Hydrological Design of Jakhol Sankri Hydroelectric Project (2 X 25.5 MW)

Project Report submitted in partial fulfillment of the degree of

Bachelor of Technology
In
Civil Engineering

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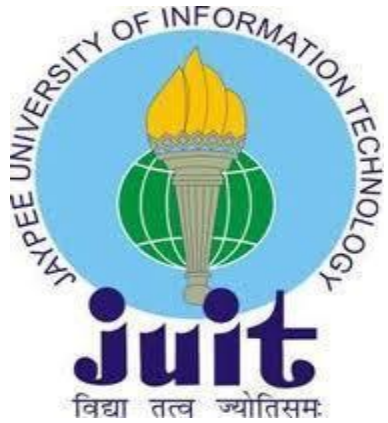

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CERTIFICATE

This is to certify that project report entitled "Hydrological Design of Jakhol Sankri Hydroelectric Project (2 X 25.5 MW)", submitted by Aman Verma (111672) and Harsh Vardhan Jain (111691) on partial fulfillment for the award of degree of Bachelor of Technology in Civil Engineering to Jaypee University of Information Technology, Waknaghat, Solan has been carried out under my supervision.

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Date: 28/05/2015

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We are sincerely grateful to Dr. Ashok Kumar Gupta, Professor and Head of Department of Civil Engineering, Jaypee University of Information Technology, Waknaghat for providing all the necessities for the successful completion of our project.

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Abstract

India’s hydropower potential is estimated at around 1, 50,000 MW, out of which only 33920.80 MW (23.34%) has been tapped so far. Uttarakhand's hydropower potential is estimated at around 20,000 plus MW, out of which only 3226.40 MW (about 17.93) has been developed and 1825MW (10.14%) is under construction so far. The Jakhol Sankri Hydroelectric Project (JSHEP) forms a part of the cascade development planned along river Supin and river Tons (after its confluence with the river Tons) in Uttarkashi district of Uttarakhand State.

The main goal of the project is to determine the maximum design flood and power potential capacity of the proposed structure and provide simple designs to some of its components. 10 daily discharge data for 33 years duration have been taken from SJVN Office, B.C.S., Shimla (H.P.) and the annexures have been worked from the above data to estimate the design flood for the barrage structure. Project report also consists of justification of plant capacity of 51 MW as well as provides some simple designs for some components of the Hydroelectric Plant.

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1. Introduction to JSHEP

1.1 Power Scenario of India

The total installed capacity in India is 223,626 MW. **Table1.1** below presents the installed power capacity in India as on April 2013.

REGION	HYDRO (MW)	THERMAL (MW)	NUCLEAR (MW)	OES (MW)	TOTAL (MW)
Northern	15,468	37,208	1,620	5,589	59,885
Western	7,447	57,993	1,840	8,987	76,267
Southern	11,353	31,085	1,320	12,252	56,010
Eastern	4,113	23,935	0	455	28,503
North-Eastern	1,242	1,390	0	253	2,885
Islands	0	70	0	6	76
TOTAL	39,623	151,681	4,780	27,542	223,626

Table 1.1 Installed Power Capacity in India

Of the total installed capacity of 223,626 MW thermal sector has biggest share of 67.82%, followed by hydro(17.72%), other energy sources (OES) which include wind energy, small hydro power, biomass and solar power (12.32%) and nuclear (2.14%).

1.2 Energy Requirement of India

Table 1.2 below gives the energy requirement, energy available and % deficit of different parts of India for the period April 2012-March 2013.

Region	Energy Requirement (MU)	Energy Available (MU)	% Deficit
Northern	300,774	273,240	9.2
Western	296,475	286,683	3.3
Southern	281,482	238,058	15.5
Eastern	107,457	102,510	4.6
North-Eastern	11,566	10,718	7.3
All-India	998,114	911,209	8.7

Table 1.2 Energy requirement, energy available and % deficit of different parts of India

Peak hour energy deficiency of India is about 9%.

India has great prospect of hydro power development. Water power era started in India over a century ago. In Darjeeling the first station was commissioned in the year 1897.In 1947 total installed capacity of India was 508 MW which has grown subsequently over the years.

Table1.3 below shows India's basin-wise water-power potential and status of capacity development in terms of installed capacity of projects over 25 MW as of 30.03.2013.

BASIN	Total Hydro-Power Potential (MW)	Hydro-power potential above 25 MW (MW)	Capacity developed MW (%)	Capacity Under construction (MW) (%)
Brahmaputra	66,065	65,400	1,988(3.04)	1,988(3.04)
Indus	33,832	33,028	11,124.3(33.68)	4,686(14.19)
Ganga	20,711	20,052	4,987.2(24.63)	1,307(6.45)
East flowing rivers	14,511	13,775	7,798.2(56.61)	455(3.30)
West flowing rivers	9,430	8,997	5,660.7(62.92)	100(1.11)
Central Indian river system	4,125	3,868	3,147.5(81.37)	400(10.34)
All India Total	148,701	145,320	34,705.8(23.88)	12,372(8.51)

Table 1.3 India's basin-wise water-power potential and status of capacity development

Different regions of India have their own average and peak load pattern as well as their own thermal/hydro mix. **Table 1.4** below shows the region-wise total hydro potential and hydro potential developed as of 30 April 2013.

