-	2.5	24.30	0.5	0.3	-	-	-	-	-	-	-	-
2	1.5	10.6	-	-	2.5	24.30	-	-	-	-	-	-	-	-	-	-
3	2.5	24.3	upto o.n.48		2.8	29.26	-	-	-	-	-	-	-	-	-	-
4	2.5	24.3	"		2.8	29.26	-	-	-	-	-	-	-	-	-	-
5	2.5	24.3	"		2.5	24.30	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	2.5	24.30	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	2.5	24.30	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	1.8	14.26	0.5	0.34	-	-	-	-
15	-	-	-	-	-	-	-	-	1.8	14.26	0.5	0.34	-	-	-	-
16	-	-	-	-	-	-	-	-	1.8	14.26	0.5	0.34	-	-	-	-
17	-	-	-	-	-	-	-	-	1.8	14.26	upto o.n.-52		-	-	-	-
18	-	-	-	-	-	-	-	-	1.8	14.26	"		-	-	-	-
19	-	-	-	-	-	-	-	-	2.6	25.91	0.5	0.34	-	-	-	-
20	-	-	-	-	-	-	-	-	2.6	25.91	upto o.n.-52		-	-	-	-
21	-	-	-	-	-	-	-	-	2.6	25.91	"		-	-	-	-
22	-	-	-	-	-	-	-	-	2.6	25.91	0.5	0.34	-	-	-	-
23	-	-	-	-	-	-	-	-	2.6	25.91	0.5	0.34	-	-	-	-
24	-	-	-	-	-	-	-	-	2.6	25.91	0.5	0.34	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-	-	1.8	14.26	upto o.n.-52	
26	-	-	-	-	-	-	-	-	-	-	-	-	1.8	14.26	-	-
27	-	-	-	-	-	-	-	-	-	-	-	-	1.8	14.26	-	-
28	-	-	-	-	-	-	-	-	-	-	-	-	1.8	14.26	upto o.n.-52	
29	-	-	-	-	-	-	-	-					1.8	14.26	-	-
30	-	-	-	-	-	-	-	-					1.8	14.26	-	-
31	-	-	-	-	-	-	-	-					1.8	14.26	-	-
Total in Cusec-day		83.5		0.0		180.0		0.34		226.8		2.4		99.8		0.0
Total in Ha-m.		20.4		0.0		44.0		0.08		55.5		0.6		24.4		0.0

Annexure:3
Table-5

Sheet-1

MONTHLY WATER WITHDRAWAL OF BHAISANI DISTRIBUTARY Unit in Ha-m.

Month	April		May		June		July		August		Septem.		October		Novem.		Decem.		January		February		March	
Year	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail
1998/99	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	20.4	0.0	44.0	0.1	55.5	0.6	24.4	0.0
2000/01	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	54.8	0.0	71.3	0.0	30.8	0.0	17.8	0.0	0.0	0.0
2001/02	101.2	0.0	203.6	0.0	31.0	0.0	67.9	0.3	170	0.0	154.6	0.0	83.2	0.0	90.0	0.0	47.6	0.0	63.0	0.0	86.0	2.5	70.3	2.6
2002/03	118.8	1.2	166.5	0.7	107.5	3.5	142.8	0.0	113.7	0.0	26.1	0.0	104.3	0.0	18.2	0.0	33.1	0.0	70.3	1.0	17.8	0.2	80.4	0.8
2003/04	49.7	0.0	120.5	0.0	138.0	0.1	92.3	3.4	91.5	5.5	36.6	0.0	5.5	0.0	10.5	0.0	0.0	0.0	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Average in Ha-m.	89.9	0.4	164	0.2	92.2	1.2	101	1.2	125	1.8	72.4	0.0	64.3	0.0	43.4	0.0	34.5	0.0	52.0	0.3	44.3	0.8	43.8	0.9

MONTHLY WATER WITHDRAWAL OF BARLA DISTREBUTARY Unit in Ha-m.

Month	April		May		June		July		August		Septem.		October		Novem.		Decem.		January		February		March	
Year	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail
1998/99	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	11.6	0.0	8.5	0.5	34.2	1.1	11.9	0.5
2000/01	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	28.5	0.0	34.1	0.0	16.6	0.0	18.9	0.0	16.9	0.0
2001/02	67.0	0.0	94.2	0.0	16.7	0.0	28.0	5.1	54.2	8.8	72.9	2.1	48.2	1.5	50.6	2.7	24.0	1.6	26.5	1.1	51.6	0.0	71.5	5.53
2002/03	84.3	8.1	85.2	2.1	89.1	1.0	99.9	0.4	47.3	0.0	15.1	0.0	44.2	0.0	22.5	0.0	22.2	0.0	31.1	0.6	12.6	2.1	46.3	7.3
2003/04	23.5	2.9	63.7	4.6	94.0	13.3	31.8	8.1	38.3	5.9	41.2	8.7	4.1	0.5	0.0	0.0	4.1	0.7	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Average in Ha-m.	58.3	3.7	81.0	2.2	66.6	4.8	53.3	4.5	46.5	4.9	43.1	3.6	32.2	0.7	25.4	0.7	19.2	0.5	20.7	0.5	29.3	0.8	36.6	2.6
Average at 1/3rd length from tail(50% more)		5.5		3.3		7.1		6.8		7.3		5.4		1.0		1.0		0.7		0.8		1.2		3.9

MONTHLY WATER WITHDRAWAL OF KHOJA NAGLA MINOR Unit in Ha-m. Sheet-2

Month	April		May		June		July		August		Septem.		October		Novem.		Decem.		January		February		March	
Year	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail
1998/99	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	5.4	2.6	7.6	2.5	3.5	0.2	1.0	0.0
2000/01	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001/02	0.0	0.0	8.7	1.8	0.0	0.0	7.4	0.0	18.9	0.2	32.2	0.0	24.0	0.0	38.5	6.7	17.2	3.0	24.7	4.1	41.6	5.3	44.4	7.0
2002/03	55.4	7.6	84.7	6.5	55.1	9.5	53.8	0.0	32.8	6.3	7.6	1.3	13.8	0.0	12.4	2.1	16.9	2.2	39.8	5.3	7.6	1.3	31.9	5.4
2003/04	42.8	7.5	64.9	6.2	65.5	3.8	47.5	8.9	31.3	3.5	22.8	3.5	12.8	0.0	25.7	0.0	3.4	0.0	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Average in Ha-m.	32.7	5.0	52.8	4.8	40.2	4.4	36.2	3.0	27.7	3.3	20.9	1.6	16.9	0.0	19.2	2.2	8.6	1.6	18.0	3.0	13.2	1.7	19.3	3.1
Average at 1/3rd length from tail(50% more)		7.6		7.3		6.7		4.5		5.0		2.4		0.0		3.3		2.3		4.5		2.6		4.7

MONTHLY WATER WITHDRAWAL OF BIJOPURA MINOR Unit in Ha-m.

Month	April		May		June		July		August		Septem.		October		Novem.		Decem.		January		February		March	
Year	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail
1998/99	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0.7	0.4	0.3	0.2	1.7	1.0	0.6	0.0
2000/01	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001/02	0.0	0.0	0.0	0.0	0.0	0.0	2.6	1.9	5.1	4.5	2.7	0.0	1.0	0.7	4.0	4.0	0.9	0.9	1.7	1.5	3.1	2.1	5.2	3.5
2002/03	6.7	4.6	7.6	4.4	7.9	5.7	1.3	0.3	1.2	0.1	1.1	0.6	0.0	0.0	0.0	0.0	1.4	0.4	2.6	2.6	1.2	1.2	5.9	5.9
2003/04	3.1	3.1	5.6	5.5	10.0	8.6	6.4	6.4	8.9	8.9	3.3	3.3	0.1	0.1	0.6	0.0	0.3	0.3	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Average in Ha-m.	3.3	2.6	4.4	3.3	6.0	4.8	3.4	2.9	5.1	4.5	2.4	1.3	0.4	0.3	1.2	1.0	0.7	0.4	1.2	1.1	1.5	1.1	2.9	2.4

Sheet-3

MONTHLY WATER WITHDRAWAL OF KHAMPUR MINOR Unit in Ha-m.

Month	April		May		June		July		August		Septem.		October		Novem.		Decem.		January		February		March	
Year	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail	Head	Tail
1998/99	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0.23	0.1	1.3	0.7	1.2	0.6	0.3	0.2
2000/01	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001/02	0.0	0.0	0.0	0.0	0.0	0.0	2.3	1.1	3.1	1.3	1.5	0.1	0.3	0.1	1.2	0.6	0.5	0.2	1.1	0.5	1.1	0.6	4.1	2.1
2002/03	5.9	2.8	9.8	5.0	7.0	3.0	1.1	0.6	2.1	1.1	0.7	0.4	0.0	0.0	0.0	0.0	0.3	0.1	2.2	1.0	0.7	0.4	3.4	1.7
2003/04	1.6	0.8	3.7	1.8	5.8	2.9	8.6	4.3	7.3	3.7	2.4	1.2	0.3	0.2	0.0	0.0	0.4	0.2	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Average in Ha-m.	2.5	1.2	4.5	2.3	4.3	2.0	4.0	2.0	4.2	2.0	1.6	0.6	0.2	0.1	0.3	0.1	0.3	0.1	1.1	0.6	0.8	0.4	1.9	1.0

Annexure:3
Table-6

MONTHLY WATER WITHDRAWAL OF RIGHT MAIN DISTRIBUTARY Unit in Ha-m.

Year/Month	April	May	June	July	August	Septem.	October	Novem.	Decem.	January	February	March
1998/1999	205.93	261.86	320.21	271.31	118.54	76.64	0.00	118.54	51.82	120.37	58.72	73.64
1999/2000	465.23	342.28	317.03	293.08	245.93	184.84	230.62	208.72	96.11	135.25	0.00	116.58
2000/2001	354.78	258.90	168.33	230.72	161.48	121.35	94.19	227.73	172.24	103.00	121.47	30.83
2001/2002	301.67	403.77	68.26	189.69	425.30	657.90	348.15	474.40	174.20	321.49	367.48	368.22
2002/2003	628.29	836.99	527.74	846.29	470.97	127.22	325.16	328.83	290.66	503.03	82.57	627.56
2003/2004	528.96	959.08	1027.6	609.45	741.82	414.95	277.94	548.04	35.48	N.A.	N.A.	N.A.
Average in Ha-m.	414.14	510.48	404.86	406.76	360.67	263.82	212.68	317.71	136.75	236.63	126.05	243.37
Average in Cusec-day	1692.7	2086.5	1654.8	1662.5	1474.2	1078.3	869.3	1298.6	558.9	967.2	515.2	994.7

MONTHLY WATER WITHDRAWAL THROUGH DIRECT OUTLETS OF RIGHT MAIN DISTRIBUTARY Unit in Ha-m.

TOTAL CAPACITY OF DIRECT OUTLETS THROUGH RIGHT MAIN DY = 27.48 Cusecs = 0.778 Cumecs

Percentage of water withdrawal through outlets of Right Main Dy=(27.48/95)x100=28.9%

Month	April	May	June	July	August	Septem.	October	Novem.	Decem.	January	February	March
Average water withdrawal through direct outlets of Right Main Dy in Ha-m.	119.7	147.5	117.0	117.6	104.2	76.2	61.5	91.8	39.5	68.4	36.4	70.3

Annexure :4
Table No.1

Sheet-1

AREA IRRIGATED IN DIFFERENT DY/MINORS (Area in Ha.)

S.No.	Name of Channel	Year	Kharif		Sugarcane	Sub Total	Rabi		Sub Total	Total
			Paddy	Other Kharif			Wheat	Other Rabi		
1	2	3	4	5	6	7	8	9	10	11
1	Right Main Dy CCA=2111 Ha.	1998-99	253	308	1350	1911	603	258	861	2772
		1999-00	148	292	1323	1763	603	258	861	2624
		2000-01	219	389	1238	1846	561	240	801	2647
		2001-02	198	430	1257	1885	578	248	826	2711
		2002-03	141	514	1307	1962	578	248	825	2787
		2003-04	251	566	1188	2005	N.A.	N.A.	N.A.	2005
Average			201.7	416.5	1277.2	1895.3	584.4	250.4	834.8	2730.133
2	Bhaisani Dy CCA=2237 Ha.	1998-99	126	249	1227	1602	427	183	610	2212
		1999-00	121	239	1225	1585	427	183	610	2195
		2000-01	111	163	1115	1389	378	162	540	1929
		2001-02	100	226	1252	1578	442	190	632	2210
		2002-03	83	280	1269	1632	445	191	636	2268
		2003-04	157	352	1160	1669	N.A.	N.A.	N.A.	1669
Average			116.3	251.5	1208.0	1575.8	423.9	181.7	605.6	2181.433
3	Barla Dy CCA= 708 Ha.	1998-99	125	113	491	729	177	76	253	982
		1999-00	125	113	491	729	177	76	253	982
		2000-01	88	50	446	584	183	78	261	845
		2001-02	76	70	461	607	179	77	256	863
		2002-03	59	92	472	623	197	85	282	905
		2003-04	84	101	437	622	N.A.	N.A.	N.A.	622
Average			92.8	89.8	466.3	649.0	182.7	78.3	261.0	910.0
4	Khoja Nagla Minor CCA=568 Ha.	1998-99	18	49	223	290	88	38	125	415
		1999-00	15	41	228	284	88	38	125	409
		2000-01	15	46	189	250	72	31	103	353
		2001-02	20	63	186	269	103	44	147	416
		2002-03	13	66	225	304	102	44	146	450
		2003-04	25	85	220	330	N.A.	N.A.	N.A.	330
Average			17.7	58.3	211.8	287.8	90.4	38.8	129.2	417.0
5	Bijopura Minor CCA=138 Ha.	1998-99	3	17	51	71	21	9	30	101
		1999-00	3	17	51	71	21	9	30	101
		2000-01	0	5	18	23	10	4	14	37
		2001-02	0	7	26	33	15	7	22	55
		2002-03	0	14	28	42	15	6	21	63
		2003-04	1	15	26	42	N.A.	N.A.	N.A.	42
Average			1.2	12.5	33.3	47.0	16.4	7.0	23.4	70.4
6	Khampur Minor CCA=128 Ha.	1998-99	3	4	59	66	22	9	31	97
		1999-00	3	4	59	66	22	9	31	97
		2000-01	4	8	52	64	13	6	19	83
		2001-02	3	2	58	63	11	5	15	78
		2002-03	3	12	38	53	13	6	19	72
		2003-04	7	10	47	64	14	6	20	64
Average			3.8	6.7	52.2	62.7	15.75	6.75	22.5	85.2

Anneure-4
Table-1

Sheet-2

EXISTING CROPPING PATTERN (Area in Ha.)

S.No.		Name of crop	Right Main Dy. CCA=2111ha.		Bhaisani Dy. CCA=2237ha.		Barla Dy. CCA=708ha.		Khoja Nagla Mr. CCA=568ha.		Bijopura Mr. CCA=138ha.		Khampur Mr. CCA=128ha.		Total Area CCA=5890 ha.		% of CCA as per proposed cropping pattern
			Area irrigated in ha.	% of CCA.	Area irrigated in ha.	% of CCA.	Area irrigated in ha.	% of CCA.	Area irrigated in ha.	% of CCA.	Area irrigated in ha.	% of CCA.	Area irrigated in ha.	% of CCA.	Area irrigated in ha.	% of CCA.	
1		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	KHARIF	Paddy	202	9.6	116	5.2	93	13.1	18	3.2	2	1.5	3.8	2.97	434.8	7.4	15
2	KHARIF	Other kharif i.e.millet, sorghum, fodder.	417	19.8	252	11.3	90	12.7	58	10.2	12	8.7	6.7	5.23	835.7	14.2	21
3		Sugarcane	1277	60.5	1208	54	466	65.8	212	37.3	33	23.9	52.2	40.78	3248.2	55.1	30
Sub Total			1896	89.9	1576	70.5	649	91.6	288	50.7	47	34.1	62.7	48.98	4518.7	76.7	66
4	RABI	Wheat	584	27.7	424	19	183	25.8	90	15.8	16	11.6	15.75	12.30	1312.75	22.3	41
5	RABI	Other rabi i.e.Berseem, Potato	251	11.9	182	8.1	78	11.0	39	6.9	8	5.8	6.75	5.27	564.75	9.6	
Sub Total			835	39.6	606	27.1	261	36.8	129	22.7	24	17.4	22.5	17.58	1877.5	31.9	41
6		TOTAL	2731	129.4	2182	97.6	910	128.5	417	73.4	71	51.5	85.2	66.56	6396.2	108.6	107

Annexure:4
Table-2

Sheet-1

MONTH-WISE GROSS IRRIGATION WATER REQUIREMENT OF DIFFERENT CHANNELS (May to October)

S.No.	Name of channel	Name of crop		Area in Ha.	May		June		July		August		September		October		Total		Remarks
					Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Individual Area
1	2	3		4	15	16	5	6	7	8	9	10	11	12	13	14	15	16	17
1	Right Main Dy. CCA= 2111ha.	KHARIF	Paddy	202	-	-	47	9.5	763	154	442	89	525	106	311	63	2088	421.8	
		KHARIF	Other kharif e.g. Millet, Sorghum, Fodder	417	-	-	-	-	107	44.6	91	37.9	193	80.5	150	62.6	541.0	225.6	
		Sugarcane		1277	352	449.5	451	576	314	401	338	432	425	543	249	318	2129	2718.7	
		RABI	Wheat	584	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Paddy = 434.8 ha. Other kharif = 835.7 ha. Sugarcane = 3248.2 ha. Wheat = 1312.75 ha. Other Rabi = 564.75 ha.
		RABI	Other rabi e.g. Berseem,Potato	251	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		Sub Total		2731		449.5		585.421		599.723		558.9		729.3		443.3		3366.1	
2	Bhaisani Dy. CCA= 2237 ha.	KHARIF	Paddy	116	-	-	47	5.5	763	88.5	442	51.3	525	60.9	311	36.1	2088	242.2	
		KHARIF	Other kharif e.g. Millet, Sorghum, Fodder	252	-	-	-	-	107	27.0	91	22.9	193	48.6	150	37.8	541.0	136.3	
		Sugarcane		1208	352	425.2	451	545	314	379	338	408	425	513	249	301	2129	2571.8	
		RABI	Wheat	424	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		RABI	Other rabi e.g. Berseem,Potato	182	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		Sub Total		2182		425.2		550.26		494.784		482.508		622.9		374.668		2950.4	

MONTH-WISE GROSS IRRIGATION WATER REQUIREMENT OF DIFFERENT CHANNELS (May to October) Sheet-2

S.No.	Name of channel	Name of crop		Area in Ha.	May		June		July		August		September		October		Total		Remarks
					Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	
1	2	3		4	15	16	5	6	7	8	9	10	11	12	13	14	15	16	17
3	Barla Dy. CCA= 708ha.	KHARIF	Paddy	93	-	-	47	4.4	763	71	442	41	525	49	311	29	2088	194.2	
		KHARIF	Other kharif e.g. Millet, Sorghum, Fodder	90	-	-	-	-	107	9.6	91	8.2	193	17.4	150	13.5	541.0	48.7	
		Sugarcane		466	352	164.0	451	210	314	146	338	158	425	198	249	116	2129	992.1	
		RABI	Wheat	183	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		RABI	Other rabi e.g. Berseem,Potato	78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		Sub Total		910		164.0		214.537		226.913		206.8		264.2		158.5		1235.0	
4	Khoja-Nagla Minor CCA= 568 ha.	KHARIF	Paddy	18	-	-	47	0.8	763	13.7	442	8.0	525	9.5	311	5.6	2088	37.6	
		KHARIF	Other kharif e.g. Millet, Sorghum, Fodder	58	-	-	-	-	107	6.2	91	5.3	193	11.2	150	8.7	541.0	31.4	
		Sugarcane		212	352	74.6	451	96	314	67	338	72	425	90	249	53	2129	451.3	
		RABI	Wheat	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		RABI	Other rabi e.g. Berseem,Potato	39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		Sub Total		417		74.6		96.5		86.5		84.9		110.7		67.1		520.3	

MONTH-WISE GROSS IRRIGATION WATER REQUIREMENT OF DIFFERENT CHANNELS (May to October) Sheet-3

S.No.	Name of channel		Name of crop	Area in Ha.	May		June		July		August		September		October		Total		Remarks
					Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	
1	2		3	4	15	16	5	6	7	8	9	10	11	12	13	14	15	16	17
5	Bijepura Minor CCA= 138 ha.	KHARIF	Paddy	2	-	-	47	0.1	763	1.5	442	0.9	525	1.1	311	0.6	2088	4.2	
		KHARIF	Other kharif e.g. Millet, Sorghum, Fodder	12	-	-	-	-	107	1.3	91	1.1	193	2.3	150	1.8	541.0	6.5	
			Sugarcane	33	352	11.6	451	14.9	314	10.4	338	11.2	425	14.0	249	8.2	2129	70.3	
		RABI	Wheat	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		RABI	Other rabi e.g. Berseem, Potato	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
			Sub Total	71		11.6		15.0		13.2		13.1		17.4		10.6		80.9	
6	Khampur Minor CCA=128 ha.	KHARIF	Paddy	3.8	-	-	47	0.2	763	2.9	442	1.7	525	2.0	311	1.2	2088	7.9	
		KHARIF	Other kharif e.g. Millet, Sorghum, Fodder	6.7	-	-	-	-	107	0.7	91	0.6	193	1.3	150	1.0	541.0	3.6	
			Sugarcane	52.2	352	18.4	451	23.5	314	16.4	338	17.6	425	22.2	249	13.0	2129	111.1	
		RABI	Wheat	15.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		RABI	Other rabi e.g. Berseem,Potato	6.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
			Sub Total	85.2		18.4		23.7		20.0		19.9		25.5		15.2		122.7	
7	Grand Total of all channels			6396.2		1143		1485		1441.11		1366.1		1770		1069.4		8275	

Annexure:4 Table-3 Sheet-1

MONTH-WISE GROSS IRRIGATION WATER REQUIREMENT OF DIFFERENT CHANNELS (November to April)

S.No.	Name of channel	Name of crop		Area in Ha.	November		December		January		February		March		April		Total		Remarks
					Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	
1	2	3		4	15	16	5	6	7	8	9	10	11	12	13	14	15	16	17
1	Right Main Dy. CCA= 2111ha.	KHARIF	Paddy	202	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		KHARIF	Other kharif e.g. Millet, Sorghum, Fodder	417	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		Sugarcane		1277	159	203	107	136.6	73	93.2	103	131.5	167	213.3	198	252.8	807.0	1030.5	
		RABI	Wheat	584	151	88.2	85	49.6	132	77.1	168	98.1	118	68.9	10	5.8	664.0	387.8	
		RABI	Other rabi e.g. Berseem, Potato	251	196	49.2	165	41.4	148	37.1	210	52.7	378	94.9	248	62.2	1345	337.6	
		Sub Total		2731		340.4		227.694		207.457		282.4		377.0		320.9		1755.9	
2	Bhaisani Dy. CCA= 2237 ha.	KHARIF	Paddy	116	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		KHARIF	Other kharif e.g. Millet, Sorghum, Fodder	252	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		Sugarcane		1208	159	192	107	129.3	73	88.2	103	124.4	167	201.7	198	239.2	807.0	974.9	
		RABI	Wheat	424	151	64	85	36.0	132	56.0	168	71.2	118	50.0	10	4.2	664.0	281.5	
		RABI	Other rabi e.g. Berseem, Potato	182	196	36	165	30.0	148	26.9	210	38.2	378	68.8	248	45.1	1345	244.8	
		Sub Total		2182		291.8		195.326		171.088		233.9		320.6		288.56		1501.2	

MONTH-WISE GROSS IRRIGATION WATER REQUIREMENT OF DIFFERENT CHANNELS (Novemer to April) Sheet-2

S.No.	Name of channel	Name of crop		Area in Ha.	November		December		January		February		March		April		Total		Remarks
					Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	
1	2	3		4	15	16	5	6	7	8	9	10	11	12	13	14	15	16	17
3	Barla Dy. CCA= 708ha.	KHARIF	Paddy	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		KHARIF	Other kharif e.g. Millet, Sorghum, Fodder	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
			Sugarcane	466	159	74	107	49.9	73	34.0	103	48.0	167	77.8	198	92.3	807.0	376.1	
		RABI	Wheat	183	151	28	85	15.6	132	24.2	168	30.7	118	21.6	10	1.8	664.0	121.5	
		RABI	Other rabi e.g. Berseem, Potato	78	196	15	165	12.9	148	11.5	210	16.4	378	29.5	248	19.3	1345	104.9	
		Sub Total		910		117.0		78.3		69.7		95.1		128.9		113.4		602.5	
4	Khoja-Nagla Minor CCA= 568 ha.	KHARIF	Paddy	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		KHARIF	Other kharif e.g. Millet, Sorghum, Fodder	58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
			Sugarcane	212	159	33.7	107	22.7	73	15.5	103	21.8	167	35.4	198	42.0	807.0	171.1	
		RABI	Wheat	90	151	13.6	85	7.7	132	11.9	168	15.1	118	10.6	10	0.9	664.0	59.8	
		RABI	Other rabi e.g. Berseem, Potato	39	196	7.6	165	6.4	148	5.8	210	8.2	378	14.7	248	9.7	1345	52.5	
		Sub Total		417		54.9		36.8		33.1		45.1		60.766		52.5		283.3	

MONTH-WISE GROSS IRRIGATION WATER REQUIREMENT OF DIFFERENT CHANNELS (November to April) Sheet-3

S.No.	Name of channel	Name of crop		Area in Ha.	November		December		January		February		March		April		Total		Remarks
					Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	
1	2	3		4	15	16	5	6	7	8	9	10	11	12	13	14	15	16	17
5	Bijopura Minor CCA= 138 ha.	KHARIF	Paddy	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		KHARIF	Other kharif e.g. Millet, Sorghum, Fodder	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		Sugarcane		33	159	5.2	107	3.5	73	2.4	103	3.4	167	5.5	198	6.5	807.0	26.6	
		RABI	Wheat	16	151	2.4	85	1.4	132	2.1	168	2.7	118	1.9	10	0.2	664.0	10.6	
		RABI	Other rabi e.g. Berseem, Potato	8	196	1.6	165	1.3	148	1.2	210	1.7	378	3.0	248	2.0	1345	10.8	
		Sub Total		71		9.2		6.2		5.7		7.8		10.4		8.7		48.0	
6	Khampur Minor CCA=128 ha.	KHARIF	Paddy	3.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		KHARIF	Other kharif e.g. Millet, Sorghum, Fodder	6.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		Sugarcane		52.2	159	8.3	107	5.6	73	3.8	103	5.4	167	8.7	198	10.3	807.0	42.1	
		RABI	Wheat	15.75	151	2.4	85	1.3	132	2.1	168	2.6	118	1.9	10	0.2	664.0	10.5	
		RABI	Other rabi e.g. Berseem, Potato	6.75	196	1.3	165	1.1	148	1.0	210	1.4	378	2.6	248	1.7	1345	9.1	
		Sub Total		85.2		12.0		8.0		6.9		9.4		13.1		12.2		61.7	
7	Grand Total of all channels			6396.2		825.38		552.3		494.0		673.7		910.8		796.3		4252.6	

Annexure:4
Table-4

GROSS IRRIGATION WATER REQUIREMENT OF DIFFERENT CHANNELS (in Ha-m.)