Region	Estimated Potential (MW)	Actual Developed (MW)	Potential Development (MW)
Northern	53,395	15,468	29
Western	8,928	7,447	83.4
Southern	16,458	11,353	69
Eastern	10,949	4,113	37.6
North-Eastern	58,971	1,242	2.1
All-India	148,701	39,623	26.6

Table 1.4 Region-wise total hydro potential and hydro potential

1.3 SJVN – A Profile

SJVN a MINI RATNA & Schedule „A" CPSU under the Ministry of Power, Govt. of India, is a joint venture between the Govt. of India & Govt. of Himachal Pradesh. Incorporated in the year 1988, the company is emerging as a power player in the country. The present authorized capital of SJVN is 7000 crores.

Beginning with single project and single state operations (i.e. NATHPA JHAKRI which is India's largest hydroelectric power plant in Himachal Pradesh) the company is presently implementing hydroelectric projects in Himachal Pradesh, Uttrakhand and Manipur besides neighboring countries viz. Nepal and Bhutan. Recently it has taken up surveys & investigations of four hydroelectric projects in Arunachal Pradesh.

For its meritorious performances during the year 2010-11, the company's 1500 MW NathpaJhakri power station was awarded "GOLD SHIELD" by the Ministry of Power in the Category of "Performance of Hydro Power Station".

The present installed capacity of SJVN is 1500 MW. The capacity addition under various stages of implementation by the corporation is 5421 MW (412 MW- under construction, and 4829 MW under various stages of clearance).

SJVN is committed to generating reliable and eco-friendly power by State of Art Technology, excellence in engineering and continual improvement in quality management. SJVN, as an IT savvy cooperation has established and is following sound business, financial and regulatory policies. SJVN believes that employees are its most valuable assets and has evolved growth oriented Human Resource Development Strategy.

1.4 Type of Project

India's hydropower potential is estimated at around 1, 50,000 MW, out of which only 33920.80 MW (23.34%) has been tapped so far. Uttarakhand's hydropower potential is estimated at around 20,000 plus MW, out of which only 3226.40 MW (about 17.93) has been developed and 1825MW (10.14%) is under construction so far. There are presently 4 major projects with an aggregate capacity of 2220 MW in various stages of implementation. These are Vishnu Prayag (400 MW of which three units already commissioned), Lakhwar – Vyasi (420 MW), Tehri Stage – II (1000 MW), Koteshwar (400 MW). 157 major and minor sites have been identified in the state with an aggregate estimated capacity of 15,000 MW.

The Jakhol Sankri Hydroelectric Project (JSHEP) forms a part of the cascade development planned along river Supin and river Tons (after its confluence with the river Tons) in Uttarkashi district of Uttarakhand State. There are several hydropower projects under different stages of development on river Tons. These are mainly 60 MW Naitwar Mori HEP, Mori Hanol HEP and HanolTuini HEP. In addition, Tons has about 500 MW of identified hydropower projects under development. Jakhol Sankri HEP is one of the three hydropower projects awarded to Sutlej Jal Vidyut Nigam Limited (SJVNL) in the State of Uttarakhand. The other two projects are Naitwar Mori HEP on river Tons downstream of Jakhol-Sankri HEP and Devasari HEP on river Pindar, a major tributary of river Alaknanda, in district Chamoli.

The JSHEP envisages a run-of-the-river scheme on the river Supin. The project shall harness the hydropower potential between Jakhol and Sankri villages by utilizing a maximum gross head of 445.80 m.

1.5 Location of Project Area

The JSHEP is located about 450 Kms North East (NE) of Delhi and 225 Kms North (N) of state capital Dehradun and on the Supin River in Uttarkashi district in the state of Uttarakhand. The potential barrage site is located some 942 m downstream (d/s) of the confluence of Supin and Devkyar (Obra Gad) rivers at E.L. 1955.00 m. The potential

powerhouse locations are all in the left bank of river Supin near its confluence with river Tons.

1.6 Access

The project area can be reached by road from the nearest railhead at Dehradun which is 225 kms from Delhi. The National Highway – NH 72A connects Dehradun to Musoorie and further from Musoorie to Yamnotrithere is State Highway, and from Yamnotri to Naugaon, the road is classified as NH 123. Naugoan via Purolato Mori and to Sankri, is connected through a district road.

1.7 General Climatic Condition in the Project Area

The climate of the area is generally temperate; it is warm in summer, humid during monsoon and cold in the winter. In the winter season, the higher regions of the Himalayas receive precipitation as snow while moderate rainfall occurs in the foothills and adjoining plains. About 2" snow falls occurs in Jakhol region and temperature in this region falls below zero degree up to minus 2.5 degree. There is no temperature recording station within the catchment, however the temperature recorded in the nearby town varies from subzero to 35°C.

1.8 Topography, Physiography and Geology of the Project Area

The Supin River is a tributary to river Tons which is one of the main tributary of the river Yamuna and located in the north Indian State of Uttarakhand (formerly Uttaranchal). This Supin River originates from the peaks of Kimlog glacier at an altitude of approximately 5000 m and after flowing a distance of 27.60 km in the south direction joins river Devkyar/ Obra Gad. River Devkyar originates from Devkyar glacier at an altitude of 4800 m. After the confluence river Supin flows in south-western direction, meetings the Tons River near Sankri Village.

The project area is located downstream of the confluence of river Supinand Devkyar, bounded by Bhararasar Dhar(4642 m) range in the north, Chansil Dhar (4058 m) in the west, Harikidun Dhar (5050 m) in the east and Tons river in the south. The area occurs in the south of Great Himalayan ranges and encompasses the southern part of the NW-SE trending Dhaula-Dhar ranges. The topography of the area is immature i.e. it shows rugged topography

with lofty mountains, steep slopes and a number of deep gorges. The average altitude of the project area is 1700 m.

The valleys are generally of alluvial terrace deposits on either bank. The thickness of alluvial deposits varies between 10 m and 50 m. The bed consists of sand, gravel and boulders.

Gentler slopes are covered with screen material, consisting of broken pieces of rock embedded in rock powder. At some places creep is observed in overburden material where the overburden material is saturated with water and the toe of the material is eroded by river action or by human activity. The vegetation cover extends to an elevation of about EL 4000 m.

1.9 Site Selection and Justification

In India, the demand for electric energy is growing at an average annual compound growth rate of 7-8% per year. According to the report of "The Working Group on Power" for Eleventh Plan (2007-12), it is observed that there is a shortfall in energy by (% and in peak demand by 14%.

Presently, the total installed capacity in India is 1,82,689.62MW (as on 31-10-2011) but as per the data available it can be seen that average demand for this period 1-4-2011 to 30-11-2011 was 1,27,724MW against the average generation of 1.09,673MW during the same period of which is almost 14% less. For this acute power shortage, Government of India has initiated a number of steps for development of new power projects and provide power for all by year 2012. The expected requirement for year 2012 is estimated at 230,000 MW, which means that 100,000 MW capacities shall have to be added during the 11th five year Plan

The development of hydropower in Uttarakhand will not only benefit the state but also meet the power requirements of the neighboring states and northern region of the country. Uttarakhand is presently a net importer of electric power, but generates a seasonal surplus and plans to become a net exporter of power by year 2011-12 by expanding its hydropower and high voltage transmission capacity. Total capacity expansion of 10,000

Megawatts (MW) are planned by the year 2018. The development of Jakhol Sankri project is a step in the direction of achieving the above targets.

The alternative to hydropower could be a thermal power project based on one of a number of fuel types. However, the State of Uttarakhand has none of fuel commonly used for generating thermal power. On the other hand, the State has enormous hydropower potential yet to be tapped.

Moreover, owing to a faster growth of thermal power projects in the country, the national ratio of hydropower projects has dropped from about 46% in 1951 to 26% in 2005. The need for an accelerated development of hydropower project is, therefore, critical for achieving an appropriate mix of thermal and hydropower. It is obvious from the above discussion that the proposed Jakhol-Sankri HEP is needed from the power demand and supply gap scenario and is the most appropriate option when compared with a thermal alternative.

2. Hydrology

2.1 Introduction

This chapter covers the hydrological aspects of the Jakhol Sankri Hydroelectric Project (JSHEP) on river Supin, a tributary of river Tons. It describes the methodology adopted to interpret available data and arrive at long term flow data for estimating power potential and design discharge for various structures.

2.2 Review of Historical Data

2.2.1 Description of Supin River –The Supin River rises from the northern part of the Tons catchment near the Himachal Pradesh and Uttarakhand border and merges into river Tons near the mountain hamlet of Sankri. Further downstream, Tons river meets its biggest tributary, Pabar at Tiuni. The river flows along a V shaped valley. A number of settlements have come up along Tons River such as Tiuni, Naitwar and Menus. The river being snow-fed has perennial flow and some untapped power potential. The catchment area of the project on Supin along with the catchment area of Tons and Supin is shown in **Figure 4.1 & Annexure 4.1a.**