S.No.	Name of Channel	Area irrigated in Ha.	Janua.	Febru.	March	April	May	June	July	Augus.	Sept.	Octob.	Nove.	Decem.	Remarks (Design discharge at head)
1	Right Main Dy. CCA= 2111ha.	2731	207.5	282.4	377.0	321.0	449.5	585.4	599.7	558.9	729.3	443.3	340.4	227.7	95 cusecs = 2.69 cumecs
2	Bhaisani Dy. CCA= 2237ha.	2182	171.1	233.9	320.6	288.6	425.2	550.3	494.8	482.5	622.9	374.7	291.8	195.3	43 cusecs= 1.22 cumecs
3	Barla Dy. CCA = 708ha.	910	69.7	95.1	128.9	113.4	164	214.5	226.9	206.8	264.2	158.5	117	78.3	12 cusecs = 0.34 cumecs
4	Khoja Nagla Minor CCA= 568ha.	417	33.1	45.1	60.8	52.5	74.6	96.5	86.5	84.9	110.7	67.1	54.9	36.8	9 cusecs = 0.25 cumecs
5	Bijopura Minor CCA = 138ha.	71	5.7	7.8	10.4	8.7	11.6	15.0	13.2	13.1	17.4	10.6	9.2	6.2	3 cusecs = 0.085 cumecs
6	Khampur Minor CCA= 128 ha.	85.2	6.9	9.4	13.1	12.2	18.4	23.7	20.0	19.9	25.5	15.2	12.0	8.0	3 cusecs = 0.085 cumecs
6	Grand Total	6396.2	494.0	673.7	910.8	796.4	1143.3	1485.4	1441.1	1366.1	1770.0	1069.4	825.3	552.3	

Annexure:4
Table-5

EXISTING CROPPING PATTERN OF LAST 1/3rd OF TOTAL REACH (TAIL REACH) (Area in Ha.)

S.No.		Name of crop	Barla Dy. CCA=671acres= 271.5 ha		Khoja Nagla Mr. CCA=898acres= 363.4ha.		Bijopura Mr. CCA=250acres= 101.2ha.		Khampur Mr. CCA=262acres= 106.0 ha.		Total Area CCA=2081acres= 842.1ha.		% of CCA as per proposed cropping pattern
			Area irrigated in ha.	% of CCA.	Area irrigated in ha.	% of CCA.	Area irrigated in ha.	% of CCA.	Area irrigated in ha.	% of CCA.	Area irrigated in ha.	% of CCA.	
1		2	7	8	9	10	11	12	13	14	15	16	17
1	KHARIF	Paddy	26.8	9.87	4.0	1.10	1.0	0.99	3.0	2.8	34.8	4.13	15
2	KHARIF	Other kharif i.e.millet, sorghum, fodder.	26.7	9.83	10.5	2.89	5.0	4.94	6.0	5.7	48.2	5.72	21
3		Sugarcane	117.7	43.35	31.5	8.67	16.0	15.81	44.0	41.5	209.2	24.84	30
Sub Total			**171.2**	**63.1**	**46.0**	**12.7**	**22.0**	**21.7**	**53.0**	**50.0**	**292.2**	**34.70**	66
4	RABI	Wheat	41.7	15.36	20.0	5.50	8.0	7.91	16.0	15.1	85.7	10.18	41
5	RABI	Other rabi i.e.Berseem,Potato	17.9	6.59	8.4	2.31	2.0	1.98	7.0	6.6	35.3	4.19	
Total			**230.8**	**85.01**	**74.4**	**20.5**	**32.0**	**31.6**	**76.0**	**71.7**	**413.2**	**49.07**	107

Annexure:4
Table-6

Sheet-1

MONTH-WISE GROSS IRRIGATION WATER REQUIREMENT OF DIFFERENT CHANNELS AT TAIL (May to October)

S.No.	Name of channel	Name of crop		Area in Ha.	May		June		July		August		September		October		Total		Remarks
					Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	
1	2	3		4	15	16	5	6	7	8	9	10	11	12	13	14	15	16	17
1	Barla Dy. CCA= 271.5ha. At tail (Last 1/3rd of Total Reach)	KHARIF	Paddy	26.8	-	-	47	1.26	763	20.45	442	11.85	525	14.07	311	8.33	2088	55.96	
		KHARIF	Other kharif e.g. Millet, Sorghum, Fodder	26.7	-	-	-	-	107	2.86	91	2.43	193	5.15	150	4.01	541	14.44	
			Sugarcane	117.7	352	41.43	451	53.08	314	36.96	338	39.78	425	50.02	249	29.31	2129	250.6	
		RABI	Wheat	41.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		RABI	Other rabi e.g. Berseem, Potato	17.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
			Sub Total	230.8		41.43		54.34		60.26		54.06		69.25		41.65		321.0	Paddy = 34.8 ha. Other kharif = 48.2 ha. Sugarcane = 209.2 ha. Wheat = 85.7 ha. Other Rabi = 35.3 ha.
2	Khoja-Nagla Minor CCA= 363.4 ha. At tail (Last 1/3rd of Total Reach)	KHARIF	Paddy	4.0	-	-	47	0.19	763	3.05	442	1.77	525	2.10	311	1.24	2088	8.35	
		KHARIF	Other kharif e.g. Millet, Sorghum, Fodder	10.5	-	-	-	-	107	1.12	91	0.96	193	2.03	150	1.58	541	5.68	
			Sugarcane	31.5	352	11.09	451	14.21	314	9.89	338	10.65	425	13.39	249	7.84	2129	67.1	
		RABI	Wheat	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		RABI	Other rabi e.g. Berseem, Potato	8.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
			Sub Total	74.4		11.09		14.39		14.07		13.37		17.51		10.66		81.1	

Sheet-2

MONTH-WISE GROSS IRRIGATION WATER REQUIREMENT OF DIFFERENT CHANNELS AT TAIL (May to October)

S.No.	Name of channel	Name of crop		Area in Ha.	May		June		July		August		September		October		Total		Remarks
					Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	
1	2	3		4	15	16	5	6	7	8	9	10	11	12	13	14	15	16	17
3	Bijopura Minor CCA= 101.2 ha. At tail (Last 1/3rd of Total Reach)	KHARIF	Paddy	1	-	-	47	0.05	763	0.76	442	0.44	525	0.53	311	0.31	2088	2.09	
			Other kharif e.g. Millet, Sorghum, Fodder	5	-	-	-	-	107	0.54	91	0.46	193	0.97	150	0.75	541	2.71	
		Sugarcane		16	352	5.63	451	7.22	314	5.02	338	5.41	425	6.80	249	3.98	2129	34.1	
		RABI	Wheat	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
			Other rabi e.g. Berseem,Potato	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		Sub Total		32		5.63		7.26		6.32		6.31		8.29		5.05		38.9	
4	Khampur Minor CCA= 106.0 ha. At tail (Last 1/3rd of Total Reach)	KHARIF	Paddy	3	-	-	47	0.14	763	2.29	442	1.33	525	1.58	311	0.93	2088	6.26	
			Other kharif e.g. Millet, Sorghum, Fodder	6	-	-	-	-	107	0.64	91	0.55	193	1.16	150	0.90	541	3.25	
		Sugarcane		44	352	15.49	451	19.84	314	13.82	338	14.87	425	18.70	249	10.96	2129	93.7	
		RABI	Wheat	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
			Other rabi e.g. Berseem,Potato	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		Sub Total		76		15.49		19.99		16.75		16.74		21.43		12.79		103.2	

Annexure:4
Table-7

Sheet-1

MONTH-WISE GROSS IRRIGATION WATER REQUIREMENT OF DIFFERENT CHANNELS AT TAIL (November to April)

S.No.	Name of channel	Name of crop		Area in Ha.	November		December		January		February		March		April		Total		Remarks
					Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	
1	2	3		4	15	16	5	6	7	8	9	10	11	12	13	14	15	16	17
1	Barla Dy. CCA= 271.5ha. At tail (Last 1/3rd of Total Reach)	KHARIF	Paddy	26.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
			Other kharif e.g. Millet, Sorghum, Fodder	26.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		Sugarcane		117.7	159	18.71	107	12.59	73	8.59	103	12.12	167	19.66	198	23.30	807	94.98	
		RABI	Wheat	41.7	151	6.30	85	3.54	132	5.50	168	7.01	118	4.92	10	0.42	664	27.69	
			Other rabi e.g. Berseem, Potato	17.9	196	3.51	165	2.95	148	2.65	210	3.76	378	6.77	248	4.44	1345	24.08	
		Sub Total		230.8		28.52		19.09		16.75		22.89		31.34		28.16		146.7	
2	Khoja-Nagla Minor CCA= 363.4 ha. At tail (Last 1/3rd of Total Reach)	KHARIF	Paddy	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
			Other kharif e.g. Millet, Sorghum, Fodder	10.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		Sugarcane		31.5	159	5.01	107	3.37	73	2.30	103	3.24	167	5.26	198	6.24	807	25.42	
		RABI	Wheat	20	151	3.02	85	1.70	132	2.64	168	3.36	118	2.36	10	0.20	664	13.28	
			Other rabi e.g. Berseem, Potato	8.4	196	1.65	165	1.39	148	1.24	210	1.76	378	3.18	248	2.08	1345	11.30	
		Sub Total		74.4		9.67		6.46		6.18		8.37		10.80		8.52		50.00	

Sheet-2

MONTH-WISE GROSS IRRIGATION WATER REQUIREMENT OF DIFFERENT CHANNELS AT TAIL (November to April)

S.No.	Name of channel	Name of crop		Area in Ha.	November		December		January		February		March		April		Total		Remarks
					Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	Depth(mm)	Volume(Ha-m)	
1	2	3		4	15	16	5	6	7	8	9	10	11	12	13	14	15	16	17
3	Bijopura Minor CCA= 101.2 ha. At tail (Last 1/3rd of Total Reach)	KHARIF	Paddy	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		KHARIF	Other kharif e.g. Millet, Sorghum, Fodder	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		Sugarcane		16	159	2.54	107	1.71	73	1.17	103	1.65	167	2.67	198	3.17	807	12.91	
		RABI	Wheat	8	151	1.21	85	0.68	132	1.06	168	1.34	118	0.94	10	0.08	664	5.31	
		RABI	Other rabi e.g. Berseem, Potato	2	196	0.39	165	0.33	148	0.30	210	0.42	378	0.76	248	0.50	1345	2.69	
		Sub Total		32		4.14		2.72		2.52		3.41		4.37		3.74		20.91	
4	Khampur Minor CCA= 106.0 ha. At tail (Last 1/3rd of Total Reach)	KHARIF	Paddy	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		KHARIF	Other kharif e.g. Millet, Sorghum, Fodder	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		Sugarcane		44	159	7.00	107	4.71	73	3.21	103	4.53	167	7.35	198	8.71	807	35.51	
		RABI	Wheat	16	151	2.42	85	1.36	132	2.11	168	2.69	118	1.89	10	0.16	664	10.62	
		RABI	Other rabi e.g. Berseem, Potato	7	196	1.37	165	1.16	148	1.04	210	1.47	378	2.65	248	1.74	1345	9.42	
		Sub Total		76		10.78		7.22		6.36		8.69		11.88		10.61		55.55	

Annexure:4
Table-8

MONTHLY CANAL DISCHARGE AT HEAD REGULATOR

S.No.	Name of canal	Item	Unit	June	July	August	Septem	Octob.	Novem.	Decem	Janua	Febru	March	April	May	Remarks
1	Right Main Dy	Full Supply Discharge	Cumecs	2.69	2.69	2.69	2.69	2.69	2.69	2.69	2.69	2.69	2.69	2.69	2.69	
		Water Required	Ha-m	585.4	599.7	558.9	729.3	443.3	340.4	227.7	207.5	282.4	377	321	449.5	
		Date of opening of canal	-	1 -15	1 -15	1 -15	1 -15	1 -7	1 -7	1 -7	1 -7	1 -7	-	1 -15	1 -15	
		Actual Flow	Cumecs	2.55	2.55	2.55	2.55	2.55	1.7	1.7	1.7	1.7	-	2.55	2.55	Roster of 2002 -2003
2	Bhaisani Dy	Full Supply Discharge	Cumecs	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	
		Water Required	Ha-m	550.3	494.8	482.5	622.9	374.7	291.8	195.3	171.1	233.9	320.6	288.6	425.2	
		Date of opening of canal	-	1 -15	1 -15	1 -15	1 -15	1 -7	1 -7	1 -7	1 -7	1 -7	1 -15	1 -15	1 -15	
		Actual Flow	Cumecs	1.2	1.2	1.2	1.2	1.2	0.8	0.8	0.8	0.8	-	1.2	1.2	Roster of 2002 -2003
3	Barla Dy	Full Supply Discharge	Cumecs	0.339	0.339	0.339	0.339	0.339	0.339	0.339	0.339	0.339	0.339	0.339	0.339	
		Water Required	Ha-m	214.5	226.9	206.8	264.2	158.5	117	78.3	69.7	95.1	128.9	113.4	164	
		Date of opening of canal	-	1 -15	1 -15	1 -15	1 -15	1 -7	1 -7	1 -7	1 -7	1 -7	1 -15	1 -15	1 -15	
		Actual Flow	Cumecs	0.303	0.303	0.303	0.303	0.303	0.202	0.202	0.202	0.202	-	0.303	0.303	Roster of 2002 -2003

MONTHLY CANAL DISCHARGE AT HEAD REGULATOR

S.No.	Name of canal	Item	Unit	June	July	August	Septem	Octob.	Novem.	Decem	Janua	Febru	March	April	May	Remarks
4	Khoja Nagla Mr.	Full Supply Discharge	Cumecs	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	
		Water Required	Ha-m	96.5	86.5	84.9	110.7	67.1	54.9	36.8	33.1	45.1	60.8	52.5	74.6	
		Date of opening of canal	-	1 -15	1 -15	1 -15	1 -15	1 -7	1 -7	1 -7	1 -7	1 -7	1 -15	1 -15	1 -15	
		Actual Flow	Cumecs	0.21	0.21	0.21	0.21	0.21	0.14	0.14	0.14	0.14	-	0.21	0.21	Roster of 2002 -2003
5	Bijopura Mr.	Full Supply Discharge	Cumecs	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	
		Water Required	Ha-m	15	13.2	13.1	17.4	10.6	9.2	6.2	5.7	7.8	10.4	8.7	11.6	
		Date of opening of canal	-	1 -15	1 -15	1 -15	1 -15	1 -7	1 -7	1 -7	1 -7	1 -7	1 -15	1 -15	1 -15	
		Actual Flow	Cumecs	0.075	0.075	0.075	0.075	0.075	0.05	0.05	0.05	0.05	-	0.075	0.075	Roster of 2002 -2003
6	Khampur Mr.	Full Supply Discharge	Cumecs	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	
		Water Required	Ha-m	23.7	20.0	19.9	25.5	15.2	12.0	8.0	6.9	9.4	13.1	12.2	18.4	
		Date of opening of canal	-	1 -15	1 -15	1 -15	1 -15	1 -7	1 -7	1 -7	1 -7	1 -7	1 -15	1 -15	1 -15	
		Actual Flow	Cumecs	0.075	0.075	0.075	0.075	0.075	0.05	0.05	0.05	0.05	-	0.075	0.075	Roster of 2002 -2003

Annexure:4

Table-9

RELATIVE WATER SUPPLY IN DIFFERENT CHANNELS (MAY TO OCTOBER)

S.No.	Name of Canal	Description	May		June		July		August		September		October		Remarks May to October	
			Total Reach	Tail Reach	Total Reach	Tail Reach	Total Reach	Tail Reach	Total Reach	Tail Reach	Total Reach	Tail Reach	Total Reach	Tail Reach	Total Reach	Tail Reach
1	Right Main Dy	Water Supply (Drawal) in Ha-m.	147.5	-	117.0	-	117.6	-	104.2	-	76.2	-	61.5	-	624	-
		Cumulative Water Demand (Requirement) in Ha-m.	449.5	-	585.4	-	599.7	-	558.9	-	729.3	-	443.3	-	3366.1	-
		Relative Water supply	0.33	-	0.20	-	0.20	-	0.19	-	0.10	-	0.14	-	0.19	-
2	Bhaisani Dy	Water Supply (Drawal) in Ha-m.	163.5	-	92.2	-	101.0	-	125.1	-	72.4	-	64.3	-	618.5	-
		Cumulative Water Demand (Requirement) in Ha-m.	425.2	-	550.26	-	494.78	-	482.51	-	622.9	-	374.7	-	2950.35	-
		Relative Water supply	0.38	-	0.17	-	0.20	-	0.26	-	0.12	-	0.17	-	0.21	-
3	Barla Dy	Water Supply (Drawal) in Ha-m.	81.0	3.3	66.6	7.1	53.3	6.8	46.6	7.3	43.1	5.4	32.2	1.0	322.8	30.9
		Cumulative Water Demand (Requirement) in Ha-m.	164.0	41.4	214.54	54.3	226.91	60.26	206.8	54.06	264.2	69.25	158.5	41.65	1234.95	320.9
		Relative Water supply	0.49	0.08	0.31	0.13	0.23	0.11	0.23	0.14	0.16	0.08	0.20	0.02	0.26	0.10

RELATIVE WATER SUPPLY IN DIFFERENT CHANNELS (MAY TO OCTOBER)

S.No.	Name of Canal	Description	May		June		July		August		September		October		Remarks May to October	
			Total Reach	Tail Reach	Total Reach	Tail Reach	Total Reach	Tail Reach	Total Reach	Tail Reach	Total Reach	Tail Reach	Total Reach	Tail Reach	Total Reach	Tail Reach
4	Khoja Nagla Mr.	Water Supply (Drawal) in Ha-m.	52.8	7.3	40.2	6.7	36.2	4.5	27.7	5	20.9	2.4	16.9	0.0	194.7	25.9
		Cumulative Water Demand (Requirement) in Ha-m.	74.6	11.09	96.5	14.39	86.5	14.07	84.9	13.37	110.7	17.51	67.1	10.66	520.3	81.09
		Relative Water supply	0.71	0.66	0.42	0.47	0.42	0.32	0.33	0.37	0.19	0.14	0.25	0.00	0.37	0.32
5	Bijopura Mr.	Water Supply (Drawal) in Ha-m.	4.4	3.3	6.0	4.8	3.4	2.9	5.1	4.5	2.4	1.3	0.4	0.3	21.7	17.1
		Cumulative Water Demand (Requirement) in Ha-m.	11.6	5.63	15.0	7.26	13.2	6.32	13.1	6.31	17.4	8.29	10.6	5.05	80.9	38.86
		Relative Water supply	0.38	0.59	0.40	0.66	0.26	0.46	0.39	0.71	0.14	0.16	0.04	0.06	0.27	0.44
6	Khampur Mr.	Water Supply (Drawal) in Ha-m.	4.5	2.3	4.3	2.0	4.0	2.0	4.2	2.0	1.6	0.6	0.2	0.1	18.8	9.0
		Cumulative Water Demand (Requirement) in Ha-m.	18.4	15.49	23.7	19.99	20.0	16.75	19.9	16.74	25.5	21.43	15.2	12.79	122.7	103.19
		Relative Water supply	0.24	0.15	0.18	0.10	0.20	0.12	0.21	0.12	0.06	0.03	0.01	0.01	0.15	0.09
7	Total of Right Main Dy System	Water Supply (Drawal) in Ha-m.	510.48	-	404.86	-	406.76	-	360.67	-	263.82	-	212.68	-	2159	-
		Cumulative Water Demand (Requirement) in Ha-m.	1143	-	1485	-	1441	-	1366	-	1770	-	1069	-	8274	-
		Relative Water supply	0.45	-	0.27	- -	0.28	-	0.26	-	0.15	-	0.20	-	0.26	-

Annexure:4

Table-10

RELATIVE WATER SUPPLY IN DIFFERENT CHANNELS (NOVEMBER TO APRIL)

S.No.	Name of Canal	Description	November		December		January		February		March		April		Remarks Nov. to April	
			Total Reach	Tail Reach	Total Reach	Tail Reach	Total Reach	Tail Reach	Total Reach	Tail Reach	Total Reach	Tail Reach	Total Reach	Tail Reach	Total Reach	Tail Reach
1	Right Main Dy	Water Supply (Drawal) in Ha-m.	91.8	-	39.5	-	68.4	-	36.4	-	70.3	-	119.7	-	**426.1**	-
		Cumulative Water Demand (Requirement) in Ha-m.	340.4	-	227.7	-	207.46	-	282.4	-	377.0	-	320.9	-	**1755.86**	-
		Relative Water supply	**0.27**	-	**0.17**	-	**0.33**	-	**0.13**	-	**0.19**	-	**0.37**	-	**0.24**	-
2	Bhaisani Dy	Water Supply (Drawal) in Ha-m.	43.4	-	34.5	-	52.0	-	44.3	-	43.8	-	89.9	-	**307.9**	-
		Cumulative Water Demand (Requirement) in Ha-m.	291.8	-	195.33	-	171.09	-	233.9	-	320.6	-	288.6	-	**1501.32**	-
		Relative Water supply	**0.15**	-	**0.18**	-	**0.30**	-	**0.19**	-	**0.14**	-	**0.31**	-	**0.21**	-
3	Barla Dy	Water Supply (Drawal) in Ha-m.	25.4	1.0	19.2	0.7	20.7	0.8	29.3	1.2	36.6	3.9	58.3	5.5	**189.5**	**13.1**
		Cumulative Water Demand (Requirement) in Ha-m.	117.0	28.52	78.3	19.09	69.7	16.75	95.1	22.89	128.9	31.34	113.4	28.16	**602.4**	**146.8**
		Relative Water supply	**0.22**	**0.04**	**0.25**	**0.04**	**0.30**	**0.05**	**0.31**	**0.05**	**0.28**	**0.12**	**0.51**	**0.20**	**0.31**	**0.09**

RELATIVE WATER SUPPLY IN DIFFERENT CHANNELS (NOVEMBER TO APRIL)

S.No.	Name of Canal	Description	November		December		January		February		March		April		Remarks Nov to April	
			Total Reach	Tail Reach	Total Reach	Tail Reach	Total Reach	Tail Reach	Total Reach	Tail Reach	Total Reach	Tail Reach	Total Reach	Tail Reach	Total Reach	Tail Reach
4	Khoja Nagla Mr.	Water Supply (Drawal) in Ha-m.	19.2	3.3	8.6	2.3	18.0	4.5	13.2	2.6	19.3	4.7	32.7	7.6	111.0	25.0
		Cumulative Water Demand (Requirement) in Ha-m.	54.9	9.67	36.8	6.46	33.1	6.18	45.1	8.37	60.77	10.8	52.5	8.52	283.2	50.0
		Relative Water supply	0.35	0.34	0.23	0.36	0.54	0.73	0.29	0.31	0.32	0.44	0.62	0.89	0.39	0.50
5	Bijopura Mr.	Water Supply (Drawal) in Ha-m.	1.2	1.0	0.7	0.4	1.2	1.1	1.5	1.1	2.9	2.4	3.3	2.6	10.8	8.6
		Cumulative Water Demand (Requirement) in Ha-m.	9.2	4.14	6.2	2.72	5.7	2.52	7.8	3.41	10.4	4.37	8.7	3.74	48.0	20.9
		Relative Water supply	0.13	0.24	0.11	0.15	0.21	0.44	0.19	0.32	0.28	0.55	0.38	0.70	0.23	0.41
6	Khampur Mr.	Water Supply (Drawal) in Ha-m.	0.3	0.1	0.3	0.1	1.1	0.6	0.8	0.4	1.9	1.0	2.5	1.2	6.9	3.4
		Cumulative Water Demand (Requirement) in Ha-m.	12.0	1.37	8.0	1.16	6.9	1.04	9.4	1.47	13.1	2.65	12.2	1.74	61.6	9.4
		Relative Water supply	0.03	0.07	0.04	0.09	0.16	0.58	0.09	0.27	0.15	0.38	0.20	0.69	0.11	0.36
7	Total of Right Main Dy System	Water Supply (Drawal) in Ha-m.	317.71	-	136.75	-	236.63	-	126.05	-	243.37	-	414.14	-	1475	-
		Cumulative Water Demand (Requirement) in Ha-m.	825.4	-	552.3	-	494.0	-	673.7	-	910.8	-	796.3	-	4253	-
		Relative Water supply	0.38	-	0.25	-	0.48	-	0.19	-	0.27	-	0.52	-	0.35	-

Annexure-4

Table-11

RELATIVE WATER SUPPLY (Season-wise)

S.No.	Name of Canal	Location along canal				Average	Remarks
		Total Reach		Tail Reach			
		May to Oct.	Nov. to April	May to Oct.	Nov. to April		
1	Right Main Dy	0.19	0.24	-	-	0.22	
2	Bhaisani Dy	0.21	0.21	-	-	0.21	
3	Barla Dy	0.26	0.31	0.10	0.09	0.19	Lowest
4	Khoja Nagla Mr.	0.37	0.39	0.32	0.50	0.40	Highest
5	Bijopura Mr.	0.27	0.23	0.44	0.41	0.34	
6	Khampur Mr.	0.15	0.11	0.09	0.36	0.18	
7	Total of Right Main Dy System	0.26	0.35	-	-	0.31	

Annexure-4
Table-12

WATER DELIVERY PERFORMANCE IN TERMS OF RELATIVE PRODUCTIVITY POTENTIAL

PERIOD : MAY TO OCTOBER

S.No.	Name of canal	Description	Unit	LOCATION ALONG THE CANAL: Total Reach				Tail Reach				Remarks
				Paddy	Other Kharif	Sugarcane (12 months)	Total	Paddy	Other Kharif	Sugarcane (12 months)	Total	
1	Right Main Dy	Crop Production	10^4 kg	101.0	208.5	8939.0	9248.5	-	-	-	-	Total area irrigated by Right Main Dy Paddy=202 ha Other kharif=417 ha Sugarcane= 1277 ha
		Water Supply	10^4 m^3	421.8x0.19 =80.14	225.6x0.19 =42.86	(2718.7+1030.5) x0.22=824.82	947.82	-	-	-	-	
		Relative Productivity Potential	kg/m^3	1.26	4.86	10.84	9.76	-	-	-	-	
2	Bhaisani Dy	Crop Production	10^4 kg	58.0	126.0	8456.0	8640	-	-	-	-	Total area irrigated by Bhaisani Dy Paddy=116 ha Other kharif=252 ha Sugarcane= 1208 ha
		Water Supply	10^4 m^3	50.86	28.62	744.81	824.29	-	-	-	-	
		Relative Productivity Potential	kg/m^3	1.14	4.40	11.35	10.48	-	-	-	-	
3	Barla Dy	Crop Production	10^4 kg	46.5	45.0	3262.0	3353.5	8.04	8.01	294.25	310.3	Total area irrigated by Barla Dy Paddy=93 ha Other kharif=90 ha Sugarcane= 466 ha
		Water Supply	10^4 m^3	50.49	12.66	389.94	453.09	5.6	1.44	32.83	39.87	
		Relative Productivity Potential	kg/m^3	0.92	3.55	8.37	7.40	1.44	5.56	8.96	7.78	
4	Khoja Nagla Mr.	Crop Production	10^4 kg	9.0	29.0	1484.0	1522	2.0	5.25	220.5	227.8	Total area irrigated by Khoja nagla mr. Paddy=18 ha Other kharif=58 ha Sugarcane= 212 ha
		Water Supply	10^4 m^3	13.91	11.62	236.51	262.0	2.67	1.82	37.93	42.4	
		Relative Productivity Potential	kg/m^3	0.65	2.50	6.27	5.81	0.75	2.88	5.81	5.37	