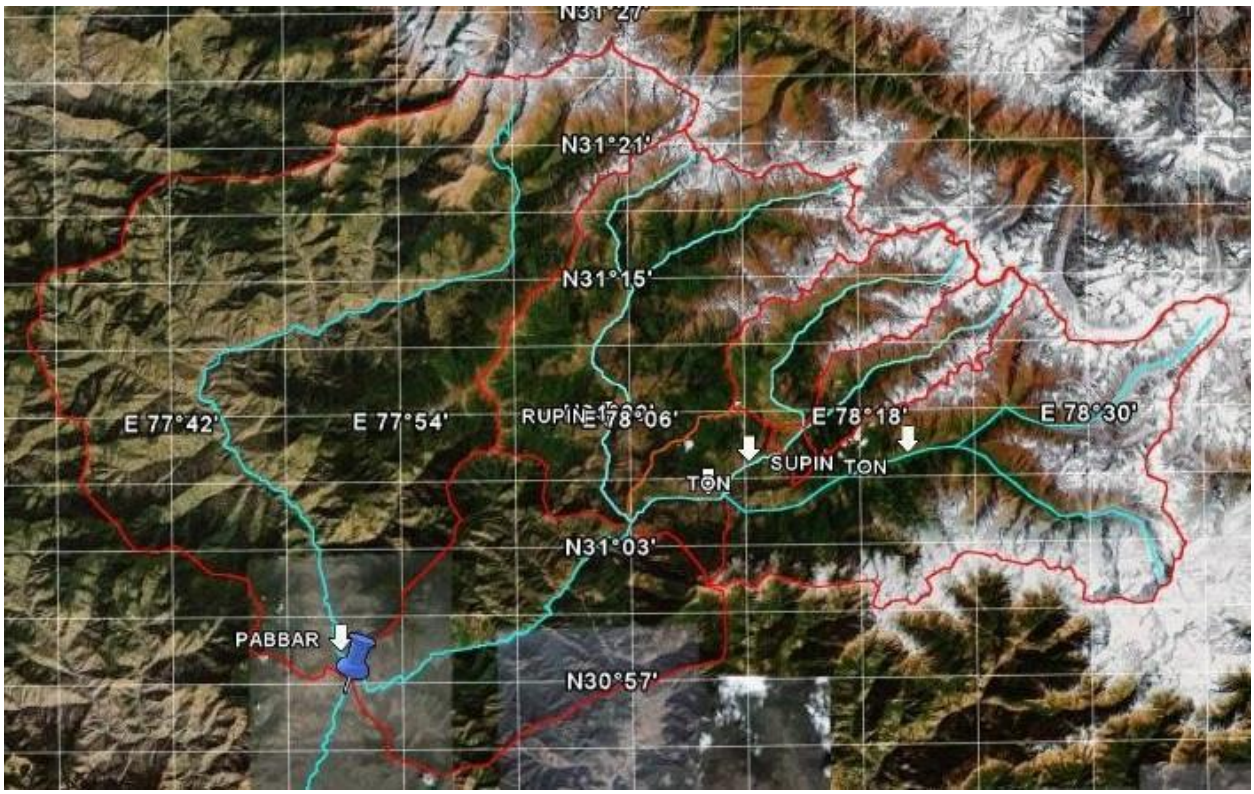


Fig 4.1 Catchment Area of Tons up to Tiuni (Source: Google Earth)

The Tons River flows through Garhwal, the western part of the Himalayan state of Uttarakhand, bordering Himachal Pradesh. With its source from Bandarpunchh Mountain at an elevation of 6320 m, it is the biggest tributary of the Yamuna, and, in fact, carries more water than the Yamuna itself. The Tons valley lies in the Jaunsar Bawar region of Garhwal.

Tons river joins Yamuna at Kalsi, approximately 48 km away from Dehradun in the North-Western part of Dehradun valley.

2.2.2 Available Information –

2.2.2.1 Catchment Area – From the available topographic maps of scale 1:50,000, the catchment area of JSHEP has been demarcated with the help of AutoCAD and is shown in

Annexure 4.1b. The entire catchment area up to Tiuni is divided into four sub catchments as shown in **Annexure 4.2.** For the individual sub catchments the parameters such as area, location of center of gravity, length of longest stream have been calculated to serve as input in preparation of unit hydrograph.

The three sub-catchment areas add up to 268.2 km2 which represents the total catchment area of JSHEP. The catchment area has also been verified using, Google Earth, a virtual Globe Program available on the internet which maps the earth by the superimposition of images obtained from satellite imagery, aerial photography and GIS over a 3D globe. The altitude in the catchment area varies from EL 5800 m to EL 1515 m. The catchment exhibits mainly three types of area viz. snow covered, fairly dense forest (mainly kail, rai, morinda, deodar, kharsu, pine and fir) and open shrubs & scattered trees. The distribution of catchment areas is approximately 14% snow bound and 86% non-snow bound area.

2.2.2.2 Rainfall Data – The daily rainfall data has been procured for thirteen rain gauge stations in Tons river basin. All these stations are maintained by Indian Meteorological Department. Nine of these stations fall in Kinnaur and Shimla districts of Himachal Pradesh and remaining four stations are in Dehradun and Uttarkashi districts of Uttarakhand. Out of the three stations falling in Uttarkashi, no rain gauge station falls within the catchment of the JSHEP. All gauging stations are located downstream of project catchment. The details of these four stations in vicinity of the project area are presented below in **Table 2.1.** Even though, any of these rain gauge stations are not located in the catchment area of the project, they can help to know the climatic conditions in and around the project area.

Station Name	District	Latitude/Longitude	Altitude	Data available for duration
Tuini Hydro	Dehradun	300 53‟ /770 55‟	1080	06/81 – 09/04
Purola	Uttarkashi	NA	NA	06/80 – 12/91
Purola Hydro	Uttarkashi	300 52‟ / 780	1250	05/82 – 09/05
Naitwar Hydro	Uttarkashi	310 06‟/ 780 12‟	1400	05/82 – 09/05

Table 2.1: Rain gauge Stations near JSHEP Area

Daily rainfall data at Naitwar station are available for a period of 1982 –2005 except for 1989 and 1990. Even for remaining years, data for several days are missing. However, available data length covers monsoon months of most of the years. In view of the fact that the rainfall data will be used for determining high flood values generally occurring during monsoon months, this data can be considered adequate for its intended purpose. The data have been used for determination of the inflow design flood of Jakhol Sankri HEP.

The daily rainfall data of these above four stations were taken for some preliminary analysis. Summary of the analysis is presented in **Figure 2.2**and **Table 2.2** and also in **Annexure 4.3a to 4.3f.**

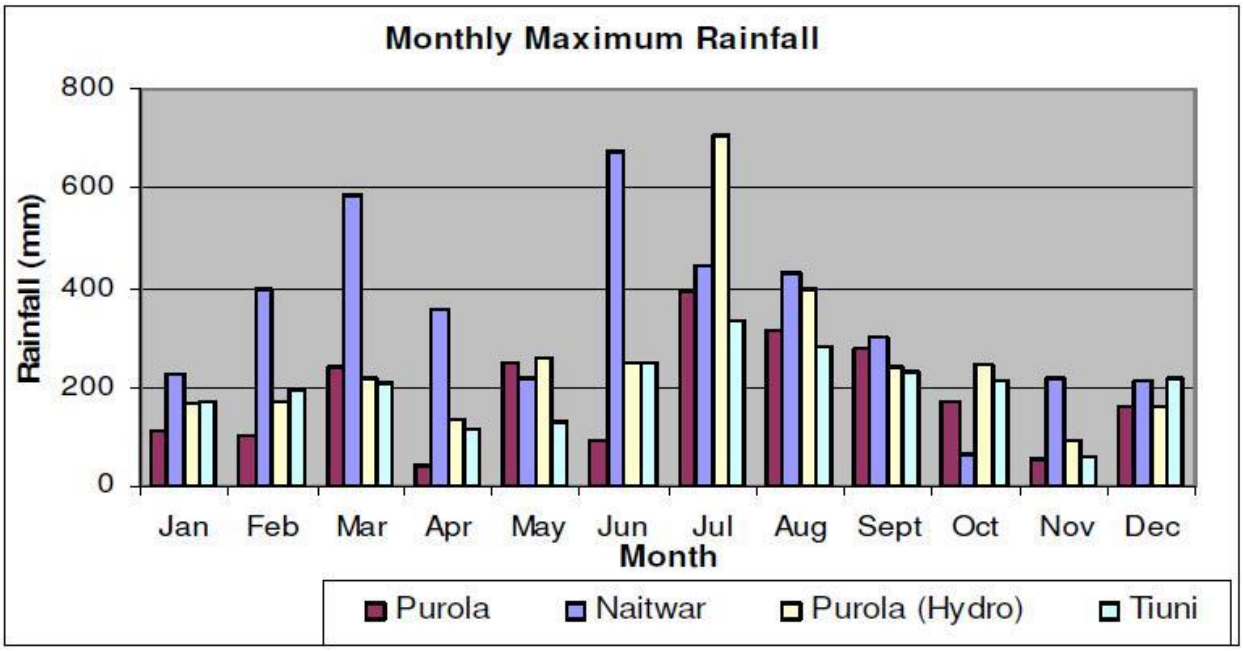


Figure 2.2 Monthly Maximum Rainfalls

Rainfall Statistics (in mm)	Rain gauge Stations			
	Tiuni Hydro	Purola	Purola Hydro	Naitwar Hydro
Average annual (mm)	799.5	1003.3	1118.6	1016.5
Maximum annual (mm)	1170.2	1368.6	1476	1909.4
Minimum annual (mm)	415.4	508.0	491.2	250
Max observed daily (mm)	121.8	125	127	210
Date of occurrence of extreme event	27th June, 2001	28th Aug, 1989	17th Oct, 1998	10th Feb, 1986

Table 2.2: Analysis of Rainfall Data of four RG Stations

Review of the maximum observed daily rainfall values reveals that the highest observed one day rainfall in three of the stations are quite comparable. However, the corresponding value for Naitwar station seems exceptionally high, more so in view of the fact that it happened in the month of February. In fact, this is the largest observed rainfall in all of these four stations. Cross checking this data with recorded rainfall values for the same day (February 10, 1986) in other three stations also pointed to some possible discrepancy in the data. Further, considering the event (of an extremely heavy rainfall) as a local one, it was investigated how this event, if occurred at all, is reflected in runoff data. The flow figure at Tiuni for the 1st ten daily interval of February 1986 matches quite well with the other two flow figures of the month and hence does not support occurrence of such an extreme event. Therefore, there is a high possibility that this data value is erroneous and hence has not been considered for any further analysis.

2.2.2.3 Gauge and Discharge Data – Central Water Commission has been carrying out discharge observation at Tiuni Gauge-Discharge (G-D) station on river Tons and at Tiuni, Sawra, Mandly and Rohru on river Pabar. These stations are near the confluence of Pabar and Tons and located downstream of JSHEP. The G-D site at Tuini on Tons is the nearest downstream site for which observed daily discharge data are available for a long period. However, the daily discharge data of combined Tons & Pabar d/s of confluence and discharge data of Pabar at Tiuni just before the confluence, only for monsoon months (July, August, September and October) for the period 1980 to 2007 and from Jan 2008 to Jun 2010 have been obtained from CWC. The same is presented **in Annexure 4.4a and 4.4b.** The 10-daily discharge data for combined Tons and Pabar at Tiuni G&D site and the 10-daily

discharge data for Pabar upstream of confluence of Tons and Pabar are presented in **Annexure 4.5a and 4.5b**. 10- Daily discharge data for Tons upstream of confluence of Tons and Pabar (**Annexure 4.6**) have been obtained by subtracting Pabar discharge from discharge of Tons at Tiuni. These data are available for the period Jun 1977 to Jun 2010.

Figure 2.3 Gauge & Discharge site on Supin

There was no gauging site at the project catchment for which a long term daily discharge data is available. SJVNL has established a gauge & discharge station at the project site in February 2006. Discharge measurement is being done by area velocity method. **Figure 2.3** shows the only gauging site in the whole of the catchment of JSHEP. The observed daily discharge data at this site is available from March 2006 to March 2011. These data are presented in **Annexure 4.7.**

Primary or observed discharge data for Jakhol diversion site is now available for a period of five years. This data length is not adequate for considering it as long term flow series as it cannot be considered as representative of the hydrological regime of the river at the diversion site. Therefore, deriving a long term flow series based on correlation between this observed series and that at Tiuni will be inappropriate. In view of this, daily discharge data at Jakhol diversion site has not been considered for hydrologic analysis. The 10- daily flow series for the period 1977-2010 at Tiuni has been transferred to JSHEP site by catchment area proportionality. Given the available hydrologic information and also considering the fact that

these two catchments are similar in terms of most of the catchment characteristics (project catchment is a sub catchment of the bigger catchment of Tons at Tuini G&D site), this approach can be considered suitable.

However, the observed daily discharge of Supin was utilized for checking consistency of the derived long term flow series. The observed long term average 10-day flow values, when plotted against the derived long term average 10-day values, showed reasonable level of consistency with a R2 value of 0.96 (Refer **Figure 2.4**). The value of R2 separately for monsoon (June to October) and non-monsoon discharge are 0.94 and 0.87.
The derived daily discharge for JSHEP is shown in **Annexure 4.8a** (calendar year) and **4.8b** (Hydrological year).