WATER DELIVERY PERFORMANCE IN TERMS OF RELATIVE PRODUCTIVITY POTENTIAL Page-2

PERIOD : MAY TO OCTOBER

S.No.	Name of canal	Description	Unit	LOCATION ALONG THE CANAL								Remarks
				Total Reach				Tail Reach				
				Paddy	Other Kharif	Sugarcane (12 months)	Total	Paddy	Other Kharif	Sugarcane (12 months)	Total	
5	Bijopura Mr.	Crop Production	10^4 kg	1.0	6.0	231.0	238.0	0.5	2.5	112.0	115.00	Total area irrigated by Bijopura Mr. Paddy=2 ha Other kharif=12 ha Sugarcane= 33 ha
		Water Supply	10^4 m^3	1.134	1.755	24.225	27.114	0.92	1.19	19.98	22.09	
		Relative Productivity Potential	kg/m^3	0.88	3.42	9.54	**8.78**	0.54	2.10	5.61	**5.21**	
6	Khampur Mr.	Crop Production	10^4 kg	1.9	3.35	365.4	370.7	1.5	3.0	308.0	312.5	Total area irrigated by Khampur Mr. Paddy=3.8 ha Other kharif=6.7 ha Sugarcane= 52.2 ha
		Water Supply	10^4 m^3	1.185	0.54	19.916	21.641	0.563	0.29	29.07	29.923	
		Relative Productivity Potential	kg/m^3	1.60	6.20	18.35	**17.13**	2.66	10.34	10.60	**10.44**	
7	Average of all channels						**9.89**				**7.20**	

Annexure-4
Table-13

WATER DELIVERY PERFORMANCE IN TERMS OF RELATIVE PRODUCTIVITY POTENTIAL

PERIOD : NOVEMBER TO APRIL

S.No.	Name of canal	Description	Unit	LOCATION ALONG THE CANAL						Remarks
				Total Reach			Tail Reach			
				Wheat	Berseem	Total	Wheat	Berseem	Total	
1	Right Main Dy	Crop Production	10^4 kg	233.6	1004	1237.6	-	-	-	Total area irrigated by Right Main Dy Wheat=584 ha Other Rabi=251 ha
		Water Supply	10^4 m^3	93.07	81.02	174.09	-	-	-	
		Relative Productivity Potential	kg/m^3	2.51	12.39	**7.11**	-	-	-	
2	Bhaisani Dy	Crop Production	10^4 kg	169.6	728	897.6	-	-	-	Total area irrigated by Bhaisani Dy Wheat=424 ha Other Rabi=182 ha
		Water Supply	10^4 m^3	59.12	51.41	110.53	-	-	-	
		Relative Productivity Potential	kg/m^3	2.87	14.16	**8.12**	-	-	-	
3	Barla Dy	Crop Production	10^4 kg	73.2	312.0	385.2	12.51	26.85	39.4	Total area irrigated by Barla Dy Wheat=183 ha Other Rabi=78 ha.
		Water Supply	10^4 m^3	37.67	32.52	70.19	2.49	2.17	4.66	
		Relative Productivity Potential	kg/m^3	1.94	9.59	**5.49**	5.02	12.37	**8.45**	
4	Khoja Nagla Mr.	Crop Production	10^4 kg	36.0	156	192	8.0	33.6	41.6	Total area irrigated by Khoja nagla mr. Wheat=90 ha Other Rabi=39 ha
		Water Supply	10^4 m^3	23.32	20.48	43.8	6.64	5.65	12.29	
		Relative Productivity Potential	kg/m^3	1.54	7.62	**4.38**	1.20	5.95	**3.38**	

WATER DELIVERY PERFORMANCE IN TERMS OF RELATIVE PRODUCTIVITY POTENTIAL

PERIOD : NOVEMBER TO APRIL

S.No.	Name of canal	Description	Unit	LOCATION ALONG THE CANAL						Remarks
				Total Reach			Tail Reach			
				Wheat	Berseem	Total	Wheat	Berseem	Total	
5	Bijopura Mr.	Crop Production	10^4 kg	6.4	32.0	38.4	3.2	8.0	11.2	Total area irrigated by Bijopura Mr. Wheat=16 ha Other Rabi=8 ha
		Water Supply	10^4 m^3	2.44	2.48	4.92	2.18	1.10	3.28	
		Relative Productivity Potential	kg/m^3	2.62	12.90	**7.80**	1.47	7.27	**3.41**	
6	Khampur Mr.	Crop Production	10^4 kg	6.3	27	33.3	6.40	28.0	34.40	Total area irrigated by Khampur Mr. Wheat=15.75 ha Other Rabi=6.75 ha
		Water Supply	10^4 m^3	1.155	1.00	2.155	3.82	3.39	7.21	
		Relative Productivity Potential	kg/m^3	5.45	27.00	**15.45**	1.68	8.26	**4.77**	
7	Average of all channels					**8.06**			**5.00**	

Annexure-4
Table-14

ABSTRACT OF WATER DELIVERY PERFORMANCE IN TERMS OF RELATIVE PRODUCTIVITY POTENTIAL

S.No.	Name of Canal	Location along the Canal				Remarks i.e. Average
		Total Reach		Tail Reach		
		May to Oct.	Nov. to April	May to Oct.	Nov. to April	
1	Right main Dy	9.76	7.11	-	-	**8.44**
2	Bhaisani Dy	10.48	8.12	-	-	**9.30**
3	Barla dy	7.4	5.49	7.78	8.45	**7.28**
4	Khoja Nagla Mr.	5.81	4.38	5.37	3.38	**4.74**
5	Bijopura Mr.	8.78	7.8	5.21	3.41	**6.30**
6	Khampur Mr.	17.13	15.45	10.44	4.77	**11.95**
7	Average	**9.89**	**8.06**	**7.20**	**5.00**	**8.00**

Annexure:4
Table No.-15

INTER-QUARTILE RATIO

S.No.	Name of Canal	Design Discharge (Cumecs)	Volume(Ha-m) delivered to the most favoured upper 25% of CCA		Volume(Ha-m) delivered to the most favoured lowest 25% of CCA		Inter-Quartile Ratio		Remarks i.e. Average
			May to October	November to April	May to October	November to April	May to October	November to April	
1	2	3	4	5	6	7	8=4/6	9=5/7	10=(8+9)/2
1	Bhaisani Dy	1.22	145.30	72.30	49.84	25.50	2.92	2.84	2.88
2	Barla Dy	0.34	62.80	36.80	23.20	9.80	2.71	3.76	3.23
3	Khoja Nagla Mr.	0.25	35.15	20.00	17.10	16.60	2.06	1.20	1.63
4	Bijopura Mr.	0.09	4.60	2.20	3.50	1.76	1.31	1.25	1.28
5	Khampur Mr.	0.09	3.76	1.38	2.13	0.80	1.77	1.73	1.75
	Average						**2.15**	**2.15**	**2.15**

$$Equity\ Ratio = \frac{1}{Inter-Quartile\ Ratio} = \frac{1}{2.15} = 0.465$$

Annexure:4

Table No.-16

DEPTH OF GROUND WATER LEVEL IN RIGHT MAIN DISTRIBUTARY SYSTEM AREA

S.No.	Year	Rajupur well		Barla		Chapar		Purkaji	
		Pre-Monsoon	Post-Monsoon	Pre-Monsoon	Post-Monsoon	Pre-Monsoon	Post-Monsoon	Pre-Monsoon	Post-Monsoon
1	1991	-	-	1.95	0.92	3.12	0.70	2.36	1.27
2	1992	-	-	2.55	1.20	2.75	0.34	3.11	1.11
3	1993	-	-	2.72	0.64	2.22	0.61	-	-
4	1994	-	-	2.22	0.64	2.22	0.91	3.08	0.65
5	1995	-	-	3.36	0.98	2.40	0.83	3.39	0.94
6	1996	-	-	3.02	0.21	3.18	0.00	3.35	1.15
7	1997	-	-	2.71	1.01	2.51	1.07	4.25	2.87
8	1998	2.60	1.31	2.33	1.20	2.92	0.41	4.39	2.00
9	1999	2.48	1.15	2.52	1.52	-	-	4.18	3.14
10	2000	2.74	2.61	2.78	1.26	3.35	0.64	4.23	2.20
11	2001	2.42	1.84	-	-	-	-	-	-
12	2002	2.52	-	-	-	-	-	-	-
13	2003	2.90	1.88	-	-	-	-	-	-
Average		**2.61**	**1.76**	**2.62**	**0.96**	**2.74**	**0.61**	**3.59**	**1.70**

Annexure:4

Table No.-17

DEPTH OF GROUND WATER LEVEL IN RIGHT MAIN DISTRIBUTARY SYSTEM AREA

S.No.	Name of Village	Location in the Command	Depth of Ground Water in Metres	
			Pre-Monsoon	Post-Monsoon
1	2	3	4	5
1	Right Main Dy			
	Rajupur well	Tail Reach	2.61	1.76
2	Bhaisani Dy			
	Rajupur well	Head Reach	2.61	1.76
	Barla	Middle Reach	2.62	0.96
	Chapar	Tail Reach	2.74	0.61
3	Barla Dy			
	Purkaji	Head Reach	3.59	1.70
	Barla	Tail Reach	2.62	0.96
4	Khoja Nagla Mr.			
	Barla	Head Reach	2.62	0.96
5	Bijopura Mr.			
	Chapar	Head Reach	2.74	0.61

Annexure :4

Table No.18

Crop: Rice (Paddy)

Effective Rooting Depth = 0.60m.

RELATIVE GROUND WATER DEPTH (RGWD)

$$= \frac{\text{ACTUAL DEPTH OF GROUND WATER}}{\text{CRITICAL DEPTH OF GROUND WATER (OR) EFFECTIVE ROOTING DEPTH}}$$

S.No.	Name of Canal	LOCATION IN THE COMMAND												Remarks
		HEAD REACH				MIDDLE REACH				TAIL REACH				
		Pre-Monsoon Period		Post- Monsoon Period		Pre-Monsoon Period		Post- Monsoon Period		Pre-Monsoon Period		Post- Monsoon Period		
		Depth of ground water (metre)	RGWD	Depth of ground water (metre)	RGWD	Depth of ground water (metre)	RGWD	Depth of ground water (metre)	RGWD	Depth of ground water (metre)	RGWD	Depth of ground water (metre)	RGWD	
1	Right Main Dy	-	-	-	-	-	-	-	-	2.61	4.35	1.76	2.93	No Waterlogging Best sustainability
2	Bhaisani Dy	2.61	4.35	1.76	2.93	2.62	4.37	0.96	1.60	2.74	4.57	0.61	1.02	"
3	Barla Dy	3.59	5.98	1.7	2.83	-	-	-	-	2.62	4.37	0.96	1.60	"
4	Khoja Nagla Mr.	2.62	4.37	0.96	1.60	-	-	-	-	-	-	-	-	"
5	Bijopura Mr.	2.74	4.57	0.61	1.02	-	-	-	-	-	-	-	-	"
Average Sustainability			4.82		2.10		4.37		1.60		4.43		1.85	3.19

Annexure :4

Table No.19

Crop: Sugarcane

Effective Rooting Depth = 0.90m.

RELATIVE GROUND WATER DEPTH (RGWD)

$$= \frac{\text{ACTUAL DEPTH OF GROUND WATER}}{\text{CRITICAL DEPTH OF GROUND WATER (OR) EFFECTIVE ROOTING DEPTH}}$$

S.No.	Name of Canal	LOCATION IN THE COMMAND												Remarks
		HEAD REACH				MIDDLE REACH				TAIL REACH				
		Pre-Monsoon Period		Post- Monsoon Period		Pre-Monsoon Period		Post- Monsoon Period		Pre-Monsoon Period		Post- Monsoon Period		
		Depth of ground water (metre)	RGWD	Depth of ground water (metre)	RGWD	Depth of ground water (metre)	RGWD	Depth of ground water (metre)	RGWD	Depth of ground water (metre)	RGWD	Depth of ground water (metre)	RGWD	
1	Right Main Dy	-	-	-	-	-	-	-	-	2.61	2.90	1.76	1.96	No Waterlogging Best sustainability
2	Bhaisani Dy	2.61	2.90	1.76	1.96	2.62	2.91	0.96	1.07	2.74	3.04	0.61	0.68	Problem during post-monsoon in tail reach only
3	Barla Dy	3.59	3.99	1.7	1.89	-	-	-	-	2.62	2.91	0.96	1.07	No Waterlogging Best sustainability
4	Khoja Nagla Mr.	2.62	2.91	0.96	1.07	-	-	-	-	-	-	-	-	"
5	Bijopura Mr.	2.74	3.04	0.61	0.68	-	-	-	-	-	-	-	-	Problem during post-monsoon in head reach only
Average Sustainability			3.21		1.40		2.91		1.07	-	2.95		1.23	2.13

Annexure :4

Table No.20

Crop: Wheat

Effective Rooting Depth = 0.60m.

RELATIVE GROUND WATER DEPTH (RGWD)

$$= \frac{\text{ACTUAL DEPTH OF GROUND WATER}}{\text{CRITICAL DEPTH OF GROUND WATER (OR) EFFECTIVE ROOTING DEPTH}}$$

S.No.	Name of Canal	LOCATION IN THE COMMAND												Remarks
		HEAD REACH				MIDDLE REACH				TAIL REACH				
		Pre-Monsoon Period		Post- Monsoon Period		Pre-Monsoon Period		Post- Monsoon Period		Pre-Monsoon Period		Post- Monsoon Period		
		Depth of ground water (metre)	RGWD	Depth of ground water (metre)	RGWD	Depth of ground water (metre)	RGWD	Depth of ground water (metre)	RGWD	Depth of ground water (metre)	RGWD	Depth of ground water (metre)	RGWD	
1	Right Main Dy	-	-	-	-	-	-	-	-	2.61	4.35	1.76	2.93	No Waterlogging Best sustainability
2	Bhaisani Dy	2.61	4.35	1.76	2.93	2.62	4.37	0.96	1.60	2.74	4.57	0.61	1.02	"
3	Barla Dy	3.59	5.98	1.7	2.83	-	-	-	-	2.62	4.37	0.96	1.60	"
4	Khoja Nagla Mr.	2.62	4.37	0.96	1.60	-	-	-	-	-	-	-	-	"
5	Bijopura Mr.	2.74	4.57	0.61	1.02	-	-	-	-	-	-	-	-	"
Average Sustainability			4.82		2.10		4.37		1.60		4.43		1.85	3.19

Annexure :4

Table No.21

Crop: Sorghum

Effective Rooting Depth = 0.60m.

RELATIVE GROUND WATER DEPTH (RGWD)

$$= \frac{\text{ACTUAL DEPTH OF GROUND WATER}}{\text{CRITICAL DEPTH OF GROUND WATER (OR) EFFECTIVE ROOTING DEPTH}}$$

S.No.	Name of Canal	LOCATION IN THE COMMAND												Remarks
		HEAD REACH				MIDDLE REACH				TAIL REACH				
		Pre-Monsoon Period		Post- Monsoon Period		Pre-Monsoon Period		Post- Monsoon Period		Pre-Monsoon Period		Post- Monsoon Period		
		Depth of ground water (metre)	RGWD	Depth of ground water (metre)	RGWD	Depth of ground water (metre)	RGWD	Depth of ground water (metre)	RGWD	Depth of ground water (metre)	RGWD	Depth of ground water (metre)	RGWD	
1	Right Main Dy	-	-	-	-	-	-	-	-	2.61	4.35	1.76	2.93	No Waterlogging Best sustainability
2	Bhaisani Dy	2.61	4.35	1.76	2.93	2.62	4.37	0.96	1.60	2.74	4.57	0.61	1.02	"
3	Barla Dy	3.59	5.98	1.7	2.83	-	-	-	-	2.62	4.37	0.96	1.60	"
4	Khoja Nagla Mr.	2.62	4.37	0.96	1.60	-	-	-	-	-	-	-	-	"
5	Bijopura Mr.	2.74	4.57	0.61	1.02	-	-	-	-	-	-	-	-	"
Average Sustainability			4.82		2.10		4.37		1.60		4.43		1.85	3.19

Annexure :4

Table No.22

Crop: Berseem

Effective Rooting Depth = 0.50m.

RELATIVE GROUND WATER DEPTH (RGWD)

$$= \frac{\text{ACTUAL DEPTH OF GROUND WATER}}{\text{CRITICAL DEPTH OF GROUND WATER (OR) EFFECTIVE ROOTING DEPTH}}$$

S.No.	Name of Canal	LOCATION IN THE COMMAND												Remarks
		HEAD REACH				MIDDLE REACH				TAIL REACH				
		Pre-Monsoon Period		Post- Monsoon Period		Pre-Monsoon Period		Post- Monsoon Period		Pre-Monsoon Period		Post- Monsoon Period		
		Depth of ground water (metre)	RGWD	Depth of ground water (metre)	RGWD	Depth of ground water (metre)	RGWD	Depth of ground water (metre)	RGWD	Depth of ground water (metre)	RGWD	Depth of ground water (metre)	RGWD	
1	Right Main Dy	-	-	-	-	-	-	-	-	2.61	5.22	1.76	3.52	No Waterlogging Best sustainability
2	Bhaisani Dy	2.61	5.22	1.76	3.52	2.62	5.24	0.96	1.92	2.74	5.48	0.61	1.22	"
3	Barla Dy	3.59	7.18	1.7	3.40	-	-	-	-	2.62	5.24	0.96	1.92	"
4	Khoja Nagla Mr.	2.62	5.24	0.96	1.92	-	-	-	-	-	-	-	-	"
5	Bijopura Mr.	2.74	5.48	0.61	1.22	-	-	-	-	-	-	-	-	"
Average Sustainability			5.78		2.52		5.24		1.92		5.31		2.22	3.83

Annexure:4

Table No.23

SUSTAINABILITY OF COMMAND AREA

S.No.	Name of Canal	Year	Initial Total Irrigable Area (Ha)	Current Irrigable Area (Ha)	Agricultural Land Lost (Ha)	Sustainability of Irrigable Area
1	2	3	4	5	6=4-5	7=5/4
1	Right Main Dy	1998-99	2111	1911	200	0.905
		1999-00	2111	1763	348	0.835
		2000-01	2111	1846	265	0.874
		2001-02	2111	1885	226	0.893
		2002-03	2111	1962	149	0.929
		2003-04	2111	2005	106	0.950
Average			**2111**	**1895.3**	**215.7**	**0.898**
2	Bhaisani Dy	1998-99	2237	1602	635	0.716
		1999-00	2237	1585	652	0.709
		2000-01	2237	1389	848	0.621
		2001-02	2237	1578	659	0.705
		2002-03	2237	1632	605	0.730
		2003-04	2237	1669	568	0.746
Average			**2237**	**1575.8**	**661.2**	**0.704**
3	Barla Dy	1998-99	708	700	8	0.989
		1999-00	708	700	8	0.989
		2000-01	708	584	124	0.825
		2001-02	708	607	101	0.857
		2002-03	708	623	85	0.880
		2003-04	708	622	86	0.879
Average			**708**	**639.3**	**68.7**	**0.903**

SUSTAINABILITY OF COMMAND AREA

S.No.	Name of Canal	Year	Initial Total Irrigable Area (Ha)	Current Irrigable Area (Ha)	Agricultural Land Lost (Ha)	Sustainability of Irrigable Area
1	2	3	4	5	6=4-5	7=5/4
4	Khoja Nagla Mr.	1998-99	568	290	278	0.511
		1999-00	568	284	284	0.500
		2000-01	568	250	318	0.440
		2001-02	568	269	299	0.474
		2002-03	568	304	264	0.535
		2003-04	568	330	238	0.581
Average			**568**	**287.8**	**280.2**	**0.507**
5	Bijopura Mr.	1998-99	138	71	67	0.514
		1999-00	138	71	67	0.514
		2000-01	138	23	115	0.167
		2001-02	138	33	105	0.239
		2002-03	138	42	96	0.304
		2003-04	138	42	96	0.304
Average			**138**	**47.0**	**91.0**	**0.341**
6	Khampur Mr.	1998-99	128	66	62	0.516
		1999-00	128	66	62	0.516
		2000-01	128	64	64	0.500
		2001-02	128	63	65	0.492
		2002-03	128	53	75	0.414
		2003-04	128	64	64	0.500
Average			**128**	**62.7**	**65.3**	**0.490**
Average of all channels			**5890**	**4508**	**1382**	**0.765**

Anneure:4

Table No.-24

FARM BUDGET PER HECTARE (2003-2004)

S.No.	PARTICULARS	COST OF CULTIVATION OF VARIOUS CROPS (Rs./Ha)									
		WITHOUT PROJECT					WITH PROJECT				
		KHARIF		Sugarcane	RABI		KHARIF		Sugarcane	RABI	
		Paddy	Other kharif / Sorghum		Wheat	Berseem	Paddy	Other kharif / Sorghum		Wheat	Berseem
1	Manpower	2000	2000	3000	1000	1000	4000	3500	6000	2000	2000
2	Animal/Mechanical Power	750	750	2000	1200	500	1500	1500	4000	2200	1000
3	Seeds	300	250	4000	2000	1000	300	350	6500	1000	800
4	Manures & Fertilizers	2000	1500	4500	2000	1000	4500	4000	8000	5000	2000
5	Irrigation water	-	-	-	-	-	287	173	474	287	99
6	Pesticides	600	500	1000	700	200	1500	1500	2000	1500	500
7	Miscellaneous	1000	1000	3000	800	1500	3600	3500	6000	1600	3500
8	TOTAL	6650	6000	17500	7700	5200	15687	14523	32974	13587	9899

Anneure:4

Table No.-25

FARM BUDGET PER HECTARE (2003-2004)

S.No.	Crops	WITHOUT PROJECT							WITH PROJECT						
		COST OF MAIN PRODUCTS			COST OF BYPRODUCTS			Gross Income	COST OF MAIN PRODUCTS			COST OF BYPRODUCTS			Gross Income
		Yield of Grain Q/ha	Unit Rate Rs/Q	Cost (Rs)	Yield of Grain Q/ha	Unit Rate Rs/Q	Cost (Rs)	Rs/Ha	Yield of Grain Q/ha	Unit Rate Rs/Q	Cost (Rs)	Yield of Grain Q/ha	Unit Rate Rs/Q	Cost (Rs)	Rs/Ha
1	Paddy	30	550	16500	12	100	1200	**17700**	50	550	27500	25	100	2500	**30000**
2	Other Kharif/ Sorghum	25	500	12500	10	100	1000	**13500**	50	500	25000	20	100	2000	**27000**
3	Sugarcane	375	95	35625	40	100	4000	**39625**	700	90	63000	80	100	8000	**71000**
4	Wheat	20	650	13000	10	100	1000	**14000**	40	650	26000	20	100	2000	**28000**
5	Berseem	200	50	10000	-	-	-	**10000**	400	50	20000	-	-	-	**20000**

Annexure: 4

Table No.-26

PROJECT BENEFITS (2003-2004)

S.No.	Name of Crop	BENEFIT WITHOUT PROJECT				BENEFIT WITH PROJECT				NET BENEFIT
		Area (ha)	Gross Income /ha	Cost of cultivation /ha	Net Income (Rs)	Area (ha)	Gross Income /ha	Cost of cultivation/ha	Net Income (Rs)	Amount (Rs)
1	Paddy	434.8	17700	6650	4804540	434.8	30000	15687	6223292	**1418752**
2	Other Kharif/ Sorghum	835.7	13500	6000	6267750	835.7	27000	14523	10427029	**4159279**
3	Sugarcane	3248.2	39625	17500	71866425	3248.2	71000	32974	123516053	**51649628**
4	Wheat	1312.75	14000	7700	8270325	1312.75	28000	13587	18920666	**10650341**
5	Berseem	564.75	10000	5200	2710800	564.75	20000	9899	5704540	**2993740**
TOTAL					**93919840**				**164791580**	**70871740**

Annexure:4
Table No.-27

ECONOMIC ANALYSIS

Annual Benefit of year 2003-2004 = 70871740.00

Let the project has been constructed 40 years ago in the year 1963-64

And let us assume that the benefit throughout last 40 years is half of the benefit of year 2003-04.

i.e. half of Rs.70871740 = 70871740/2 = Rs. 35435870

So, the Present worth of benefit at 1963-64 =Pwb = A[{(1+i)^n-1}/i(1+i)^n}]

Here i = 10% = 0.1 and n = 40

Pwb = Rs.35435870.00 x [{(1+0.1)^40-1}/0.1(1+0.1)^40}] = Rs. **346529170**

Let us assume the cost of construction=Rs. 200000000

and the operation and maintenance cost @ 2.5% = Rs 5000000

The Present worth of cost=Pwc= 200000000 + 5000000x [{(1+0.1)^40-1}/0.1(1+0.1)^40}]

= Rs. **248895254**

The Net Present Benefit = Pwb - Pwc = **97633916**

B/C Ratio=Pwb/Pwc = *346529170/248895254* = 1.39 Fair

<u>For Internal Rate of Return:</u>

Pwb - Pwc = 0

35435870 [{(1+i)^40-1}/i(1+i)^40}] 200000000 - 5000000x [{(1+i)^40-1}/i(1+i)^40}]= 0

30.4 [{(1+i)^40-1}/i(1+i)^40}] = 200

By Trial and error

When i =	0.12	L.H.S. =	250.91
When i =	0.13	L.H.S. =	232.36
When i =	0.14	L.H.S. =	216.25
When i =	0.15	L.H.S. =	202.15
When i =	0.151	L.H.S. =	200.84

Hence Internal Rate of Return = 15.10%

Anneure:4
Table No.-28

ABSTRACT OF PERFORMANCE STANDARDS

S.No.	Measures or Standards	Average Value	Performance Class
1	Equity i.e.water distribution	0.465	Fair (Not Equitable)
2	Adequacy or water application	0.31	Poor (Not appropriate)
3	Timeliness or water delivery	3.56	Very good
4	Sustainability	0.765	Good
5	Design of Structure	-	Economic
6	Construction	-	Easy
7	Operation	-	Easy
8	Wastage of water	35-40 %	Moderate
9	Complete Management	-	Good and Prompt
10	Communication	-	Accessible
11	Decision making	-	Quick
12	Irrigation Service Fee (ISF) collection	-	Moderate
13	Operation and Maintenance share	-	Average
14	Overall Efficiency	-	Moderate
15	Productivity	127.5 quintal/ha.	High
16	Cropping Intensity	129.4% Right Main, 97.6% Bhaisani, 129% Barla and 62% others	High to Low
17	Ownership feeling	-	Good
18	Willingness to pay	-	Good
19	Overall Performance	-	Very good
20	Irrigation Employment generation	70 no./Ha	Fair
21	Per Capita Income	Rs.3234.00	Good
22	Irrigable Area (Ha)	5890 Ha	Good
23	Economic Internal Rate of Return	15.10%	Very good