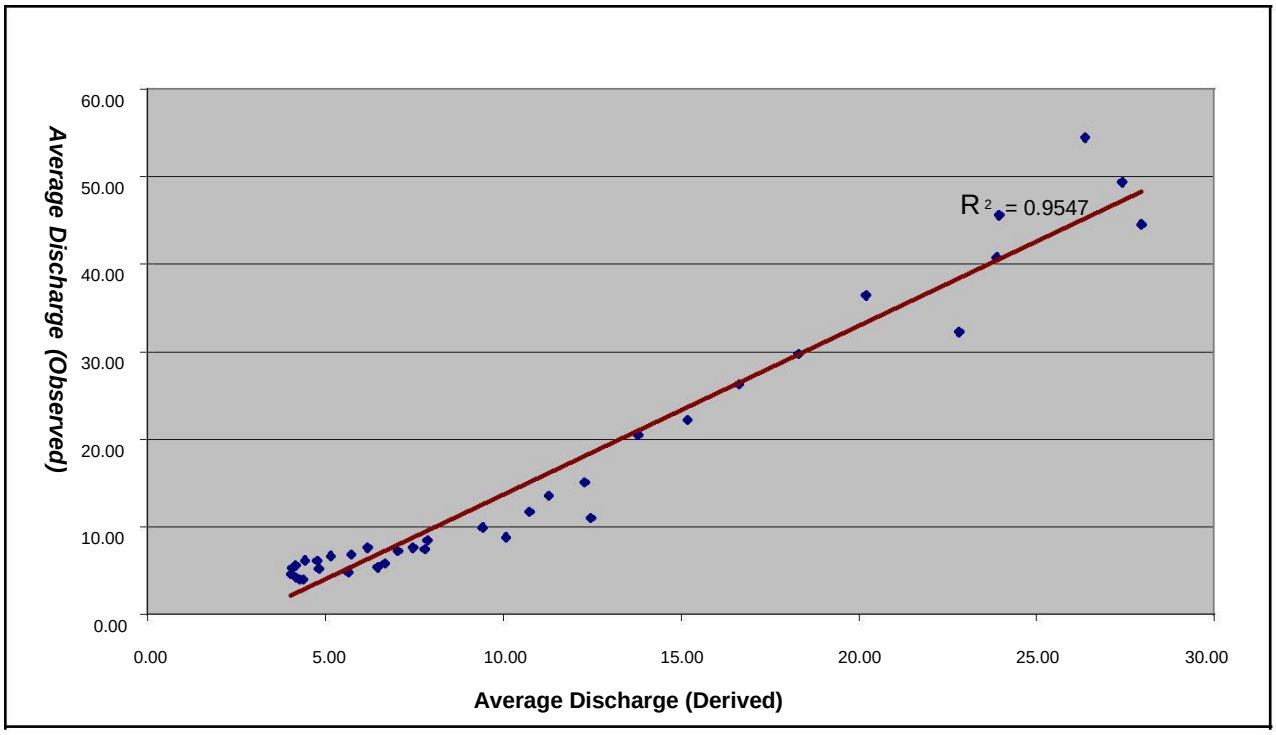


Fig 2.4: Supin Discharge - Observed vs. Derived

2.2.2.4 Sediment Data – The sediment data at Jakhol site is available from July 2006 to Mar 2011. Some preliminary analysis was carried out with this data. Summary of this analysis in terms of variation of sediment load during monsoon months and its particle size distribution is presented in **Figure 2.5a and 2.5b**.

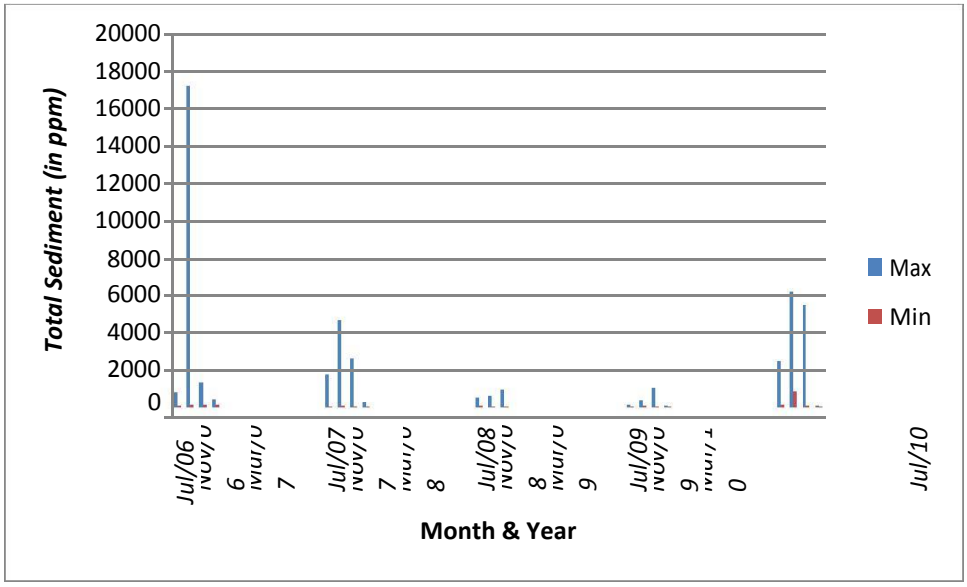


Fig 2.5a: Total Sediment Load during Monsoon Months

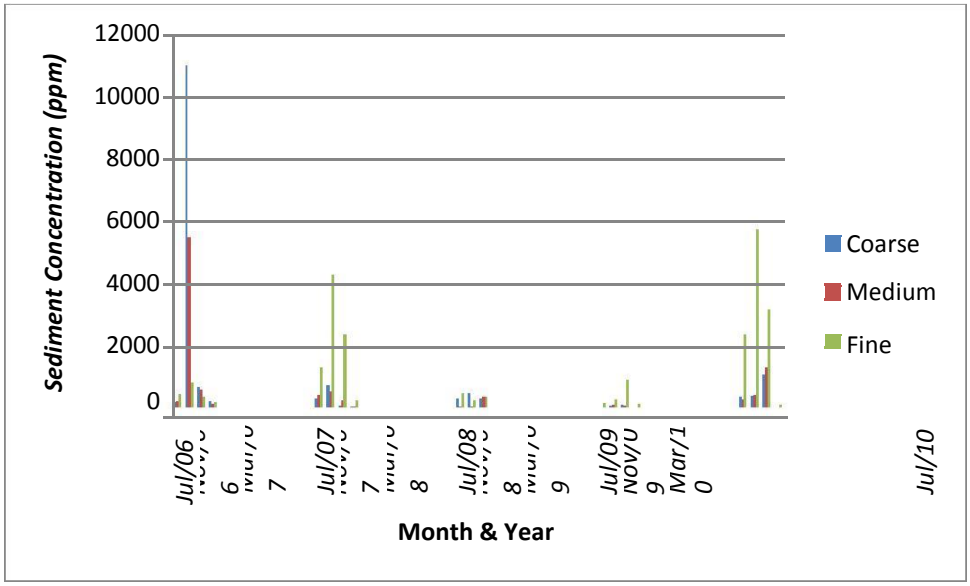


Fig 2.5b: Particle Size Distribution - Monsoon Sediment

The silt analysis has been carried out for samples collected at Jakhol site. The silt analysis report gives information on mineralogical composition of silt sample collected from the project site. The report categorized the silt samples in Supin as varying from fine to medium grained. The summary of study on mineralogical composition of sediments is given in the **Table 2.3**.

Mineral	Mineral Composition in Percentage Sample No. & Date		
	JS-01/07 29/06/07 and 26/07/07	JS-02/07 27/07/07 and 12/08/07	JS-03/07 13/08/07 and 16/08/07
	%	%	%
Quartz	51	43	49
Biotite	11	14	15
Muscovite	7	8	12
Feldspar	18	20	14
Opaque	3	4	4
Iron Oxide	5	3	2
Rock Fragment	3	7	3
% Not determinable	$\pm$ 2	$\pm$ 1	$\pm$ 1

Table 2.3: Summary of Silt Sample Analysis Report of Supin

2.2.2.5 Climatological Data

In the winter season, the higher regions of the Himalayas receive precipitation as snow while moderate rainfall occurs in the foothills and adjoining plains.

There is no temperature recording station within the catchment; however the temperature recorded in the nearby town varies from 0° to 35°C. The climate of the area is generally temperate; it is warm in summer, humid during monsoon and cold in the winter.

2.3 Data Consistency Check

The 10-daily runoff data series of 1977-2007 of Tons (catchment area 1,914 km^2) and Pabar River (catchment area 1,406 km^2) have been obtained from the combined flow at Tiuni on the basis of individual catchment area. The flow data was checked for consistency. It was observed the runoff pattern for Pabar shows unusual behavior for a few years as runoff is comparatively much less than that of Tons despite the two being in adjacent catchments of similar size. In certain years when Pabar experienced dry spells,

Tons was having considerably high discharges in the same period.

The Tons catchment has a considerable snow covered area in its upper reaches, whereas, the Pabar catchment mostly consists of dense forests and almost negligible snow covered region. Therefore, though the catchment might not have received a good monsoon in that particular year, the snow melt from the glaciers in the upper catchment of Tons might have resulted in the high runoff even as Pabar maintained a low flow. Hence, the dissimilar characteristics of the two catchments might explain different flow patterns of Pabar and Tons as discussed above.

2.4 Water Availability

Hydrologic analysis crucial for project configuration such as water availability, power potential study etc. has been conducted on the basis of water years.

The 10-daily discharge data series at JSHEP site for 1977 to 2009 is given in **Annexure 4.8a, 4.8b & 4.8c**, which has been generated based on Tiuni data through catchment area proportionality. The JSHEP catchment is a part of the bigger catchment of Tons at Tuini located downstream. The proportion of snow bound area is higher in case of the upper catchment (JSHEP). Some of the flow figures characterizing the flow pattern of the river at the project site are given in **Table 2.4** below:

Characteristic Flow	Value in Mm^3
Average annual flow	358.053
Maximum annual flow	667.96 – Year 1990-91
Minimum annual flow	214.07 – Year 2000-01
Av. monsoon flow (July-Oct.)	236.16.
Av. Non-monsoon flow (Remaining months)	170.53
Maximum 10-daily discharge	65.24 m^3/s
Minimum 10-daily discharge	1.56 m^3/s

Table 2.4: Flow Pattern of Supin at Jakhol

2.5 Estimation of Inflow Design Flood

The diversion barrage and intake structure should be safe against the inflow design flood. 1 in 100 year flood has been considered for design of barrage and 1 in 500 year flood has been considered for design free board for intake structure.