Anneure:4

Table No.-29

OUTLETS DETAIL OF RIGHT MAIN DISTRIBUTARY

S.No.	Outlet No.	Chainage Mile-Farlang-Feet	CCA in Acres	Outlet size	Type	Discharge in Cusecs
1	1 L	0-2-50	79	5"	Free fall	0.50
2	2 R	0-2-220	50	4"	"	0.30
3	3 L	0-4-187	70	4"	"	0.30
4	3A R	0-5-380	45	4"	"	0.30
5	4 R	0-6-317	107	6"	"	0.66
6	5 L	0-6-415	86	5"	"	0.50
7	6 R	1-0-300	200	6"	"	0.90
8	7 R	1-3-527	101	5"	"	0.50
9	8 L	1-3-543	43	4"	"	0.30
10	9 R	1-5-325	54	4"	"	0.30
11	10 L	1-6-110	48	4"	"	0.30
12	11 R	1-6-320	57	4"	"	0.30
13	12 L	2-0-345	13	3"	"	0.15
14	13 R	2-1-133	33	4"	"	0.30
15	15 L	2-3-411	46	4"	"	0.30
16	16 R	2-4-103	143	4"	"	0.40
17	17 L	2-7-200	53	5"	"	0.50
18	18 R	2-7-202	60	4"	"	0.40
19	19 L	3-0-335	131	6"	"	0.66
20	20 R	2-3-01	84	5"	"	0.50
21	21 L	3-2-435	63	4"	"	0.40
22	22 L	3-4-420	37	4"	"	0.30
23	23 R	3-4-440	84	5"	"	0.50
24	24 L	3-6-284	51	4"	"	0.30
25	25 R	4-0-30	102	6"	"	0.66
26	26 L	4-2-366	79	4"	"	0.40
27	29 L	4-3-572	23	4"	"	0.30
28	30 R	4-3-617	150	6"	"	0.90
29	30A R	2-4-00	75	4"	"	0.40
30	30B R	4-5-584	163	4"	"	0.40
31	33 R	5-0-600	77	4"	"	0.40
32	34A R	7-6-80	186	6"	"	0.90
33	34B R	6-7-210	107	6"	"	0.66
34	35 L	7-0-35	155	6"	"	0.90
35	36 L	7-2-110	23	4"	"	0.30
36	37 R	7-2-175	162	6"	"	0.90
37	38 R	4-7-82	111	6"	"	0.66
38	39 L	7-3-416	90	5"	"	0.50
39	40 R	5-7-75	196	6"+3"	"	1.10
40	41 L	7-5-120	56	4"	"	0.30
41	42 L	7-7-270	56	4"	"	0.30
42	43 R	7-7-506	198	6"+3"	"	1.10
43	44 L	8-0-288	111	6"	"	0.66
44	45 L	8-2-525	88	4"	"	0.40
45	46 R	4-8-06	54	4"	"	0.30
46	48 R	9-0-50	91	4"	"	0.40
47	49 L	9-0-77	108	6"	"	0.66
48	50 R	9-1-350	215	6"	"	0.90
49	51 L	9-1-350	96	6"	"	0.55
50	52 R	9-5-278	81	4"	"	0.40
51	53 L	9-7-644	135	6"	"	0.66
52	53A L	9-6-421	87	4"	"	0.40
53	54 R	10-0-110	186	6"	"	0.90
54	55 L	10-2-510	37	4"	"	0.30
Total			**5036**			**27.48**

OUTLETS DETAIL OF BHAISANI DISTRIBUT

S.No.	Outlet No.	Chainage Mile-Farlang-Feet	CCA in Acres	Outlet size	Type	Discharge in Cusecs
1	1 L	0-0-82	32	4"	Free fall	0.40
2	2 R	0-2-459	60	4"	"	0.40
3	3 L	0-3-99	86	4"	"	0.40
4	4 R	0-4-118	78	4"	"	0.40
5	5 L	0-5-272	72	4"	"	0.40
6	6 R	0-6-449	137	6"	"	0.90
7	7 R	0-7-131	228	6"	"	0.90
8	8 L	1-1-118	33	3"		0.20
9	9 R	1-1-172	105	6"	"	0.90
10	10 L	1-3-110	108	6"	"	0.90
11	11 R	4-1-99	155	6"	"	0.90
12	12 L	1-5-346	77	5"	"	0.68
13	13 L	1-6-400	104	6"	"	0.90
14	14 R	1-6-475	166	6"	"	0.90
15	15 R	1-7-334	46	4"	"	0.40
16	16 L	2-1-160	88	4"	"	0.40
17	17 R	2-2-273	50	4"	"	0.40
18	18 L	2-2-367	48	4"	"	0.40
19	19 R	5-2-37	187	6"+6"	"	1.80
20	20 L	2-5-131	116	6"	"	0.90
21	21 R	2-5-545	87	4"	"	0.40
22	22 R	2-5-554	116	6"	"	0.9(2%lift)
23	23 R	2-6-213	88	4"	"	0.40
24	23A R	3-0-328	56	4"	"	0.4(2%lift)
25	24 L	3-0-418	31	4"	"	0.40
26	24A L	1-3-00	176	6"+3"	"	1.10
27	25 L	3-2-467	38	4"	"	0.40
28	26 R	3-2-477	59	4"	"	0.4(2%lift)
29	27 L	3-4-117	112	5"	"	0.68
30	28 R	3-4-615	319	6"+6"	"	1.80
31	29 L	3-5-647	57	4"	"	0.40
32	29A L	6-3-07	58	3"	"	0.20
33	30 R	4-0-502	84	4"	"	0.40
34	31 R	4-1-359	73	4"	"	0.40
35	32 L	4-1-465	52	4"	"	0.40
36	33 R	3-4-65	103	5"	"	0.68
37	34 L	4-3-632	41	4"	"	0.40
38	35 R	4-6-483	123	6"	"	0.90
39	35A L	4-6-501	48	4"	"	0.40
40	36 L	5-0-279	80	4"	"	0.40
41	37 R	1-5-32	140	6"	"	0.90
42	38 L	5-3-454	61	4"	"	0.40
43	39 R	5-5-606	95	5"	"	0.68
44	40 L	5-6-429	83	6"	"	0.90
45	41 R	6-0-292	95	6"	17%submer	0.66
46	42 L	6-0-494	28	4"	Free fall	0.40
47	43 L	6-1-548	96	6"	"	0.90
48	44 R	6-2-488	49	4"	"	0.40
49	45 L	6-3-150	97	6"	"	0.90
50	46 L	6-5-475	25	4"	"	0.40
51	47 L	6-7-148	105	6"	"	0.90
52	48 R	7-0-187	83	4"	"	0.40
53	48A L	7-0-204	44	4"	"	0.40
54	49 R	7-1-565	110	6"	"	0.90
55	50 L	7-2-322	42	4"	"	0.40
56	51 R	7-2-542	51	4"	"	0.40
57	52 R	7-4-441	70	4"	"	0.40
58	53 L	7-4-654	65	6"	"	0.90
59	54 R	7-7-59	50	4"	"	0.40
60	55 L	7-7-91	44	4"	"	0.40
61	56 R	8-0-635	32	4"	"	0.40
62	57 L	8-0-635	105	6"	"	0.90
63	58 R	8-3-228	52	5"	"	0.68
64	59 L	8-3-228	31	5"	"	0.68
65	Last	8-4-250	98	5"	-	-
Total			**5528**			**37.94**

OUTLETS DETAIL OF BARLA DISTRIBUTARY

S.No.	Outlet No.	Chainage Mile-Farlang-Feet	CCA in Acres	Outlet size	Type	Discharge in Cusecs
1	1 R	0-0-392	145	6"	Free fall	0.90
2	2 L	0-1-621	30	4"	"	0.40
3	3 L	0-4-440	30	4"	"	0.40
4	4 R	0-5-81	62	4"	"	0.40
5	5 L	0-6-15	42	4"	"	0.40
6	6 R	0-7-368	80	6"	"	0.90
7	7 L	1-1-296	74	4"	"	0.40
8	8 R	1-2-146	44	4"	"	0.40
9	9 L	1-3-570	55	4"	"	0.40
10	10 R	1-4-338	36	4"	"	0.40
11	11 L	1-5-353	49	4"	"	0.40
12	12 L	1-7-542	81	4"	"	0.40
13	12A R	7-1-00	-	4"	"	0.40
14	13 L	2-2-511	151	6"	"	0.90
15	13A R	2-2-511	54	4"	"	0.40
16	14 R	6-2-57	20	4"	sub.13%lift	0.30
17	15 L	2-6-119	75	4"	Free fall	0.40
18	16 L	2-7-589	60	4"	"	0.40
19	17 R	3-0-570	32	4"	sub.40%lift	0.25
20	18 L	3-1-105	63	4"	Free fall	0.40
21	19 L	2-3-59	53	4"	"	0.40
22	20 R	2-3-59	38	4"	sub.38%lift	0.25
23	21 L	3-4-499	52	4"	Free fall	0.40
24	22 R	3-4-499	38	4"	"	0.40
25	23 L	3-5-458	45	4"	"	0.40
26	24	3-5-484	45	4"	"	0.40
27	25 L	4-0-115	48	4"	"	0.40
28	26 R	4-0-118	20	4"	"	0.40
29	27 L	4-2-423	110	6"	"	0.90
30	28 R	4-2-424	15	4"	"	0.40
31	29 R	4-4-173	36	6"	"	0.90
32	30 L	4-4-173	72	6"	" (1%lift)	0.90
TOTAL			1755			15.40

OUTLETS DETAIL OF KHOJA NAGLA MINOR

S.No.	Outlet No.	Chainage Mile-Farlang-Feet	CCA in Acres	Outlet size	Type	Discharge in Cusecs
1	1 R	0-3-397	77	4"	Free fall	0.40
2	2 L	0-3-426	58	4"	"	0.40
3	3 R	0-6-144	170	6"	"	0.90
4	4 R	0-6-220	119	6"	"	0.90
5	5 L	0-6-269	101	6"	"	0.90
6	6 R	1-0-197	44	4"	"	0.40
7	7 R	1-1-340	68	4"	"	0.40
8	7A L	1-2-391	50	4"	"	0.40
9	8 L	1-4-391	68	5"	"	0.68
10	10 L	1-6-148	131	6"	"	0.90
11	10A R	1-7-590	23	3"	"	0.20
12	11 L	2-0-280	31	4"	"	0.40
13	12 L	2-2-94	51	4"	"	0.40
14	13 R	2-2-177	53	4"	"	0.40
15	14 L	2-3-118	49	4"	"	0.40
16	15 R	2-3-646	246	6"+6"	"	1.80
17	Last R	2-4-175	314	6"+6"	"	1.80
TOTAL			1653			11.68

OUTLETS DETAIL OF BIJOPURA MINOR

S.No.	Outlet No.	Chainage Mile-Farlang-Feet	CCA in Acres	Outlet size	Type	Discharge in Cusecs
1	1 L	0-2-565	30	4"	Free fall	0.40
2	2 L	0-3-639	29	3"	"	0.20
3	2A R	0-5-219	32	4"	"	0.40
4	Last centre	1-0-426	250	6"+6"	"	1.80
TOTAL			341			2.80

OUTLETS DETAIL OF KHAMPUR MINOR

S.No.	Outlet No.	Chainage Mile-Farlang-Feet	CCA in Acres	Outlet size	Type	Discharge in Cusecs
1	1 L	0-3-504	48	4"	Free fall	0.40
2	Last centre	1-4-189	262	Open	"	-
TOTAL			310			

Annexure: 4
Table No.- 30

AREA IRRIGATED BY CANAL (OUTLET-WISE)

S.No.	Name of Channel/outlet	Year	Kharif		Sugarcane	Sub Total	Rabi		Sub Total	Total
			Paddy	Other Kharif			Wheat	Other Rabi		
1	2	3	4	5	6	7	8	9	10	11
1	Khoja nagla Mr. Outlet No-2, CCA=23.5 Ha.	1998-99	3	4	18	25	10	4	14	39
		1999-00	3	4	18	25	10	4	14	39
		2000-01	5	2	15	22	5	2	7	29
		2001-02	5	3	18	26	8	5	13	39
		2002-03	3	2	21	26	16	8	24	50
		2003-04	16	9	25	50	N.A.	N.A.	N.A.	-
Average			5.8	4.0	19.2	29.0	9.8	4.6	14.4	43.4
2	Khoja nagla Mr. Outlet No-7A, CCA=20.2 Ha.	1998-99	1	6	18	25	6	4	10	35
		1999-00	1	6	18	25	6	4	10	35
		2000-01	2	6	13	21	5	4	9	30
		2001-02	2	7	13	22	5	4	9	31
		2002-03	1	5	16	22	6	5	11	33
		2003-04	2	4	15	21	N.A.	N.A.	N.A.	-
Average			1.5	5.7	15.5	22.7	5.6	4.2	9.8	32.5
3	Khoja nagla Mr. Outlet No-15, CCA=99.6 Ha.	1998-99	0	0	0	0	2	0	2	2
		1999-00	0	0	0	0	2	0	2	2
		2000-01	0	0	0	0	4	0	4	4
		2001-02	0	0	0	0	6	2	8	8
		2002-03	0	5	4	9	5	2	7	16
		2003-04	0	3	8	11	N.A.	N.A.	N.A.	-
Average			0.0	1.3	2.0	3.3	3.8	0.8	4.6	7.9
4	Bijopura Mr. Outlet No-1, CCA=11.0 Ha.	1998-99	2	3	5	10	4	1	5	15
		1999-00	2	3	5	10	4	1	5	15
		2000-01	0	0	3	3	0	0	0	3
		2001-02	0	0	2	2	1	0	1	3
		2002-03	0	0	2	2	1	0	1	3
		2003-04	0	0	2	2	N.A.	N.A.	N.A.	-
Average			0.7	1.0	3.2	4.8	2.0	0.4	2.4	7.2
5	Bijopura Mr. Outlet No-2A, CCA=13.0 Ha.	1998-99	0	3	7	10	4	1	5	15
		1999-00	0	3	7	10	4	1	5	15
		2000-01	0	3	5	8	3	1	4	12
		2001-02	0	2	8	10	4	2	6	16
		2002-03	0	4	5	9	3	0	3	12
		2003-04	0	2	3	5	N.A.	N.A.	N.A.	-
Average			0.0	2.8	5.8	8.7	3.6	1.0	4.6	13.3
6	Bijopura Mr. Outlet No-Tail, CCA=101.2 Ha.	1998-99	1	8	30	39	11	3	14	53
		1999-00	1	8	30	39	11	3	14	53
		2000-01	0	0	0	0	3	0	3	3
		2001-02	0	3	6	9	6	1	7	16
		2002-03	0	5	14	19	7	2	9	28
		2003-04	1	6	15	22	N.A.	N.A.	N.A.	-
Average			0.5	5.0	15.8	21.3	7.6	1.8	9.4	30.7

Annexure: 4
Table No.- 31

Month Wise Gross Irrigation Water Requirement of Khoja Nagla Minor (Outlet-wise)

No. of Outlet	Season	Name of Crop	Area in Ha.	May		June		July		August		Septem		October		Novemb		Decemb		January		Februa		March		April		Total	
				Depth (mm)	Volume (Ha-m)	Depth (mm)	Volume (Ha-m)	Depth (mm)	Volume (Ha-m)	Depth (mm)	Volume (Ha-m)	Depth (mm)	Volume (Ha-m)	Depth (mm)	Volume (Ha-m)	Depth (mm)	Volume (Ha-m)	Depth (mm)	Volume (Ha-m)	Depth (mm)	Volume (Ha-m)	Depth (mm)	Volume (Ha-m)	Depth (mm)	Volume (Ha-m)	Depth (mm)	Volume (Ha-m)	Depth (mm)	Volume (Ha-m)
Outlet No.-2 (Head Reach)	Kharif	Paddy	5.8	-	-	47	0.27	763	4.43	442	2.56	525	3.0	311	1.8	-	-	-	-	-	-	-	-	-	-	-	-	2088	12.11
	Kharif	O.K.	4.0	-	-	-	-	107	0.43	91	0.36	193	0.77	150	0.6	-	-	-	-	-	-	-	-	-	-	-	-	541	2.164
		Sugarcane	19.2	352	6.758	451	8.66	314	6.0	338	6.49	425	8.16	249	4.78	159	3.05	107	2.05	73	1.4	103	2.0	167	3.21	198	3.8	2936	56.371
	Rabi	Wheat	9.8	-	-	-	-	-	-	-	-	-	-	-	-	151	1.48	85	0.83	132	1.3	168	1.6	118	1.16	10	0.1	664	6.5072
	Rabi	O.R.	4.6	-	-	-	-	-	-	-	-	-	-	-	-	196	0.9	165	0.76	148	0.7	210	1.0	378	1.74	248	1.14	1345	6.187
		Sub Total	43.4	352	6.758	498	8.93	1184	10.9	871	9.42	1143	12	710	7.18	506	5.43	357	3.65	353	3.4	481	4.6	663	6.1	456	5.0	7574	83.3
Outlet No.-7A (Middle Reach)	Kharif	Paddy	1.5	-	-	47	0.07	763	1.14	442	0.66	525	0.8	311	0.47	-	-	-	-	-	-	-	-	-	-	-	-	2088	3.132
	Kharif	O.K.	5.7	-	-	-	-	107	0.61	91	0.52	193	1.1	150	0.86	-	-	-	-	-	-	-	-	-	-	-	-	541	3.0837
		Sugarcane	15.5	352	5.456	451	7.0	314	4.87	338	5.24	425	6.59	249	3.86	159	2.46	107	1.66	73	1.1	103	1.6	167	2.59	198	3.07	2936	45.508
	Rabi	Wheat	5.6	-	-	-	-	-	-	-	-	-	-	-	-	151	0.85	85	0.48	132	0.7	168	0.9	118	0.66	10	0.06	664	3.7184
	Rabi	O.R.	4.2	-	-	-	-	-	-	-	-	-	-	-	-	196	0.82	165	0.69	148	0.6	210	0.9	378	1.59	248	1.0	1345	5.649
		Sub Total	32.5	352	5.456	498	7.06	1184	6.62	871	6.42	1143	8.48	710	5.18	506	4.13	357	2.83	353	2.5	481	3.4	663	4.84	456	4.17	7574	61.091
Outlet No.-15 (Tail Reach)	Kharif	Paddy	0.0	-	-	47	0	763	0	442	0	525	0.0	311	0	-	-	-	-	-	-	-	-	-	-	-	-	2088	0
	Kharif	O.K.	1.3	-	-	-	-	107	0.14	91	0.12	193	0.25	150	0.2	-	-	-	-	-	-	-	-	-	-	-	-	541	0.7033
		Sugarcane	2.0	352	0.704	451	0.9	314	0.63	338	0.68	425	0.85	249	0.5	159	0.32	107	0.21	73	0.1	103	0.2	167	0.33	198	0.4	2936	5.872
	Rabi	Wheat	3.8	-	-	-	-	-	-	-	-	-	-	-	-	151	0.57	85	0.32	132	0.5	168	0.6	118	0.45	10	0.0	664	2.5232
	Rabi	O.R.	0.8	-	-	-	-	-	-	-	-	-	-	-	-	196	0.16	165	0.13	148	0.1	210	0.2	378	0.3	248	0.2	1345	1.076
		Sub Total	7.9	352	0.704	498	0.9	1184	0.77	871	0.79	1143	1.1	710	0.69	506	1.0	357	0.67	353	0.8	481	1.0	663	1.08	456	0.63	7574	10.175

Month Wise Gross Irrigation Water Requirement of Bijopura Minor (Outlet-wise)

No. of Outlet	Season	Name of Crop	Area in Ha.	May		June		July		August		Septem		October		Novemb		Decemb		January		Februa		March		April		Total	
				Depth (mm)	Volume (Ha-m)	Depth (mm)	Volume (Ha-m)	Depth (mm)	Volume (Ha-m)	Depth (mm)	Volume (Ha-m)	Depth (mm)	Volume (Ha-m)	Depth (mm)	Volume (Ha-m)	Depth (mm)	Volume (Ha-m)	Depth (mm)	Volume (Ha-m)	Depth (mm)	Volume (Ha-m)	Depth (mm)	Volume (Ha-m)	Depth (mm)	Volume (Ha-m)	Depth (mm)	Volume (Ha-m)	Depth (mm)	Volume (Ha-m)
Outlet No.-1 (Head Reach)	Kharif	Paddy	0.7	-	-	47	0.0	763	0.53	442	0.31	525	0.4	311	0.22	-	-	-	-	-	-	-	-	-	-	-	-	2088	1.4616
	Kharif	O.K.	1.0	-	-	-	-	107	0.11	91	0.09	193	0.19	150	0.15	-	-	-	-	-	-	-	-	-	-	-	-	541	0.541
	Sugarcane		3.2	352	1.126	451	1.44	314	1.0	338	1.08	425	1.36	249	0.8	159	0.51	107	0.34	73	0.2	103	0.3	167	0.53	198	0.63	2936	9.3952
	Rabi	Wheat	2	-	-	-	-	-	-	-	-	-	-	-	-	151	0.3	85	0.17	132	0.3	168	0.3	118	0.24	10	0.0	664	1.328
	Rabi	O.R.	0.4	-	-	-	-	-	-	-	-	-	-	-	-	196	0.1	165	0.1	148	0.1	210	0.1	378	0.2	248	0.1	1345	0.5
	Sub Total		**7.3**	**352**	**1.126**	**498**	**1.48**	**1184**	**1.65**	**871**	**1.48**	**1143**	**1.92**	**710**	**1.16**	**506**	**0.89**	**357**	**0.58**	**353**	**0.6**	**481**	**0.7**	**663**	**0.92**	**456**	**0.8**	**7574**	**13.3**
Outlet No.-2A (Middle Reach)	Kharif	Paddy	0.0	-	-	47	0	763	0	442	0	525	0.0	311	0.0	-	-	-	-	-	-	-	-	-	-	-	-	2088	0
	Kharif	O.K.	2.8	-	-	-	-	107	0.3	91	0.25	193	0.54	150	0.42	-	-	-	-	-	-	-	-	-	-	-	-	541	1.5148
	Sugarcane		5.8	352	2.042	451	2.6	314	1.82	338	1.96	425	2.47	249	1.44	159	0.92	107	0.62	73	0.4	103	0.6	167	0.97	198	1.15	2936	17.029
	Rabi	Wheat	3.6	-	-	-	-	-	-	-	-	-	-	-	-	151	0.54	85	0.31	132	0.5	168	0.6	118	0.42	10	0.04	664	2.3904
	Rabi	O.R.	1.0	-	-	-	-	-	-	-	-	-	-	-	-	196	0.2	165	0.17	148	0.1	210	0.2	378	0.38	248	0.2	1345	1.345
	Sub Total		**13.2**	**352**	**2.042**	**498**	**2.62**	**1184**	**2.12**	**871**	**2.22**	**1143**	**3.01**	**710**	**1.86**	**506**	**1.66**	**357**	**1.09**	**353**	**1**	**481**	**1.4**	**663**	**1.77**	**456**	**1.43**	**7574**	**22.279**
Outlet No.-Tail (Tail Reach)	Kharif	Paddy	0.5	-	-	47	0.0	763	0.4	442	0.2	525	0.3	311	0.2	-	-	-	-	-	-	-	-	-	-	-	-	2088	1.044
	Kharif	O.K.	5.0	-	-	-	-	107	0.54	91	0.46	193	0.97	150	0.75	-	-	-	-	-	-	-	-	-	-	-	-	541	2.705
	Sugarcane		15.8	352	5.562	451	7.1	314	4.96	338	5.34	425	6.72	249	3.93	159	2.51	107	1.69	73	1.2	103	1.6	167	2.64	198	3.13	2936	46.389
	Rabi	Wheat	7.6	-	-	-	-	-	-	-	-	-	-	-	-	151	1.15	85	0.65	132	1.0	168	1.3	118	0.9	10	0.1	664	5.0464
	Rabi	O.R.	1.8	-	-	-	-	-	-	-	-	-	-	-	-	196	0.35	165	0.3	148	0.3	210	0.4	378	0.68	248	0.4	1345	2.421
	Sub Total		**30.7**	**352**	**5.562**	**498**	**7.15**	**1184**	**5.88**	**871**	**6.02**	**1143**	**7.94**	**710**	**4.84**	**506**	**4.0**	**357**	**2.63**	**353**	**2.4**	**481**	**3.3**	**663**	**4.22**	**456**	**3.65**	**7574**	**57.605**

Annexure: 4
Table No.-32

DISCHARGE OF WELL

Discharge through well is given by

Q=Pi D Ls Vc

Where, D = Diameter of well

Ls = Length of screen

Vc = Entrance velocity in cm/sec.

Here, D = 4" = 0.10 m.

Average depth of tubewell = 120 feet = 36.0 m (approx.)

In top 30 feet length, there is no screen

In remaining 90 feet, the length of screen = 50% of total length

So, length of screen = 45 feet = 14.0m. (approx)

The value of co-efficient of permeability (k) for sand varies from $5x10^3$ to $15x10^4$ litres per day per square meter

$5x10^3$ lpd/ sq. m. = (5x1000x1000)/(10000x24x3600)=0.005787 cm/sec

So,$15x10^4$ = 30x.005787 = 0.1736

Average = 0.0896 = 0.09 cm/sec.

Permeability	Entrance Velocity
0.07 cm/sec	2.54 cm/sec
0.094 cm/sec	3.05 cm/sec

Q = 3.142x0.10x14.0x(3/100)x0.15x0.5

= 0.00989 cumecs

= 9.89 say 10 litres/sec.

Taking open area of screen=15% and efficiency of screen = 50% because of clogging after sometime.

In the same way,

For D = 5", Q = 12.6 litres/sec

For D = 6", Q = 15.0 litres/sec

Annexure: 4
Table No.-33

CANAL WATER SUPPLY

S.No.	Name of canal	Reach	Canal Water Supply (Drawal) in Ha-m.					
			May to Oct.	Nov. to April	Total	Outlet No-2	Outlet No-7A	Tail
1	Khoja Nagla Mr.	Total Reach	194.7	111	305.7	27.51	27.51	16.97
		Tail Reach (1/3rd of total)	25.9	25	50.9	-	-	-

CANAL WATER SUPPLY

S.No.	Name of canal	Reach	Canal Water Supply (Drawal) in Ha-m.					
			May to Oct.	Nov. to April	Total	Outlet No-1	Outlet No-2A	Last (centre)
1	Bijopura Mr.	Total Reach	21.7	10.8	32.5	4.64	4.64	21.0
		Tail Reach	17.1	8.6	25.7	-	-	-

Annexure: 4
Table No.-34

WATER SUPPLY BY TUBEWELLS

S.No	Name of Canal	Outlet No.	Reach	No.of Tube-wells	Diameter of Tube-well	Discharge per tubewell (cumecs)	Total Discharge (Cumecs)	Operation hour/day	Operation days/year	Volume of water delivered (Ha-m)	Total volume (Ha-m)	Average expense/hour (Rs)	Total Expense (Rs)
1	Khoja Nagla Mr.	2	Head	1	4"	0.01	0.01	8	90	2.59	2.59	40	28800
		7A	Middle	5	4"	0.01	0.05	9	90	14.58	18.25	40	162000
				1	5"	0.0126	0.0126	9	90	3.67		50	40500
		15	Tail	5	4"	0.01	0.05	12	180	38.88	38.88	40	432000
2	Bijopura Mr.	1	Head	7	4"	0.01	0.07	10	120	30.24	30.24	40	336000
		2A	Middle	4	4"	0.01	0.04	12	120	20.74	20.74	40	230400
		Last	Tail	40	4"	0.01	0.4	14	170	342.72	381.28	40	3808000
				3	6"	0.015	0.045	14	170	38.56		60	428400

Annexure: 4
Table No.-35

GROUND WATER PERCENTAGE

S.No.	Name of Canal	Outlet No.	Reach	Canal Supply (Ha-m)	Requirement met by private tubewells (Ha-m)	Total (Ha-m)	Percentage of ground water
1	Khoja Nagla Mr.	2	Head	27.51	2.59	30.1	8.6
		7A	Middle	27.51	18.25	45.76	39.9
		Tail	Tail	16.97	38.88	55.85	69.6
2	Bijopura Mr.	1	Head	4.64	30.24	34.88	86.7
		2A	Middle	4.64	20.74	25.38	81.7
		Last	Tail	21.0	381.28	402.28	94.8

Annexure: 4
Table No.-36

GANGA CANAL DIVISION, MUZAFFARNAGAR

CCA = 117388 ha

S.No.	Financial Year	Maintenance (M)		Operation(Establishment) (O)		Total O & M		Irrigated Area			Revenue		
		Allotment (lacs)	Expenditure (lacs)	Allotment (lacs)	Expenditure (lacs)	Allotment (lacs)	Expenditure (lacs)	Kharif (ha)	Rabi (ha)	Total (ha)	Kharif (lacs)	Rabi (lacs)	Total (lacs)
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	1987-88	46.50	47.55	76.25	76.25	122.75	123.80	93820	48756	142576	168.174	57.759	225.933
2	1988-89	56.00	56.63	86.21	86.21	142.21	142.84	93610	50391	144001	169.047	58.654	227.701
3	1989-90	52.20	52.54	125.96	125.96	178.16	178.50	92784	45328	138112	169.95	57.904	227.854
4	1990-91	109.15	110.37	121.86	121.86	231.01	232.23	91080	45635	136715	166.027	59.501	225.528
5	1991-92	94.05	94.21	137.05	137.05	231.10	231.26	90118	46070	136188	193.996	69.986	263.982
6	1992-93	87.43	87.32	152.84	152.84	240.27	240.16	92161	47432	139593	194.202	105.613	299.815
7	1993-94	82.61	83.98	174.32	174.32	256.93	258.30	91661	48215	139876	166.55	65.608	232.158
8	1994-95	78.60	80.14	194.30	194.30	272.90	274.44	91228	48231	139459	164.953	123.673	288.626
9	1995-96	80.40	81.56	244.48	244.48	324.88	326.04	91451	47479	138930	310.658	90.361	401.019
10	1996-97	88.23	89.64	280.62	280.62	368.85	370.26	91782	46748	138530	309.166	104.247	413.413

Annexure: 4
Table No.-37

GANGA CANAL DIVISION, MUZAFFARNAGAR

CCA = 117388 ha

S. No.	Financial Year	Maintenance Expenditure		Operation Expenditure		O & M Expenditure		Revenue per unit O & M expenditure (lacs/lacs)	Revenue	
		Per unit CCA (Rs/ha)	Per unit irrigated area (Rs/ha)	Per unit CCA (Rs/ha)	Per unit irrigated area (Rs/ha)	Per unit CCA (Rs/ha)	Per unit irrigated area (Rs/ha)		Per unit CCA (Rs/ha)	Per unit irrigated area (Rs/ha)
1	2	3	4	5	6	7	8	9	10	11
1	1987-88	40.50	33.35	64.95	53.48	105.45	86.83	1.825	192.46	158.46
2	1988-89	48.24	39.33	73.44	59.87	121.68	99.20	1.594	193.97	158.12
3	1989-90	44.76	38.04	107.30	91.20	152.06	129.24	1.274	194.1	164.87
4	1990-91	94.02	80.73	103.81	89.13	197.83	169.86	0.97	192.12	164.962
5	1991-92	80.25	69.18	116.75	100.63	197.00	169.81	1.14	224.88	193.84
6	1992-93	74.38	62.55	130.20	109.49	204.58	172.04	1.248	225.4	214.77
7	1993-94	71.54	60.04	148.50	124.62	220.04	184.66	0.899	197.85	165.974
8	1994-95	68.27	57.46	165.52	139.32	233.79	196.78	1.052	245.87	206.96
9	1995-96	69.48	58.70	208.26	175.97	277.74	234.67	1.23	341.62	288.65
10	1996-97	76.36	64.71	239.05	202.57	315.41	267.28	1.116	352.18	298.43

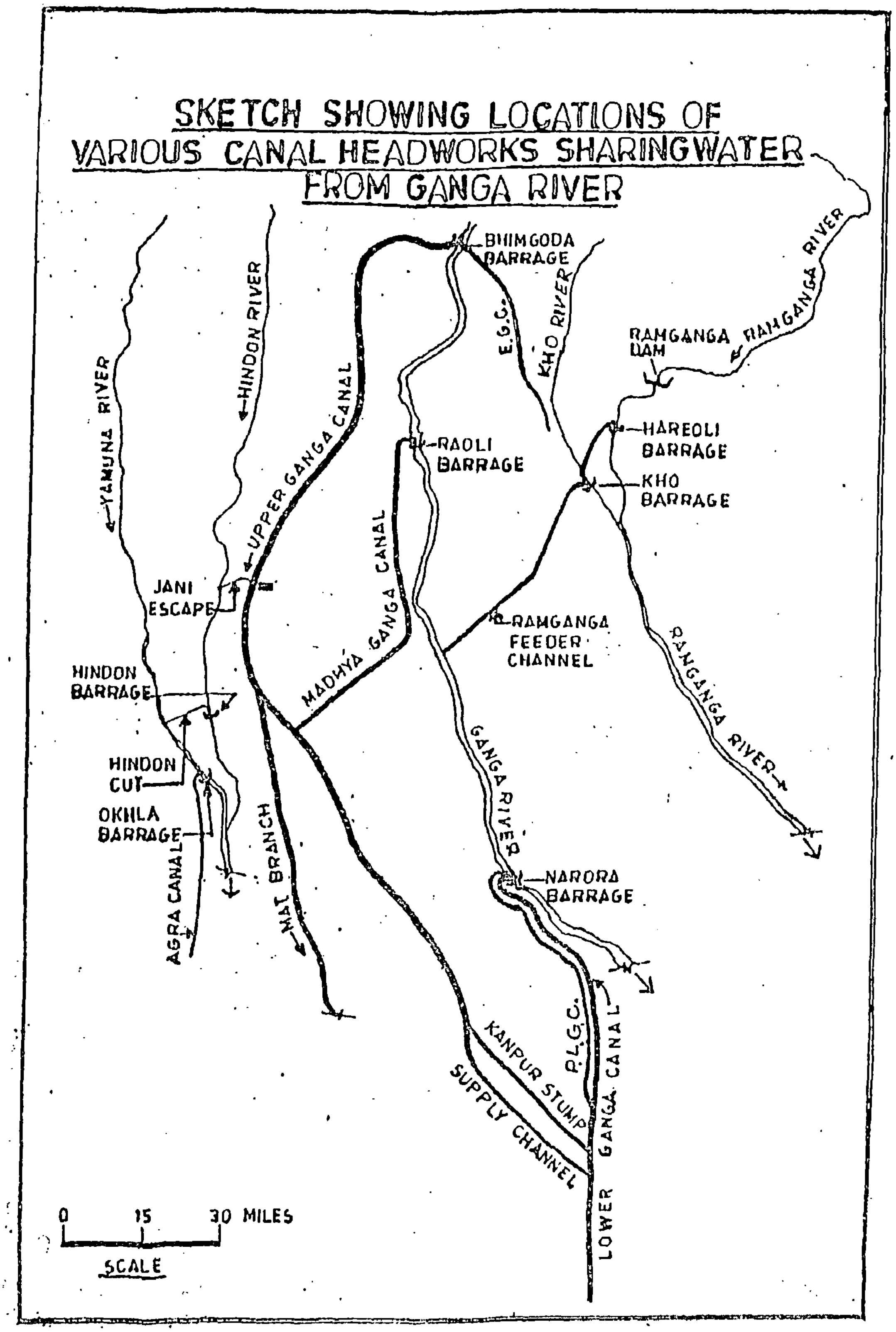

SKETCH SHOWING LOCATIONS OF VARIOUS CANAL HEADWORKS SHARINGWATER FROM GANGA RIVER
BHIMGODA BARRAGE
E.G.C.
KHO RIVER
RAMGANGA DAM
RAMGANGA RIVER
HINDON RIVER
YAMUNA RIVER
UPPER GANGA CANAL
RAOLI BARRAGE
HAREOLI BARRAGE
KHO BARRAGE
MADHYA GANGA CANAL
JANI ESCAPE
RAMGANGA FEEDER CHANNEL
HINDON BARRAGE
HINDON CUT
OKHLA BARRAGE
AGRA CANAL
MAT BRANCH
GANGA RIVER
NARORA BARRAGE
P.L.G.C.
KANPUR STUMP
SUPPLY CHANNEL
LOWER GANGA CANAL
0 15 30 MILES
SCALE

FIG. No.1.1

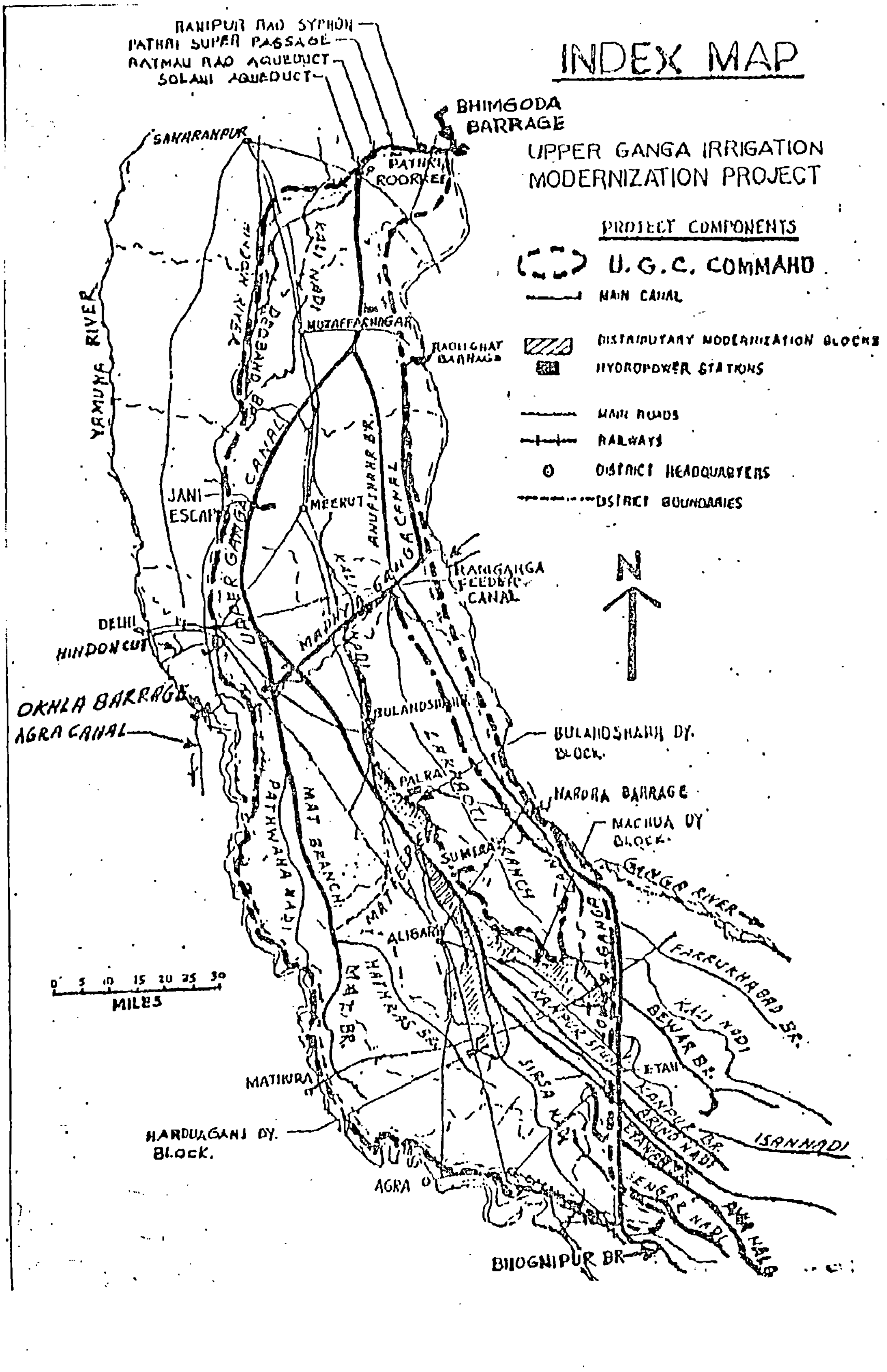

INDEX MAP
UPPER GANGA IRRIGATION MODERNIZATION PROJECT
BHIMGODA BARRAGE
SAHARANPUR
ROORKEE
MUZAFFARNAGAR
MEERUT
DELHI
HINDON CUT
OKHLA BARRAGE
AGRA CANAL
JANI ESCAPE
YAMUNA RIVER
UPPER GANGA CANAL
MADHYA GANGA CANAL
RAMGANGA FEEDER CANAL
BULANDSHAHR
BULANDSHAHR DY. BLOCK.
NARORA BARRAGE
MACHUA DY BLOCK.
GANGA RIVER
ALIGARH
MAT BRANCH
PATHWAHA NADI
MATHURA
HARDUAGANJ DY. BLOCK.
AGRA
BHOGNIPUR BR
ETAH
FARRUKHABAD BR.
KALI NADI
BEWAR BR.
KANPUR BR.
ISANNADI
SENGAR NADI
SIRSA NADI
0 5 10 15 20 25 30
MILES
N

Fig. No-1.2

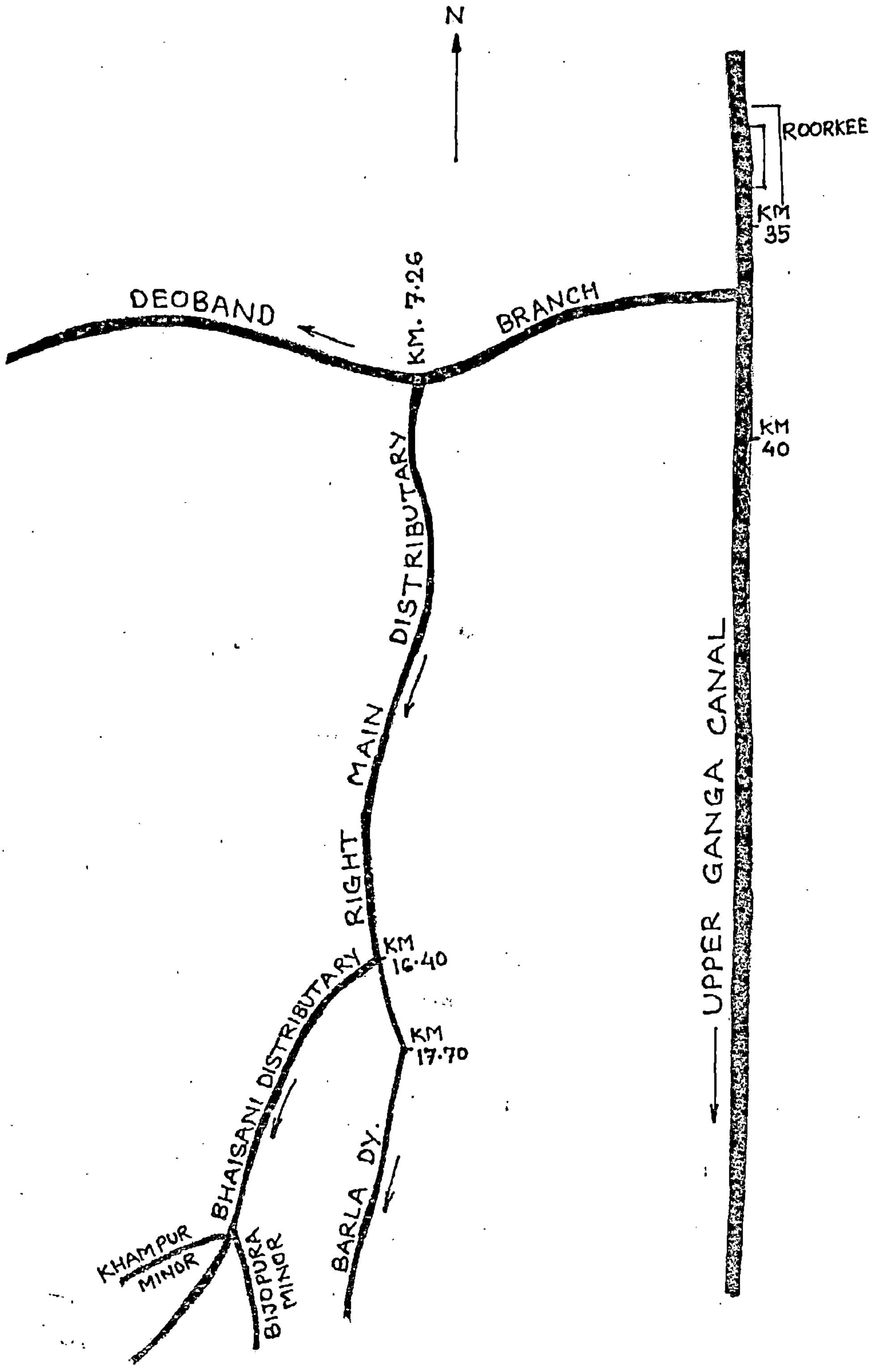
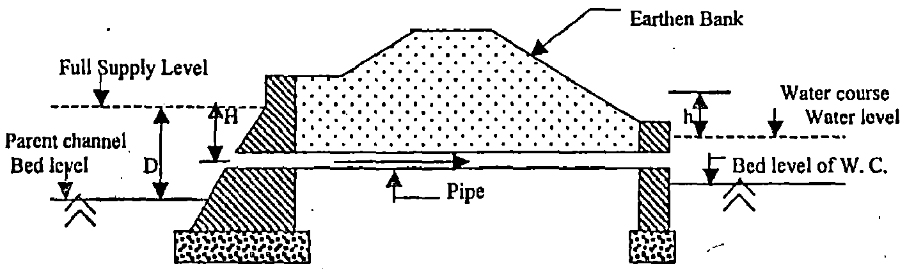
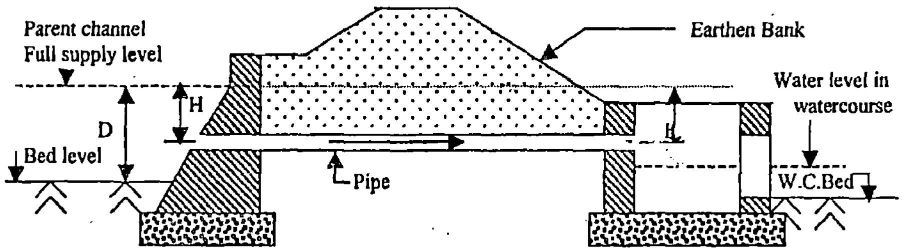


Fig. No.- 1.3 : INDEX PLAN

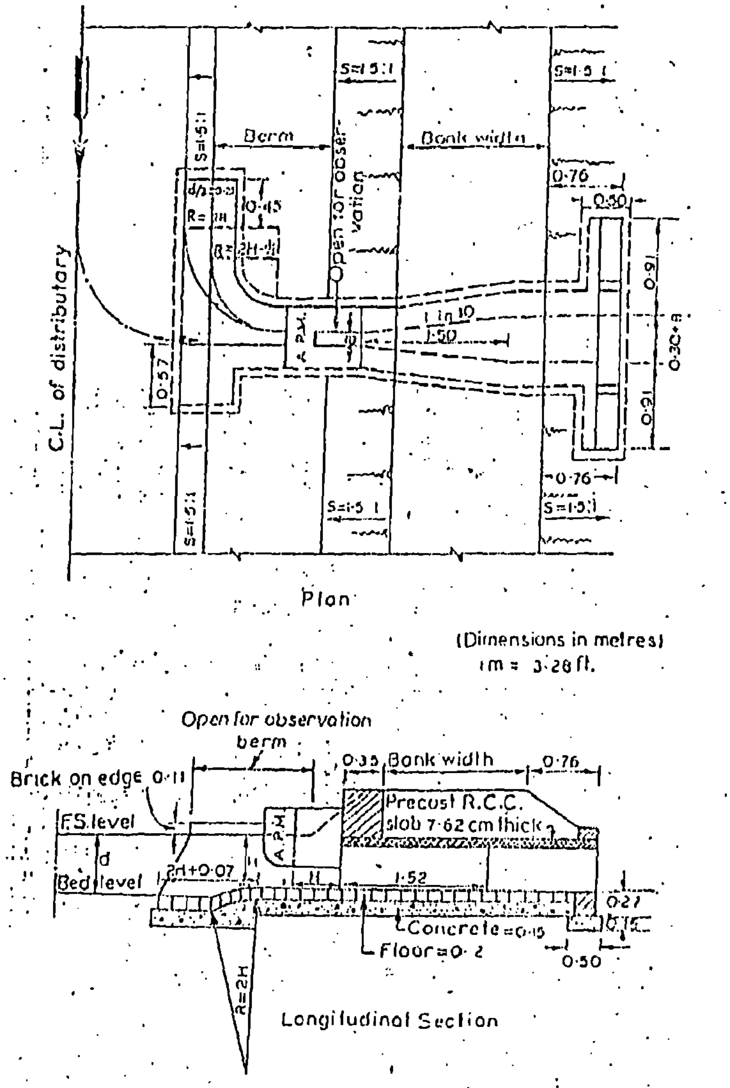


Submerged Pipe Outlet



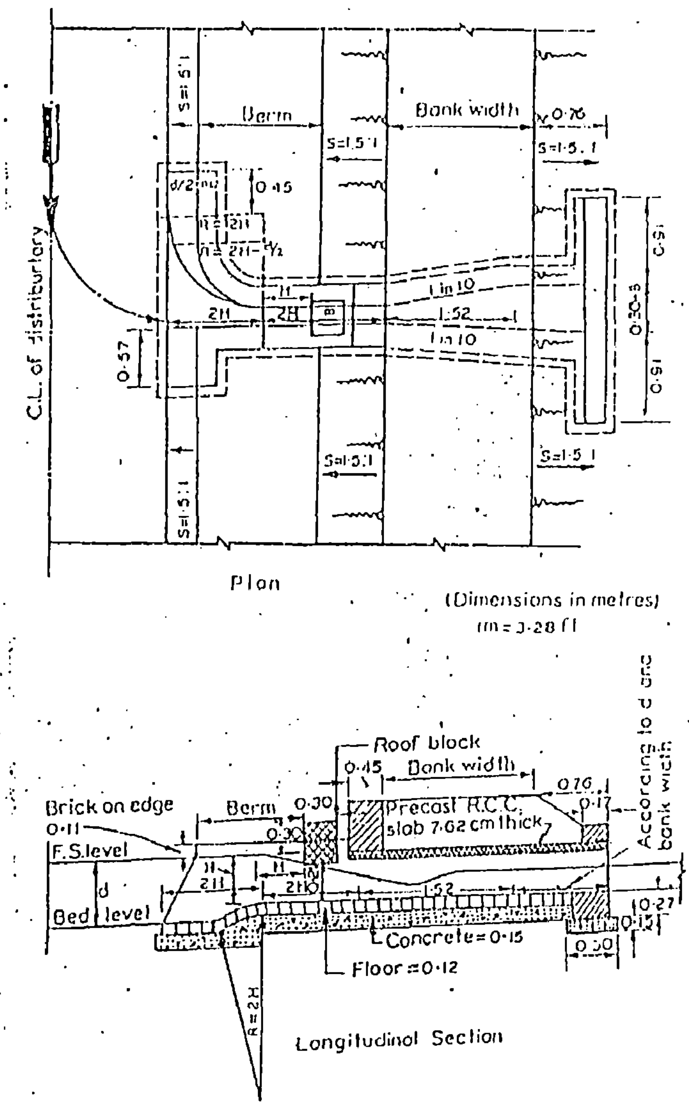
Pipe Outlet with Free fall

FIG. No.-2 .1



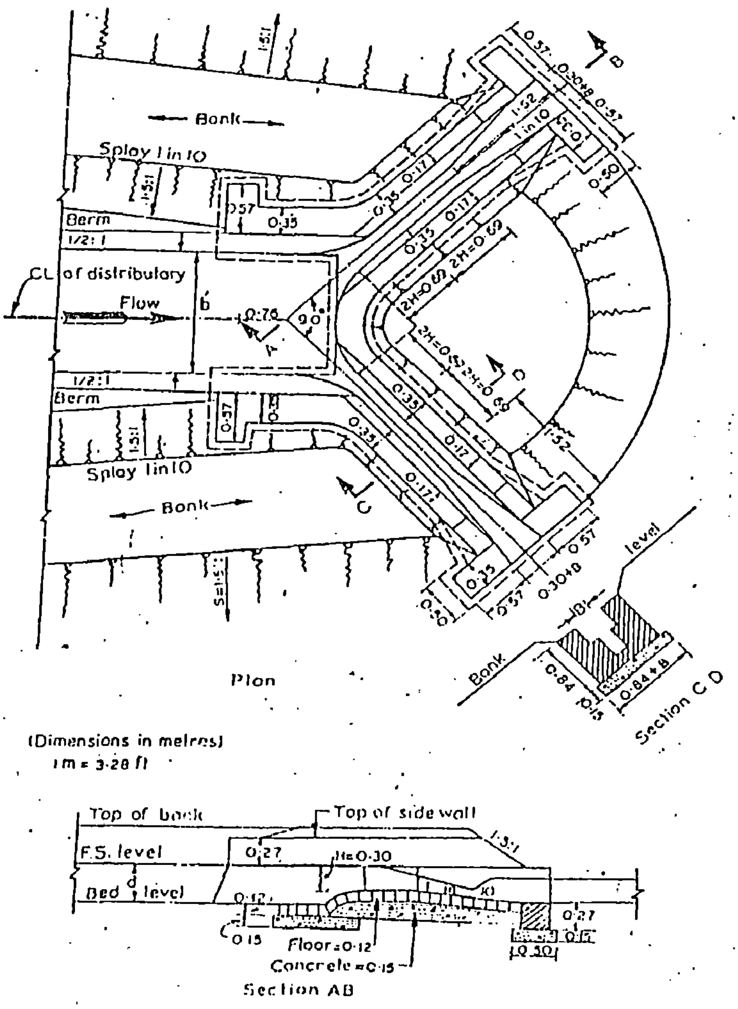
: Type plan of APM Outlet.

Figure No.-2.2



: Type plan of open-flume outlet.

Figure No.-2.3



: Type plan of fall cluster of two outlets.

Figure No.- 2.4

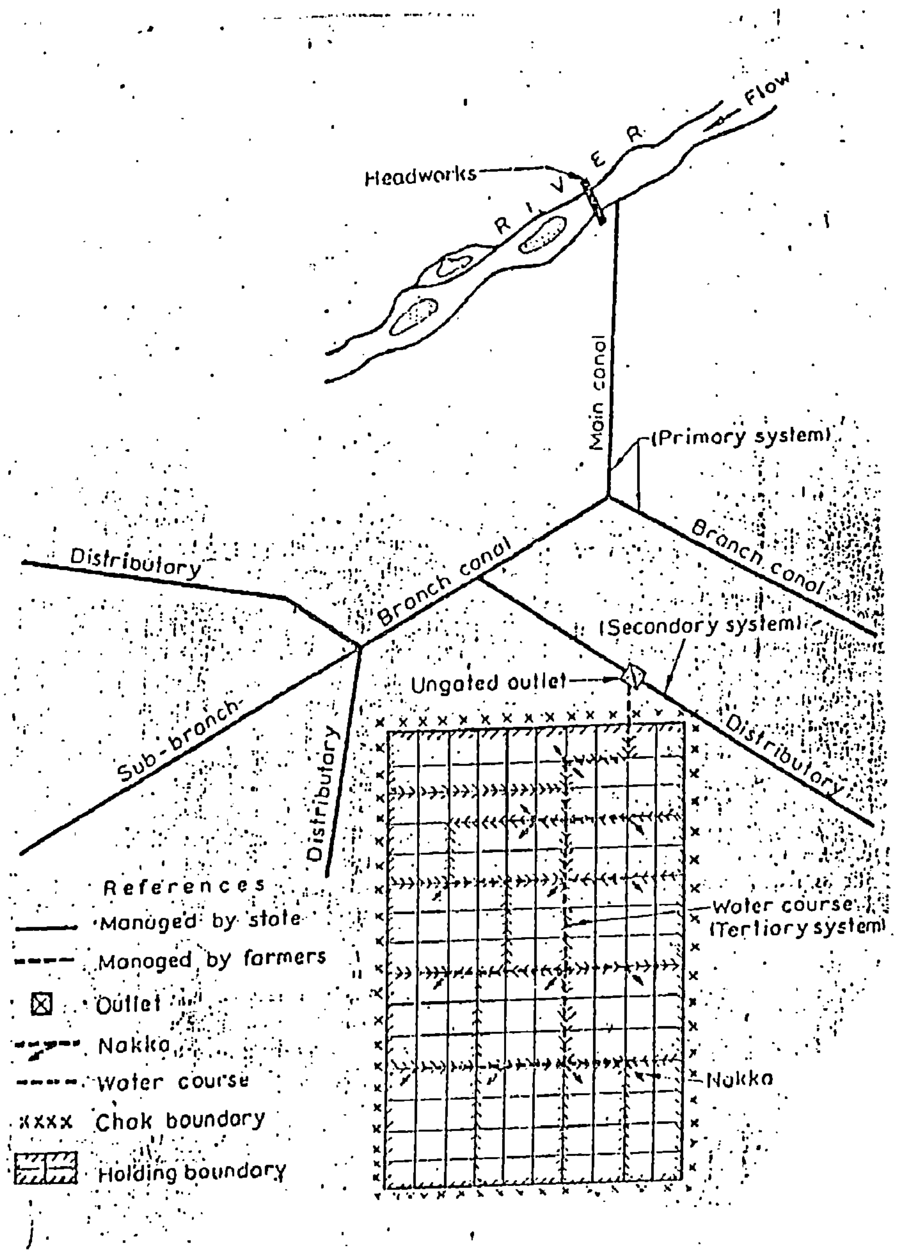


Figure No.- 2.5: TYPICAL DISTRIBUTION SYSTEM

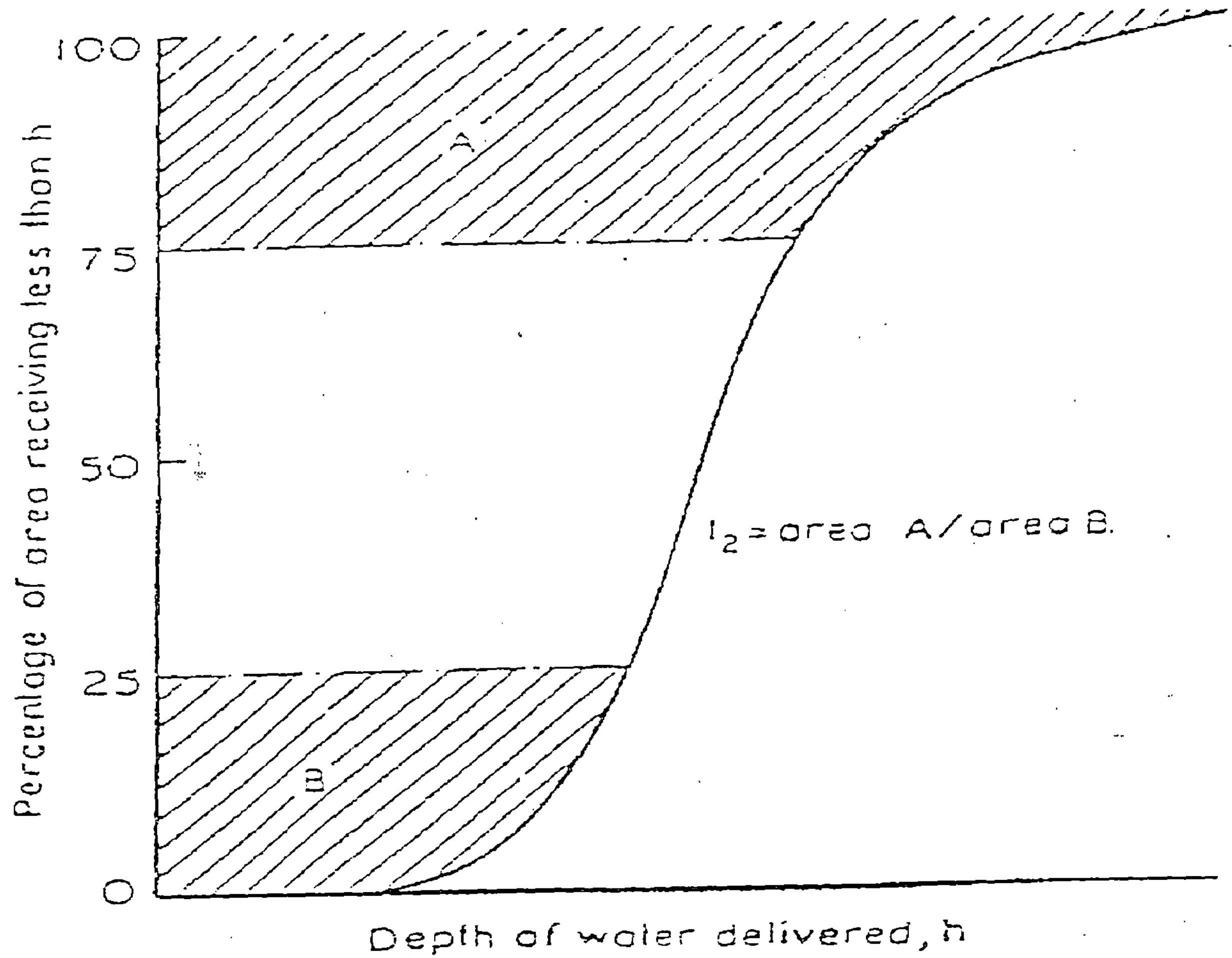


FIG. 3.1: DEFINITION OF INTER-QUARTILE RATIO

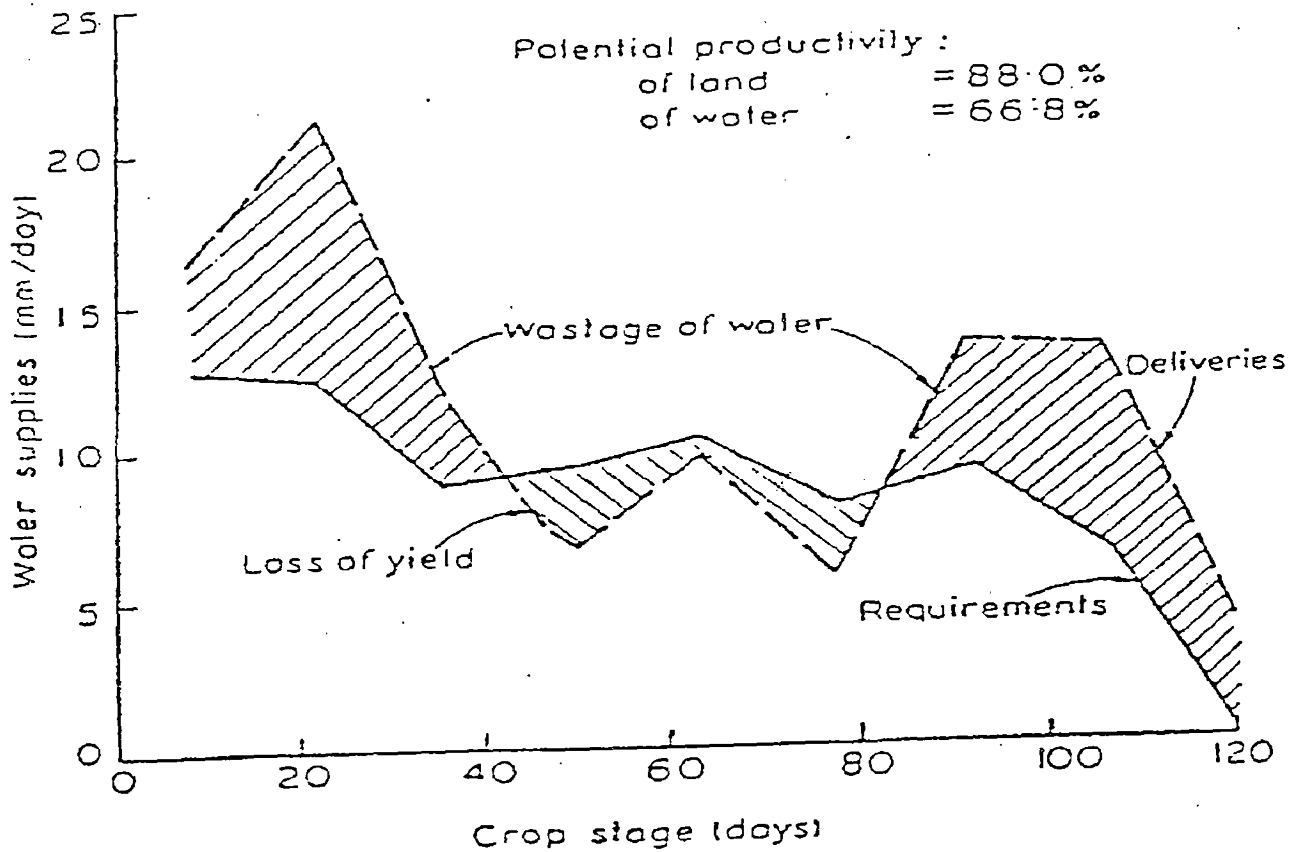


FIG. 3.2: EFFECT OF TIMELINESS OF WATER SUPPLY UPON PRODUCTIVITY OF LAND AND WATER

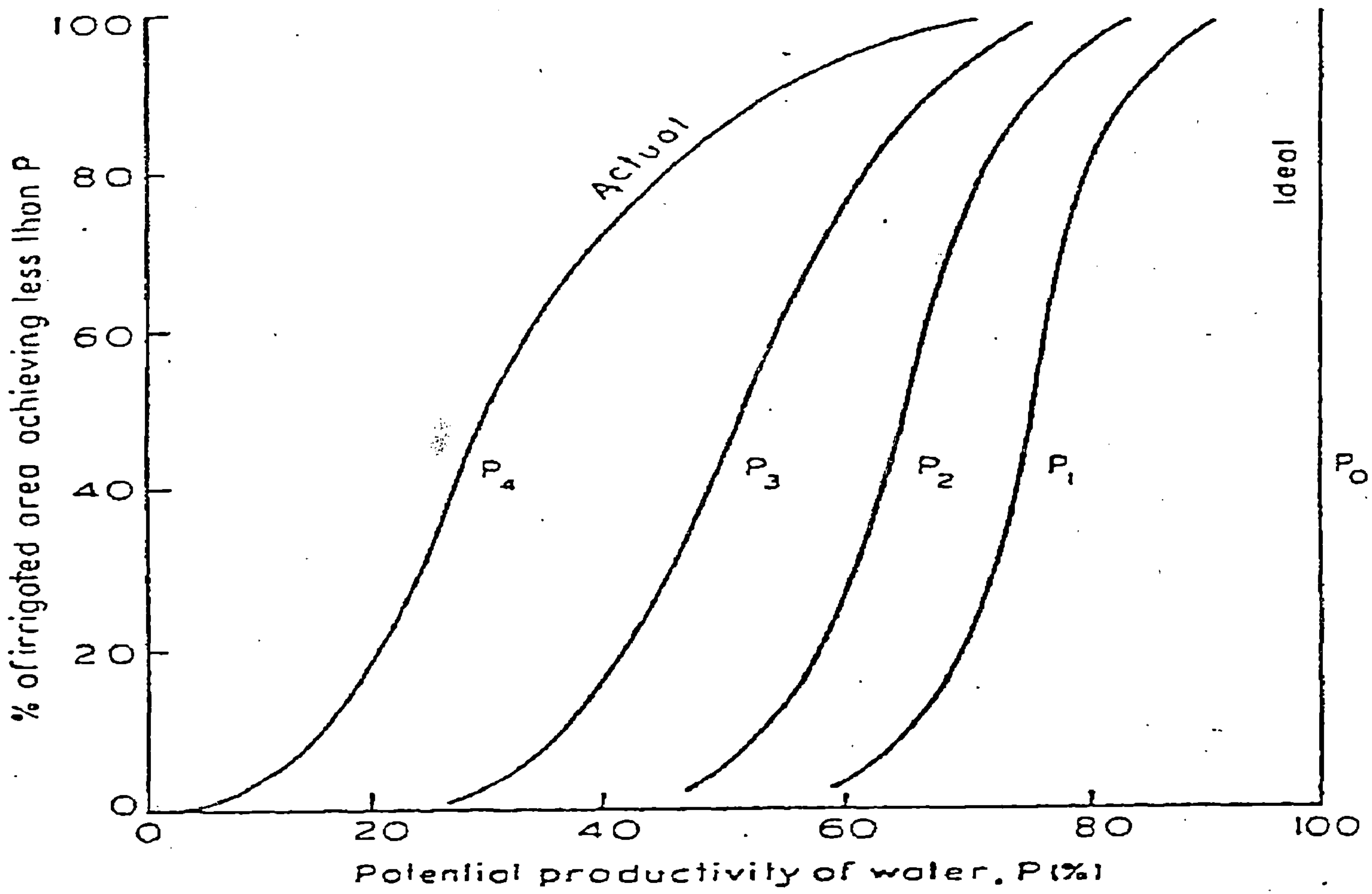


FIG. 3.3 : EFFECT OF DIFFERENT CONSTRAINTS UPON POTENTIAL PRODUCTIVEITY OF WATER

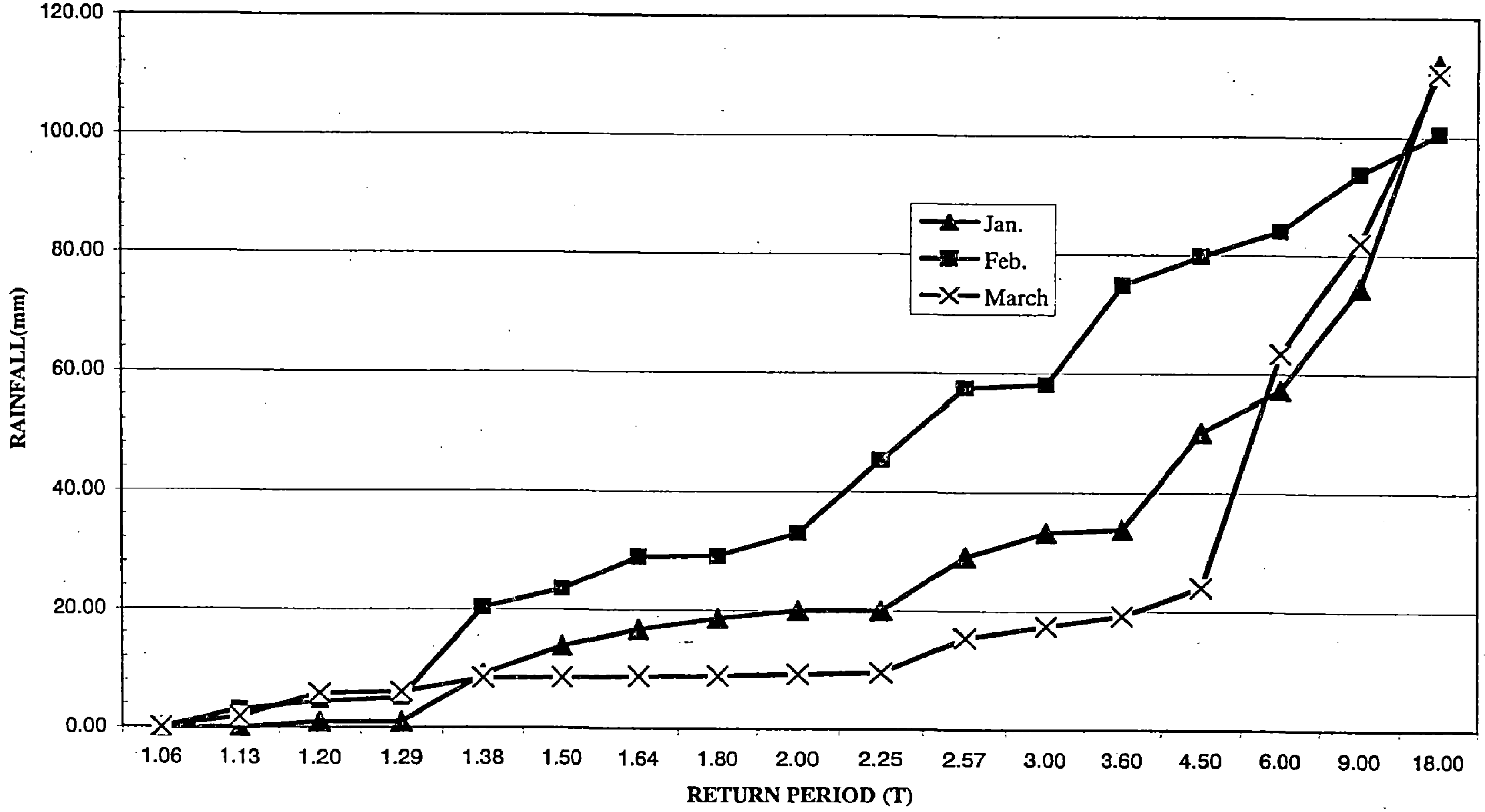


Fig.No-4.1: PROBABLE RAINFALL OF VARIOUS MONTH

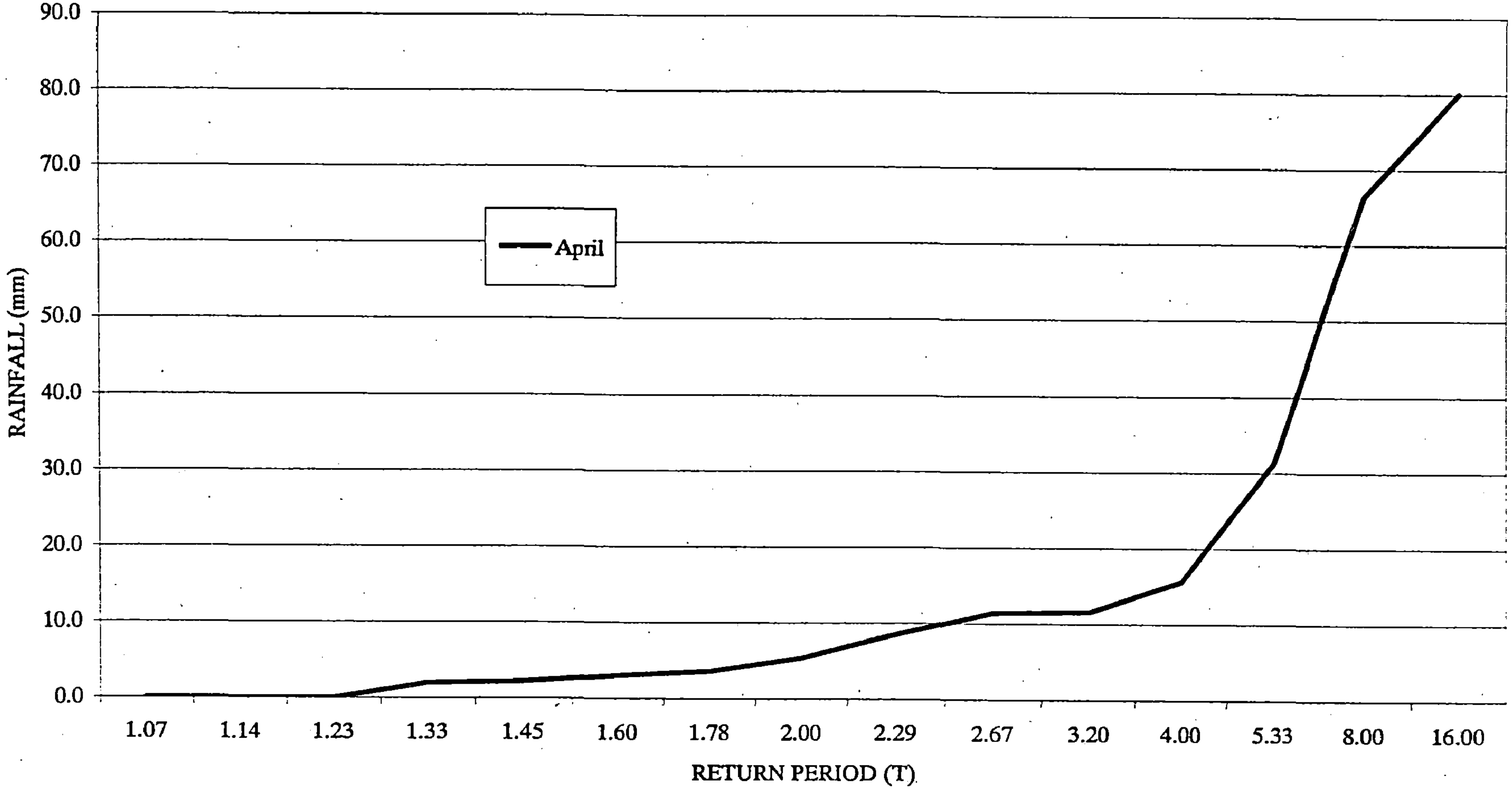


Fig. No.4.2: PROBABLE RAINFALL OF APRIL MONTHI

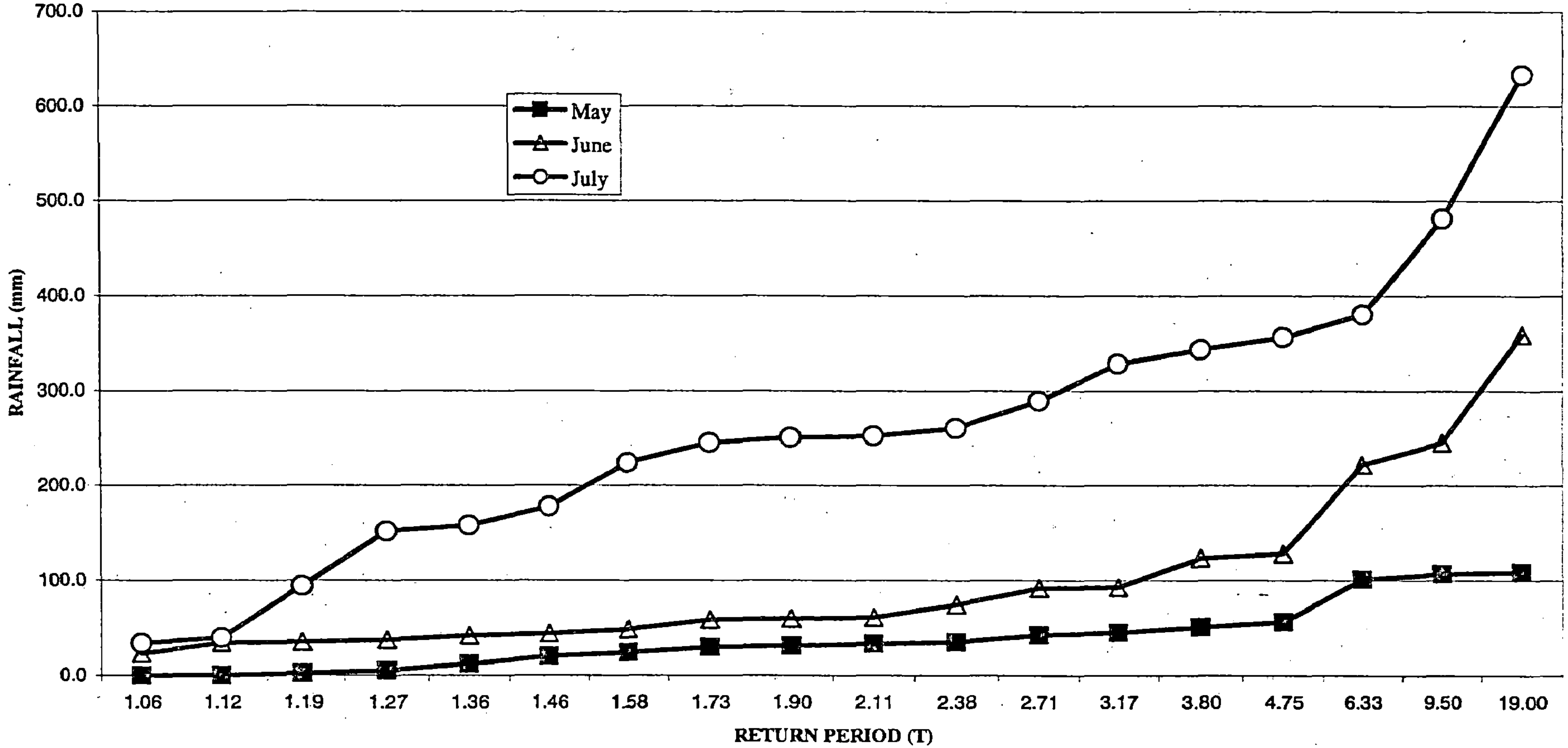


Fig. No. 4.3: PROBABLE RAINFALL OF VARIOUS MONTH

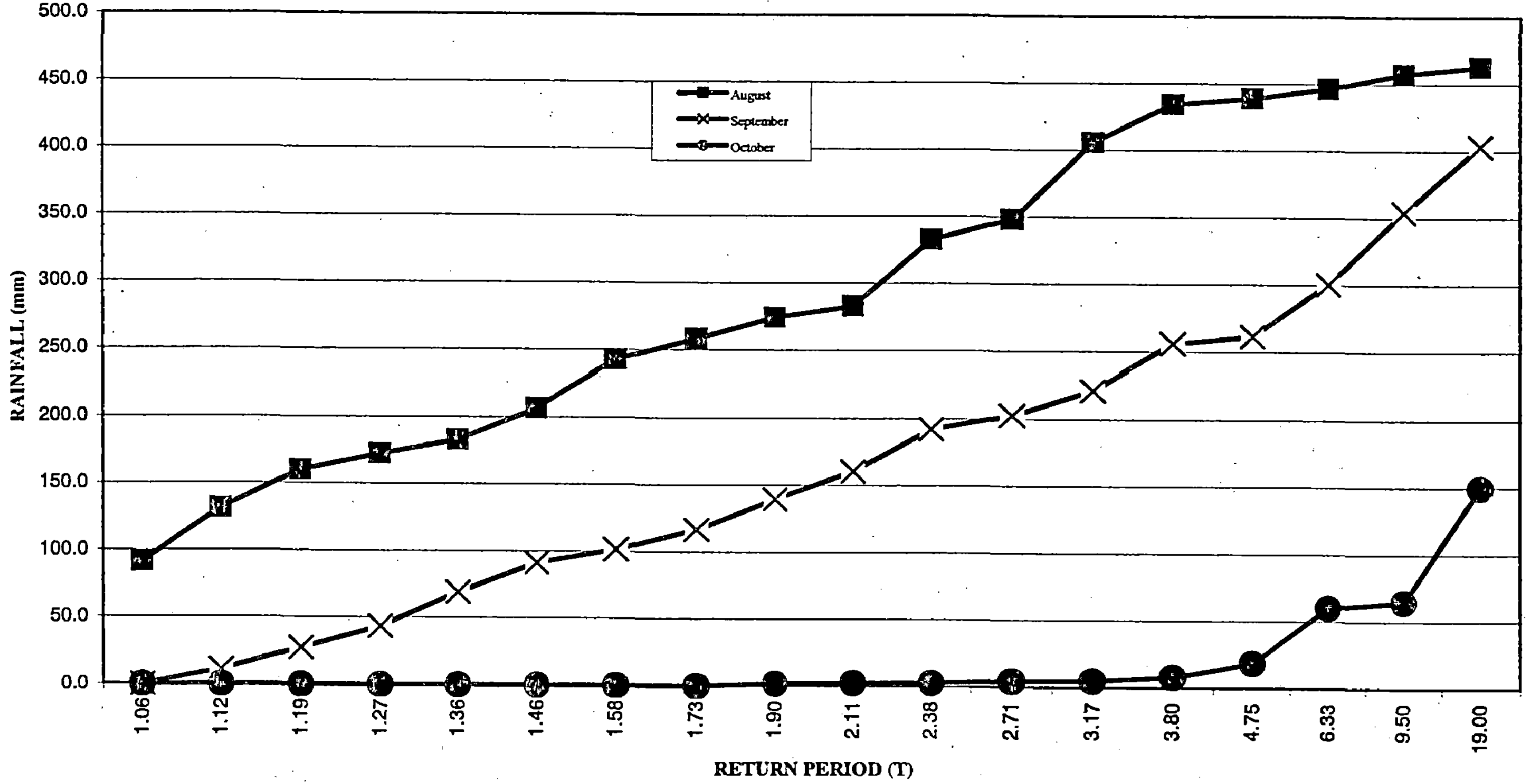


Fig. No.4.4: PROBABLE RAINFALL OF VARIOUS MONTH

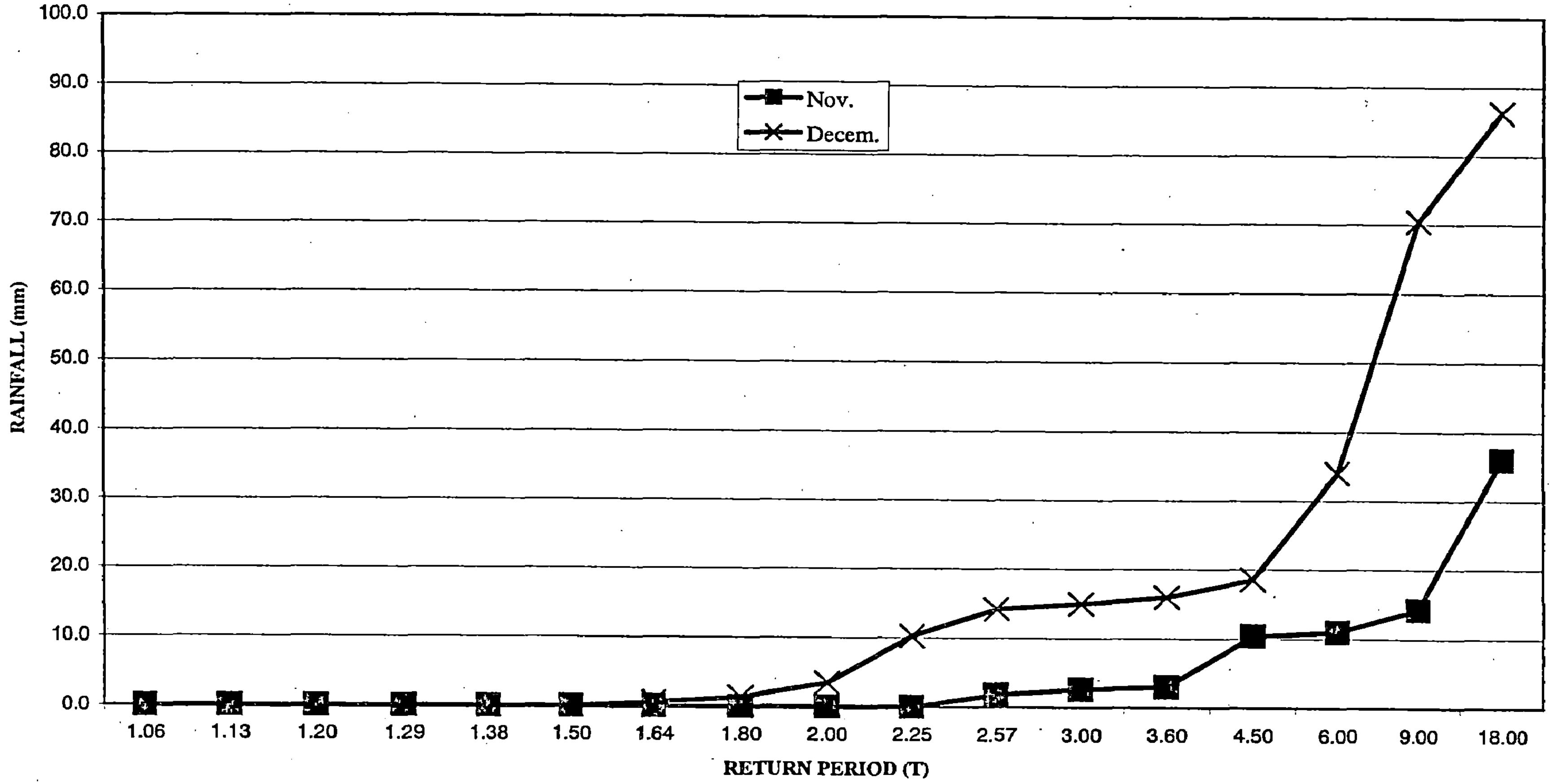


Fig. No.-4.5: PROBABLE RAINFALL OF VARIOUS MONTH

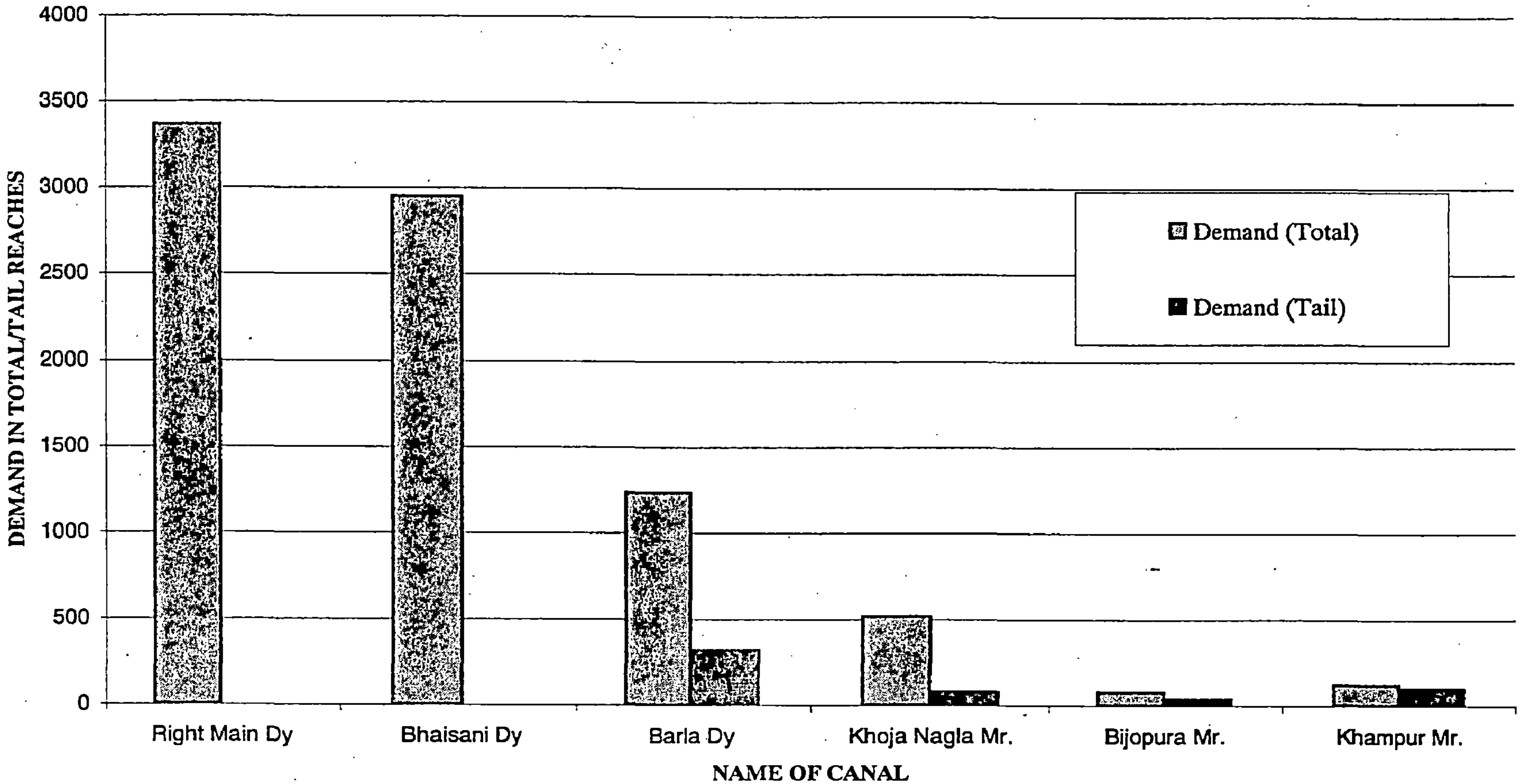


Fig.No.5.1: TOTAL DEMAND (May to October) IN Ha-m

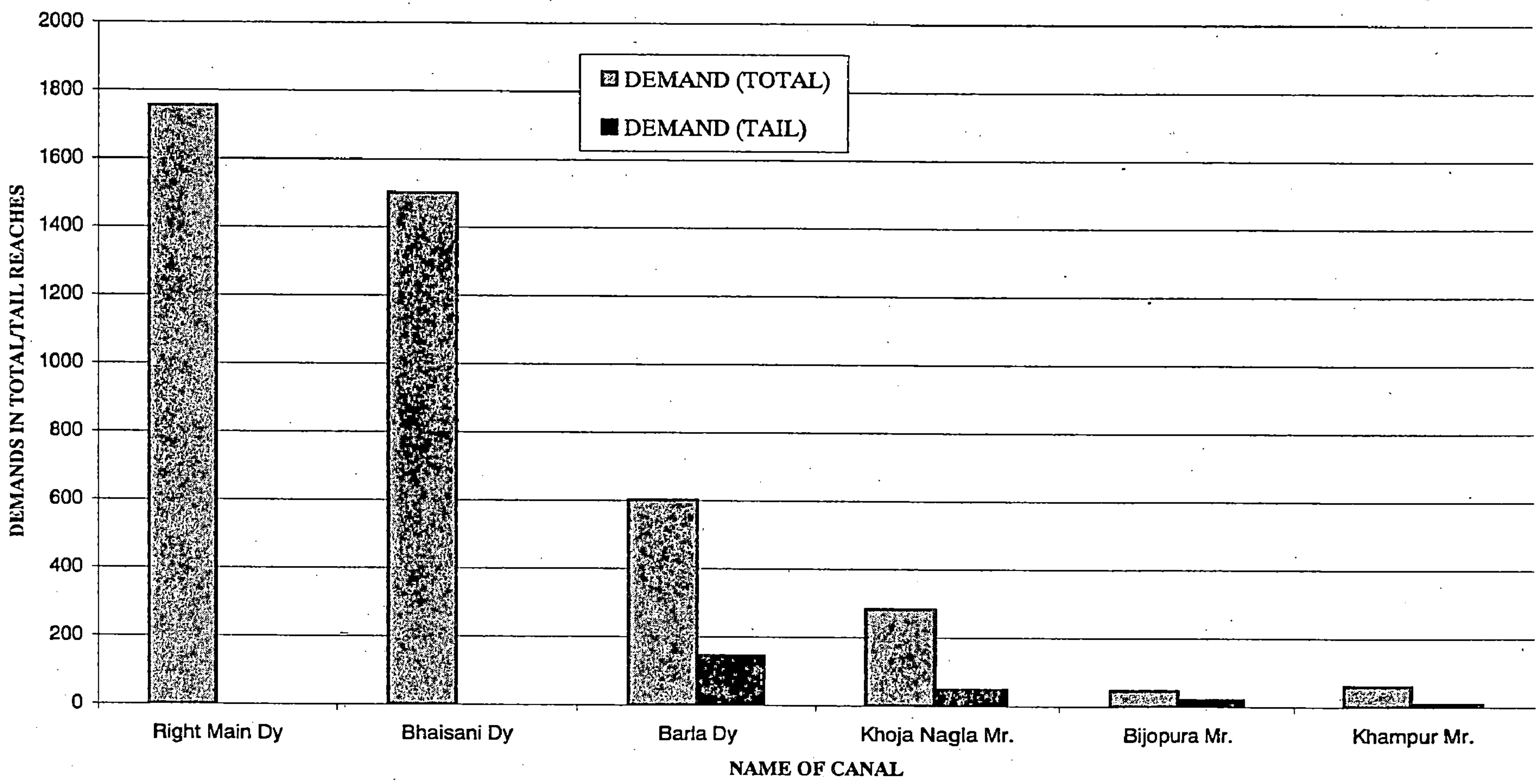


Fig. No.-5.2: TOTAL DEMAND (Nov. to April) IN Ha-m

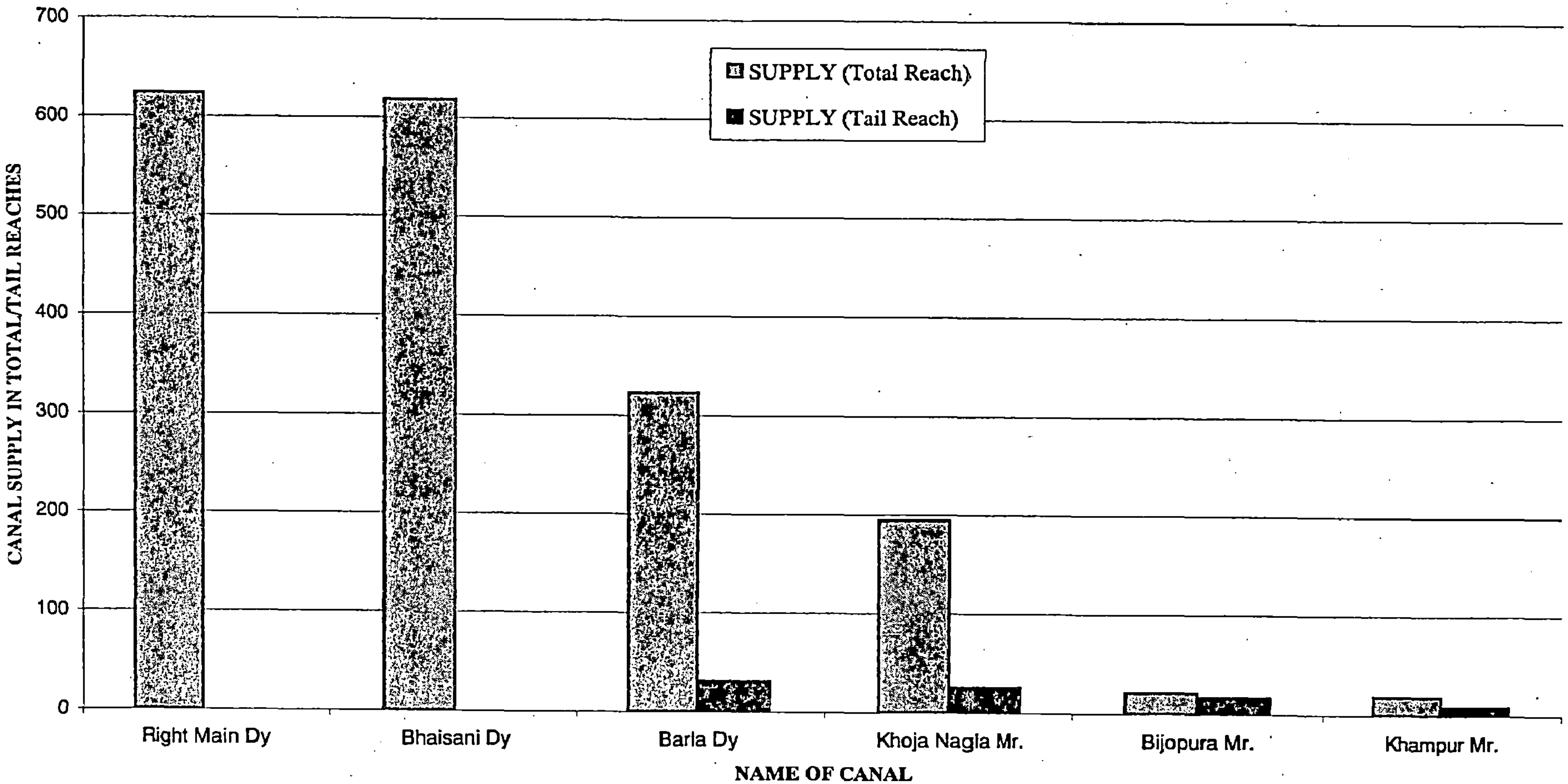
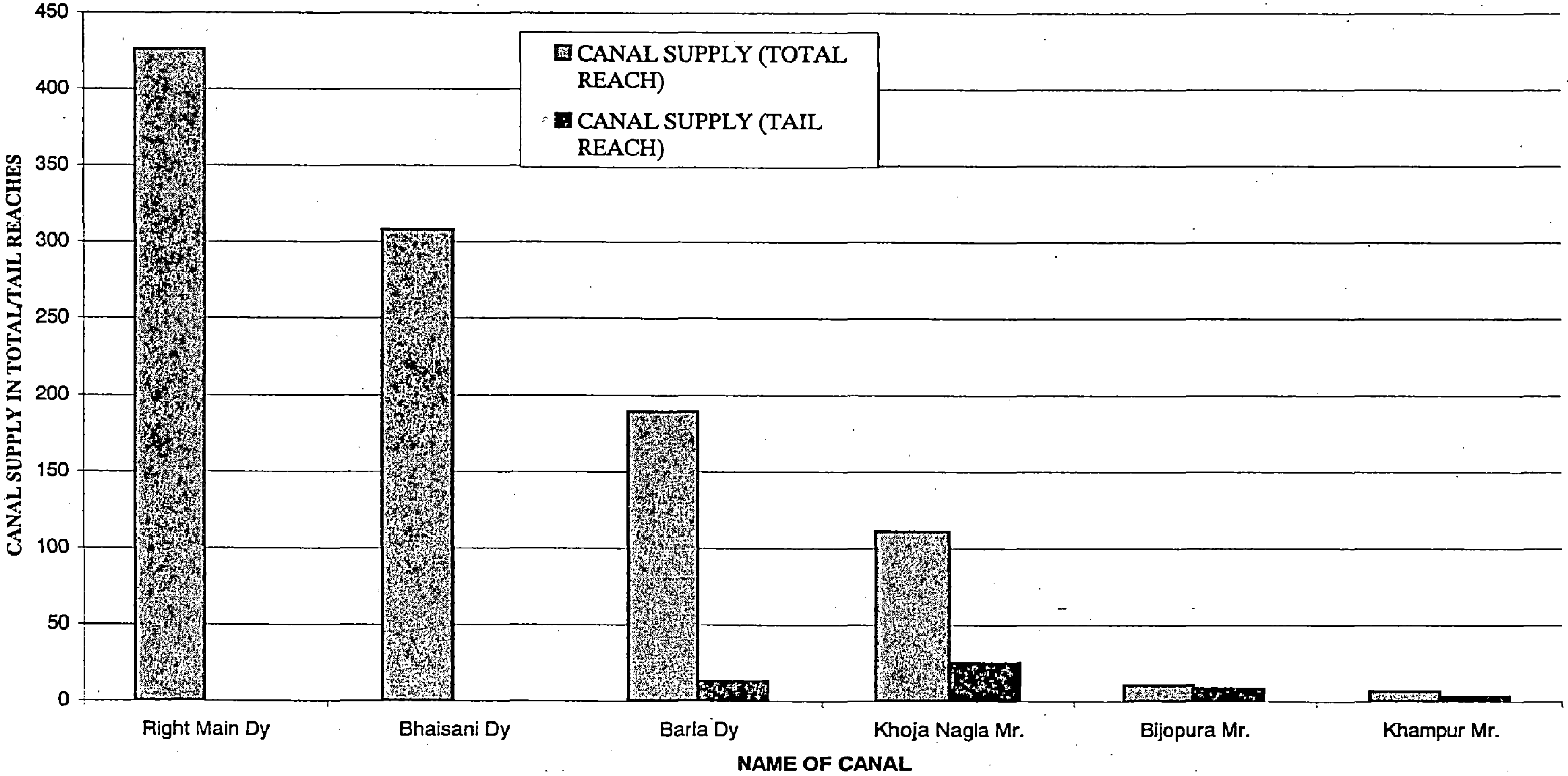


Fig. No.-5.3: CANAL SUPPLY (May to October) IN Ha-m



Gig. No.-5.4: CANAL SUPPLY (Nov. to April) IN Ha-m

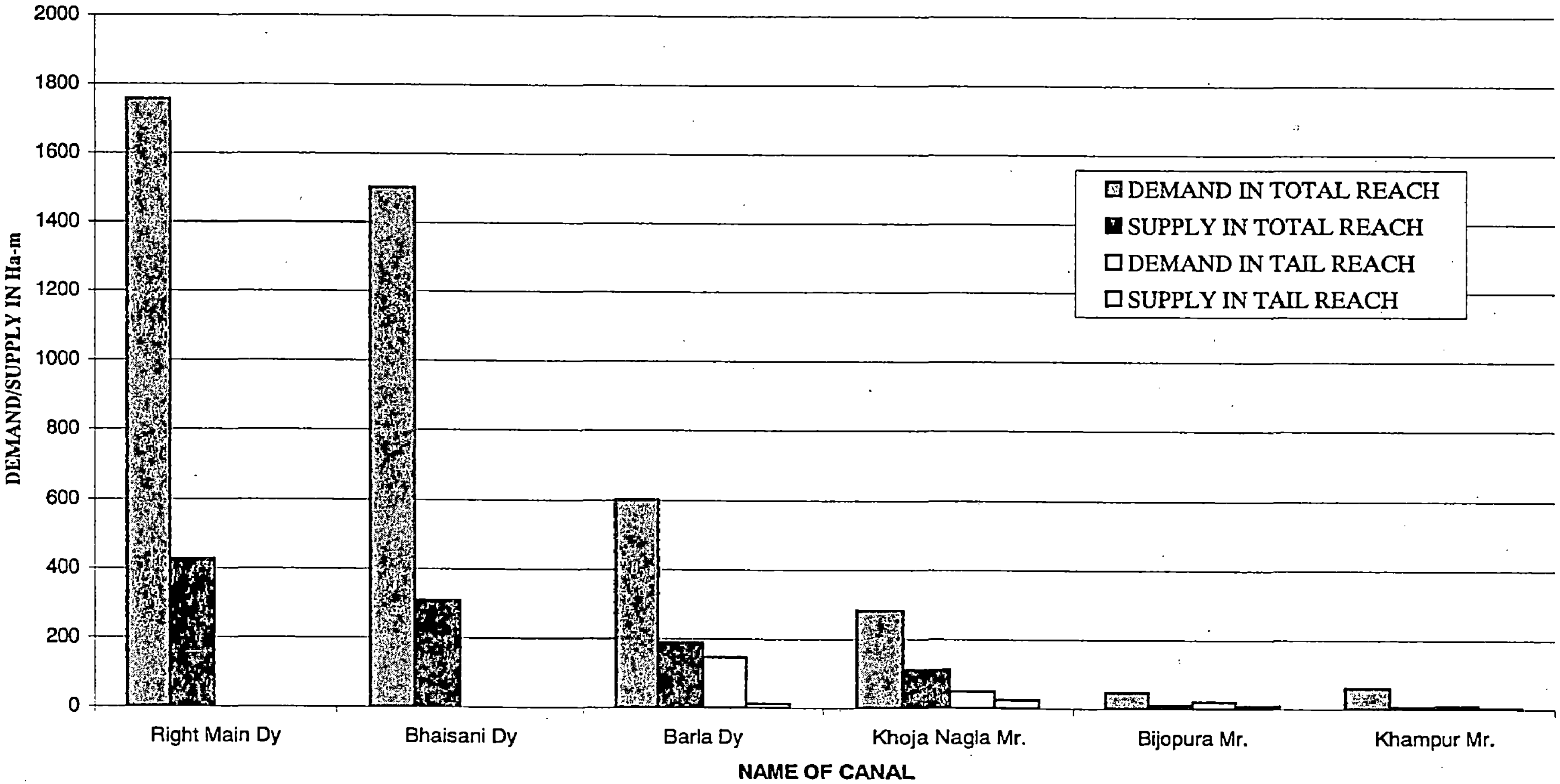


Fig. No.5.5: DEMAND AND SUPPLY IN Ha-m (Nov. to April) IN TOTAL AND TAIL REACHES

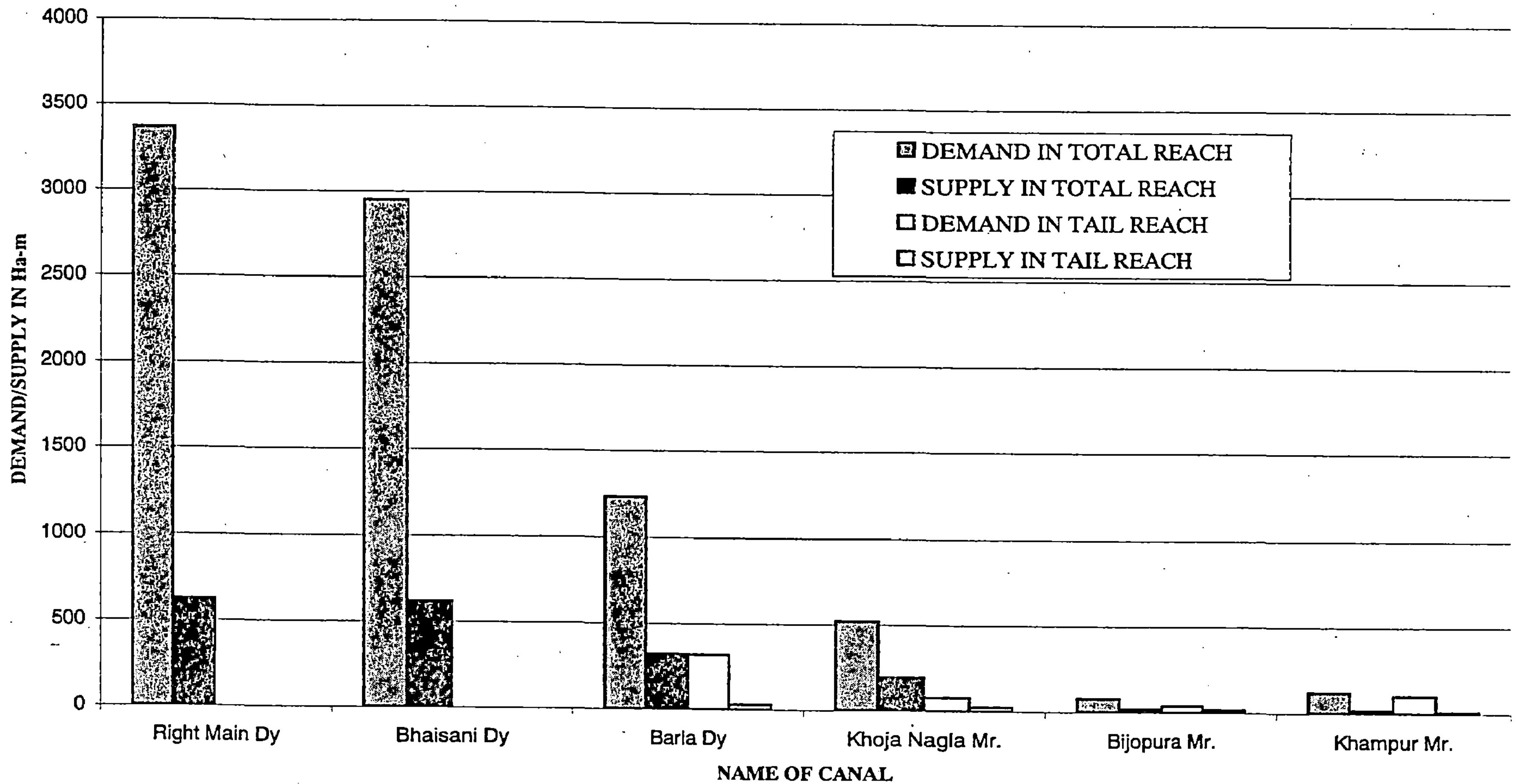


Fig. No.-5.6: DEMAND AND SUPPLY IN Ha-m (May to October) IN TOTAL AND TAIL REACHES

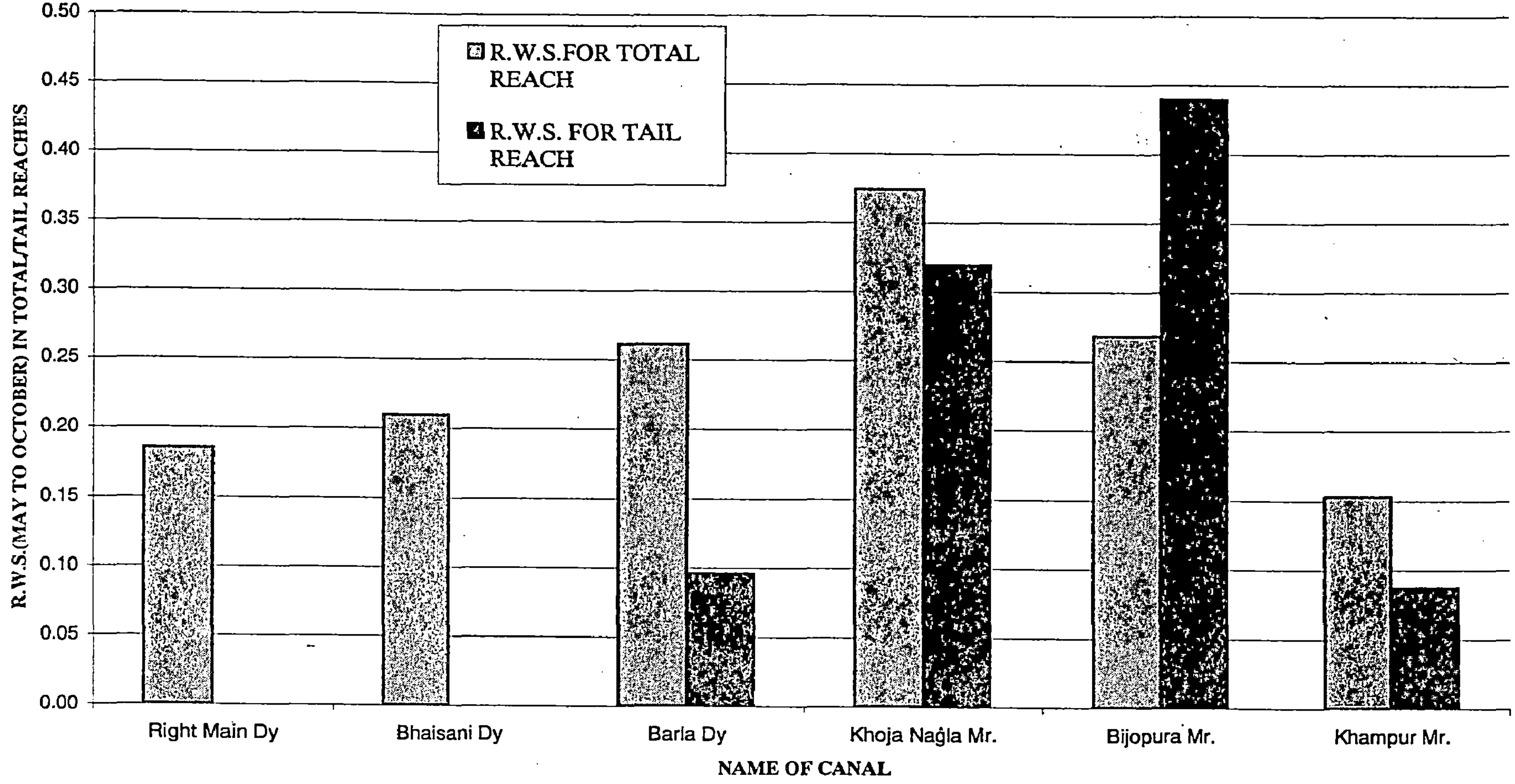


Fig.No.-5.7: RELATIVE WATER SUPPLY (KHARIF) FOR ADEQUACY

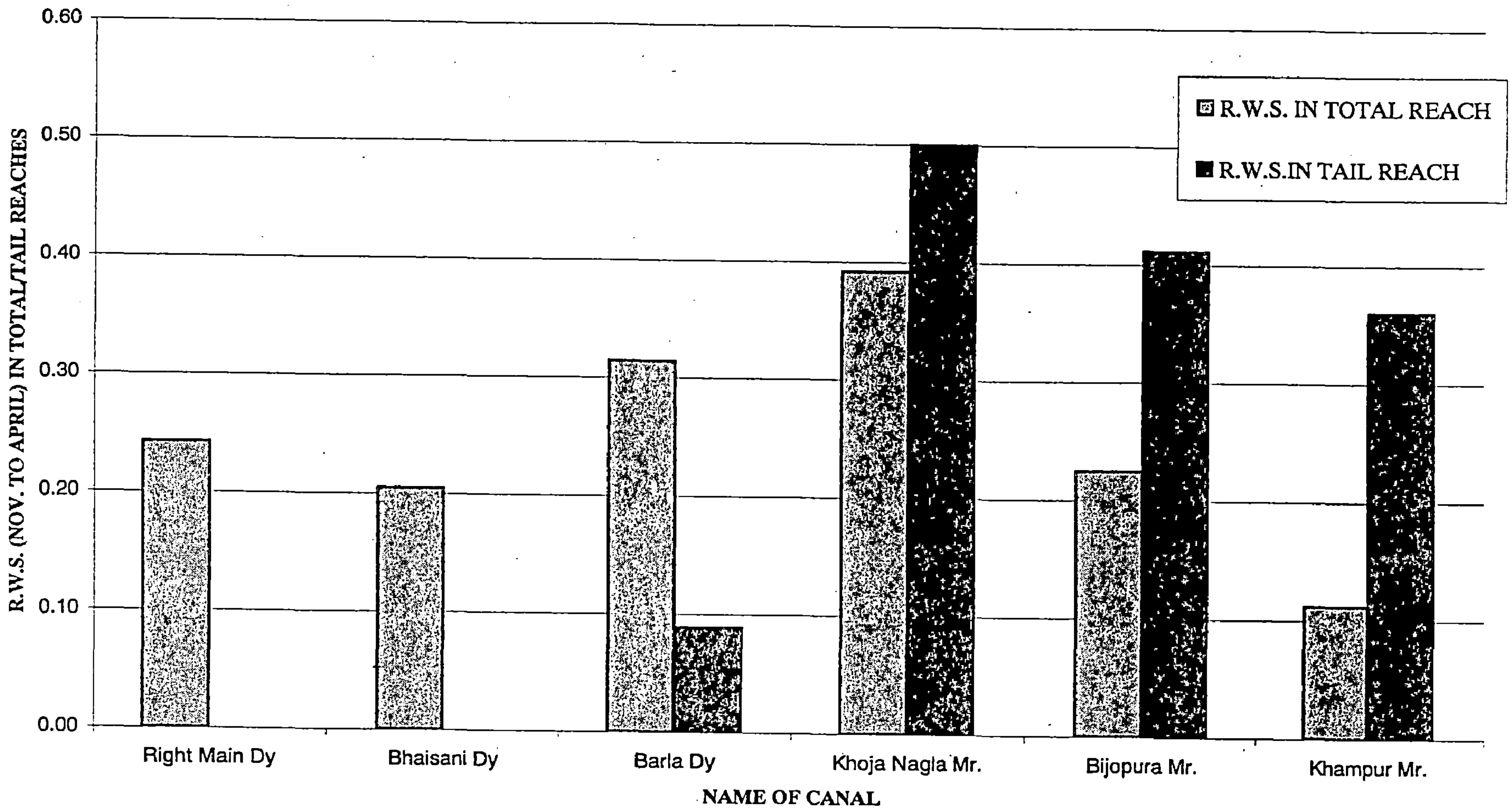


Fig. No.-5.8: RELATIVE WATER SUPPLY (RABI) FOR ADEQUACY

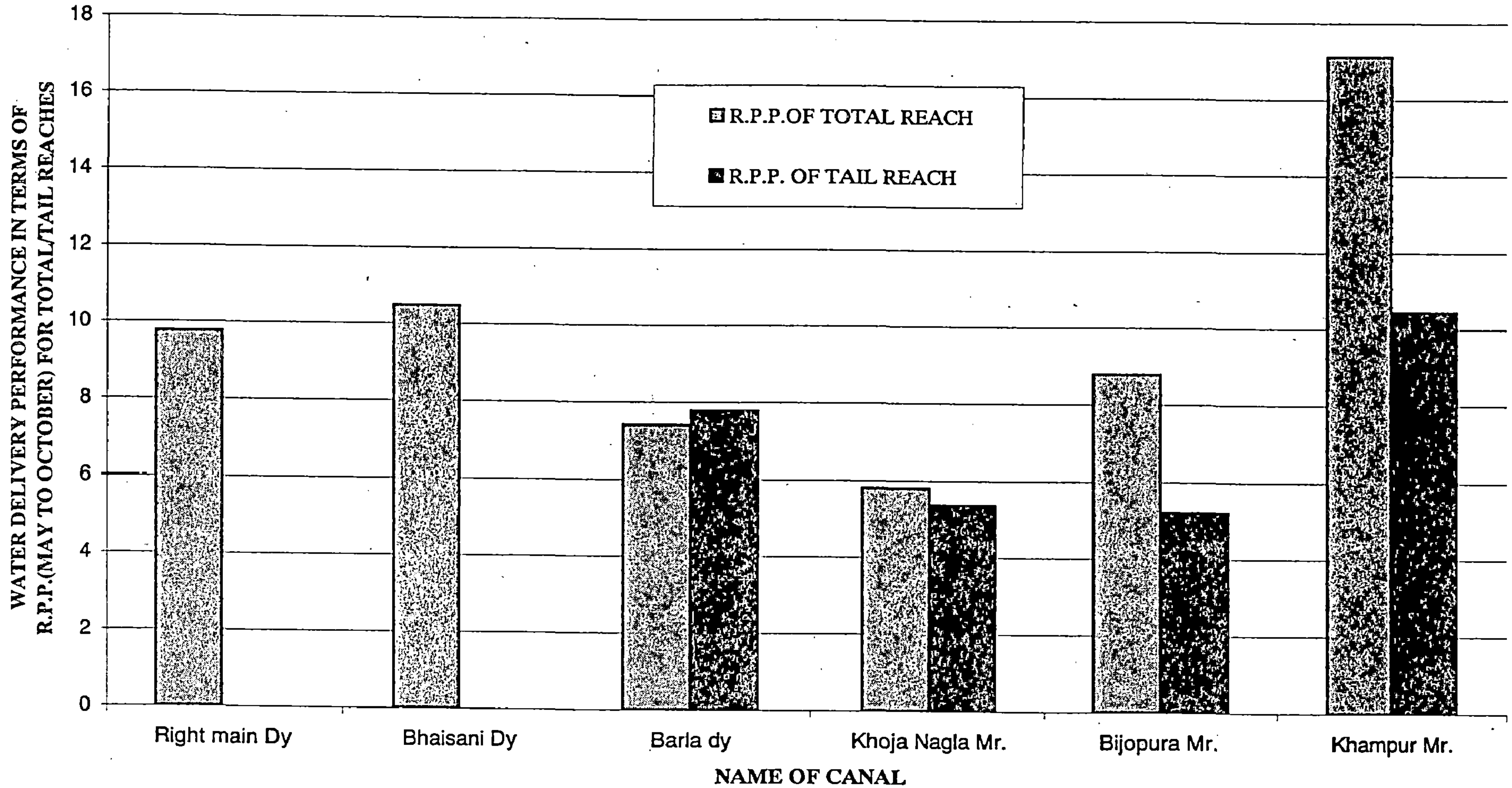


Fig. No.-5.9: WATER DELIVERY PERFORMANCE IN TERMS OF RELATIVE PRODUCTIVITY POTENTIAL FOR TIMELINESS (KHARIF)

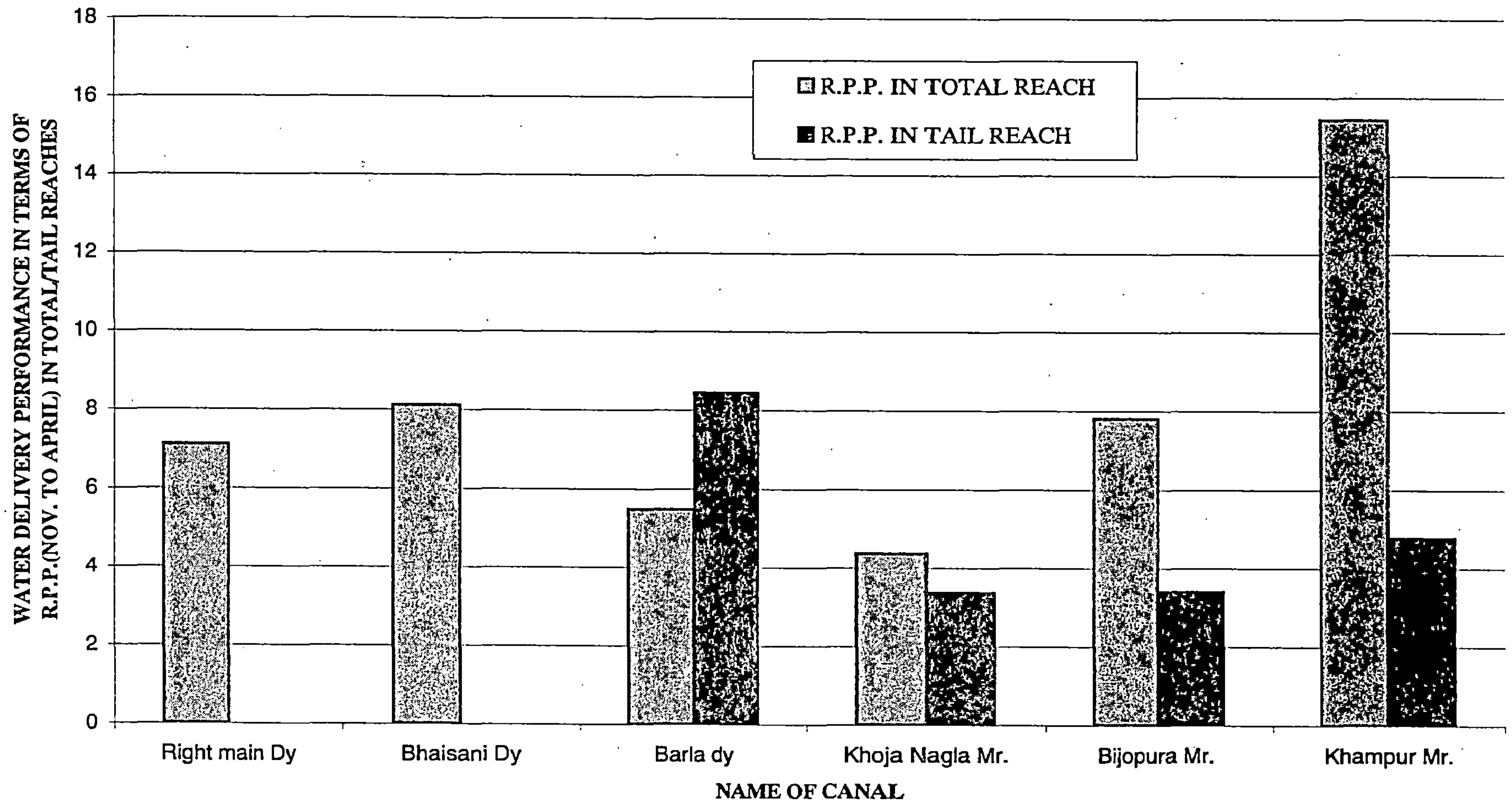


Fig.No.-5.10: WATER DELIVERY PERFORMANCE IN TERMS OF RELATIVE PRODUCTIVITY POTENTIAL FOR TIMELINESS (RABI)

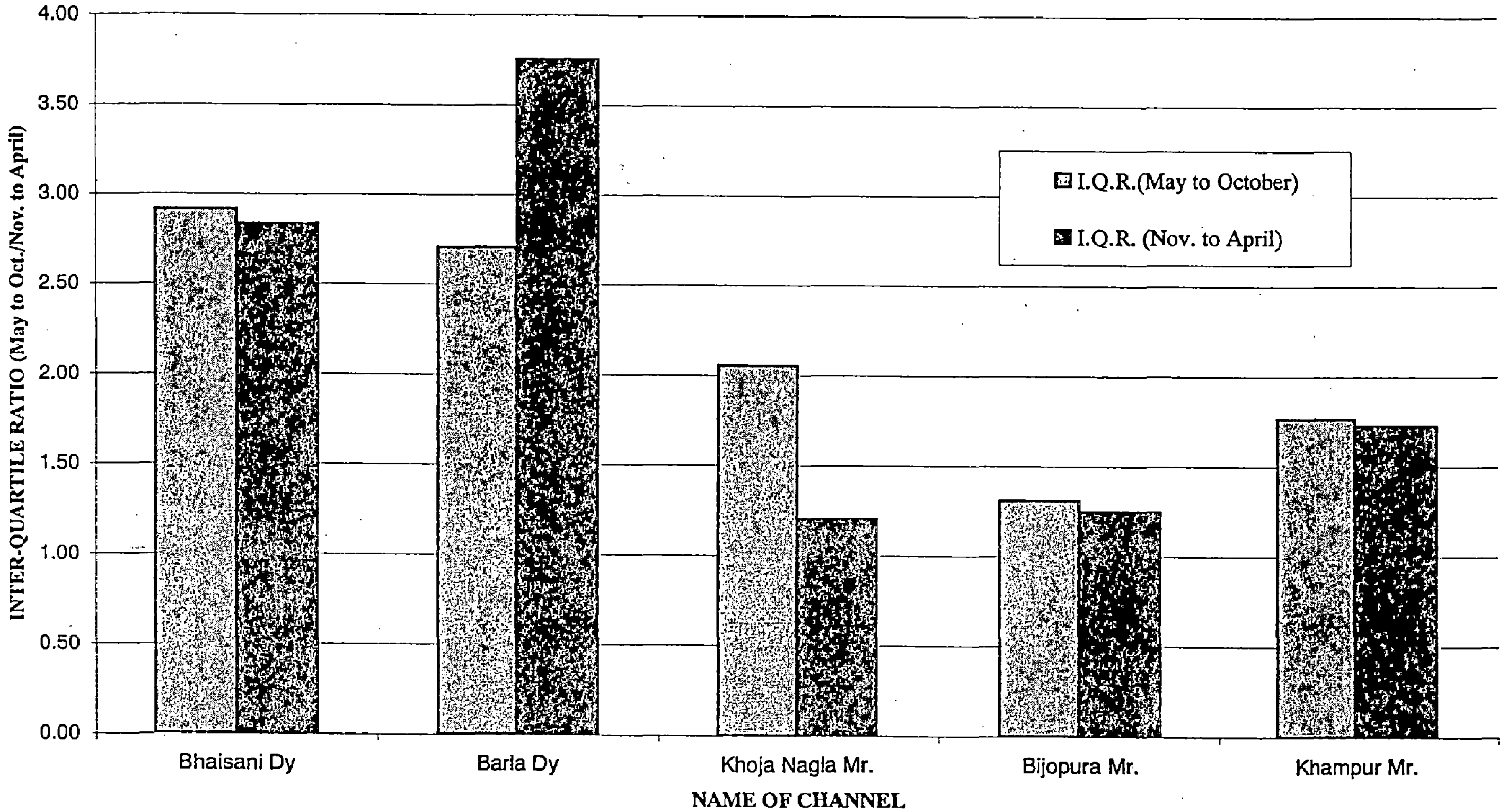


Fig. No.-5.11: INTER-QUARTILE RATIO

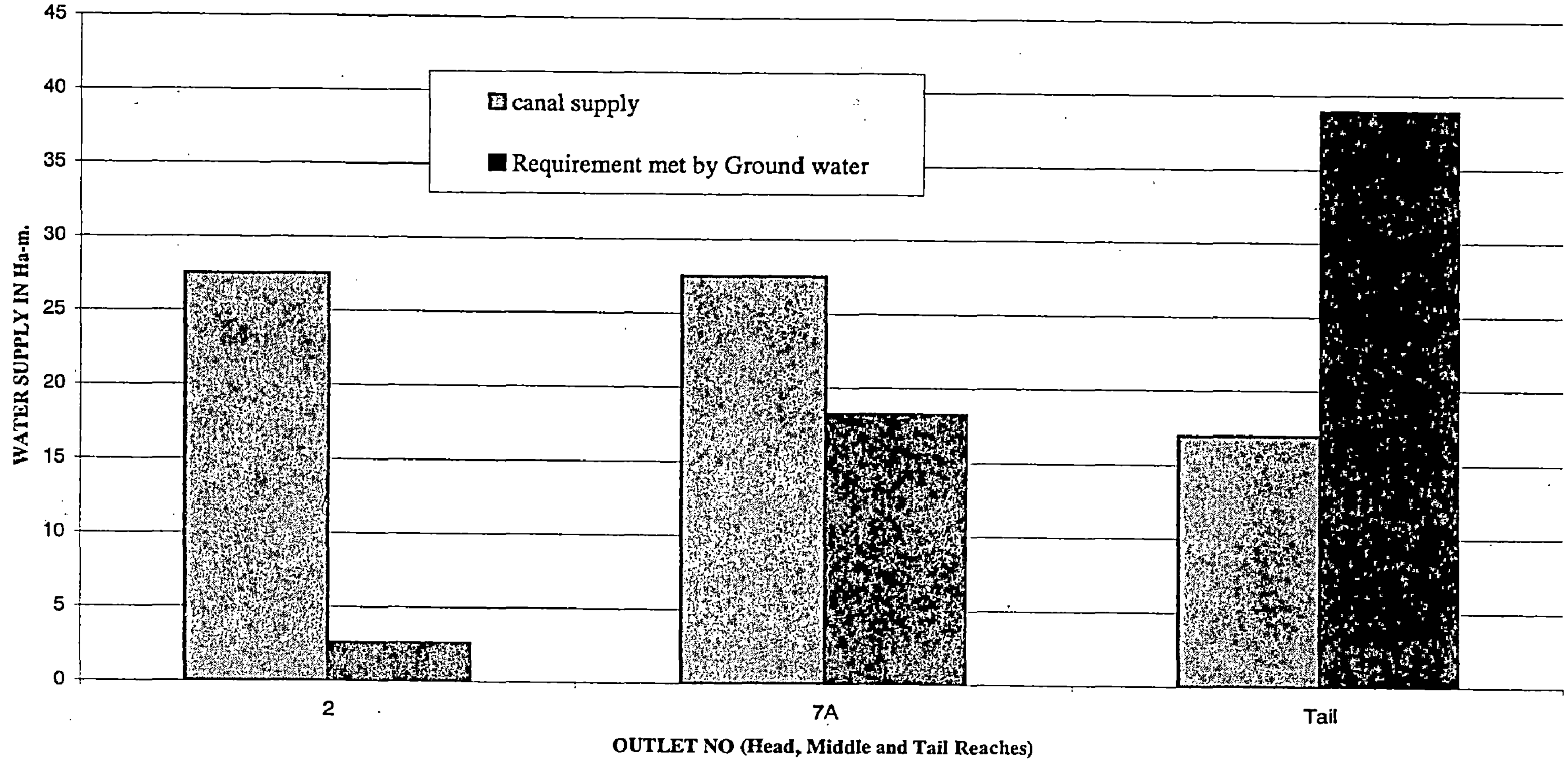


Fig. No.-12: GROUND WATER CONTRIBUTION IN COMMAND OF KHOJA NAGLA MINOR

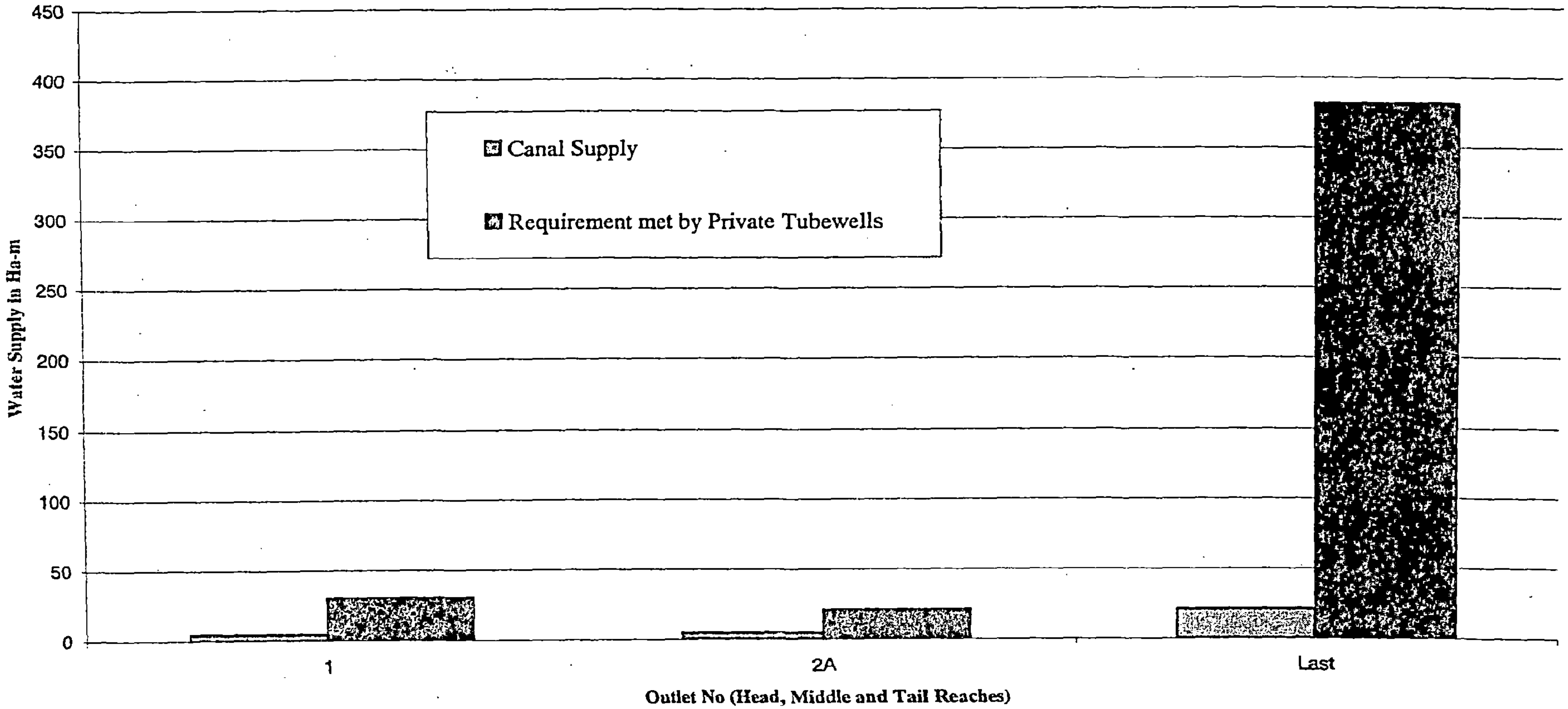


Fig. No.-13: GROUND WATER CONTRIBUTION IN COMMAND OF BIJOPURA MINOR