Design flood for river diversion works is considered as higher of the following;

a. Maximum non-monsoon flow observed at the barrage site or

b. 25 year return period flow, calculated on the basis of non-monsoon yearly peaks

2.5.1 Flood Frequency Analysis

Derivation of design floods is based on a two-step procedure involving first a frequency analysis of annual maximum daily flood records on Tons river at Tiuni station, followed by re-scaling flood estimates from Tuini station to JSHEP site by catchment area proportionality. The essential procedure is indicated below:

The daily discharge series for monsoon months (July, August, September and October) for Tons at Tuini is derived from available discharge data for combined flow of Tons and Pabar at Tuini and the discharge data of Pabar. The data length is of 30 years (1980-2009). An annual series for peak discharge in Tons at Tiuni is then generated. This series was used for frequency analysis by Gumbel Distribution Method. Then flood values at Jakhol barrage site have been calculated on catchment proportionality basis. Estimated values by Gumbel distribution (at Jakhol).

In order to take care of the possible errors in measurement and absence of hourly discharge records and also to account for conversion from daily to instantaneous peak values, the above values were increased by 15%. Summary of the computation is presented in **Table 2.5.**
Details of flood frequency analysis are presented in **Annexure 4.9.a & 4.9.b**.

Predicted Maximum Daily Flood in m^3 /s for Return Period						
Years	5	10	25	50	100	500
Qd	112	145	187	219	250	321
Qp/Qd ratio	1. 15					
Predicted Maximum Peak Flood for Return Period						
Qp	128	167	215	251	287	370

Table 2.5: Flood Data at Jakhol Diversion Site

3. Power Potential & Installed Capacity

3.1 Type of power plant

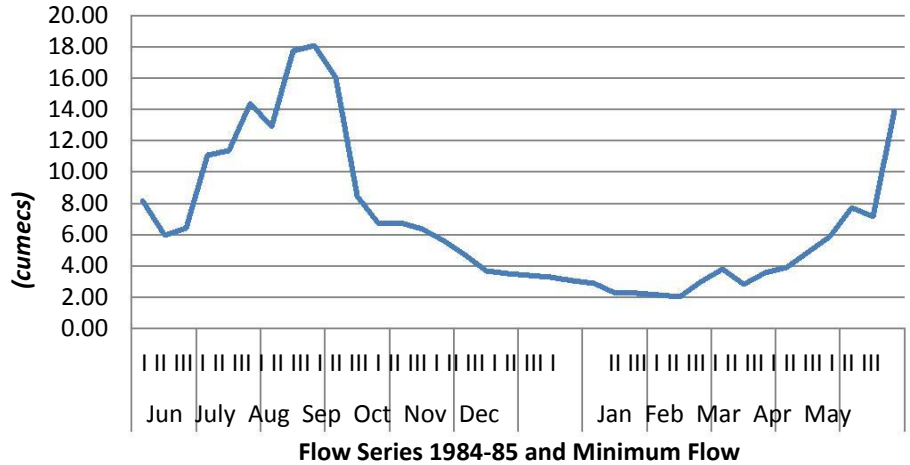
The Jakhol-Sankri Hydroelectric Project (JSHEP) is a run-of-the-river project on Supin River that will harness the hydropower upstream of Jakhol village located in the Uttarkashi district of Uttarakhand. The scheme's main components are barrage, underground de-silting chamber, headrace tunnel, surge shaft, pressure shaft, underground powerhouse and a tailrace tunnel. The main objective of this chapter is to establish the power potential of the project and to select an optimum plant capacity and unit size.

3.2 Water availability for generation

The 10-daily discharge data series at JSHEP site for the water years 1977-78 to 2009-10 has been derived based on long-term data available at Tiuni through catchment area proportionality. The 33 years 10-daily discharge data of river Supin at barrage location is given at **Annexure 5.1.**

The flow considered for energy generation is the net flow available after downstream release for the environment purpose as per CEA guidelines. 10% of the minimum flow during lean period has been considered for the environmental release. The minimum flow in the 90% hydrologic year (1984-85, discussed in Hydrology Section) is 2.31m^3/s. So a minimum discharge of 0.231m^3/s has been considered for release in the river all through the year. Figure 5.1 shows the minimum flow for the 90% hydrologic year. The 33 years 10-daily discharge data of river Supin at barrage location excluding the environmental release is given at **Annexure 3.5.**

Figure 3.1: Flow Series in 1984-85 and minimum flow



3.3 Parameters for Energy Computations

The energy computations have been carried out based on the main hydraulic parameters like headwater/full reservoir level (HWL/FRL), machine centerline elevation, efficiency of the turbo-generator and the minimum and maximum load. As this is a run of the river scheme, no seasonal or diurnal storage has been envisaged. A barrage has been provided as diversion structure to divert Supin river flows into the water conductor system. The FRL at the barrage/ intake has been fixed based on the hydraulic and environmental consideration and the level proposed is EL.1959.40 m. The normal tail water level (EL 1510.66 m) at the tail race outlet corresponds to the design discharge passing through the turbine. The minimum tail water level at tailrace outlet (EL 1509.26 m) has been calculated for a part load of 33% of design flow for one unit running. The net head at the turbine has been estimated as difference between full reservoir level and turbine runner axis minus losses. The basis on which full reservoir and tail water levels are estimated is included in Section, "Design of Civil Structures".

A gross head of 445.80 m is available between the Head water level, EL 1959.40 m, and Centre line of turbine EL 1513.60 m. The total head losses in the system have been estimated as 13.37 m, which results in a net head of 432.43 m for energy generation. FRL/Head water level has been assumed as constant in energy calculations. While calculating the net head, in energy calculations, the losses in the system (hf) are varied for different flow discharges as a function of square of the ratio of discharge available (Q) to the design discharge (Q d), i.e. $h_f = h_{fd} \times (Q/Q_d)^2$, where hfd is head loss at design flow.

For energy estimate, average combined efficiency of the turbo-generator equipment was considered instead of rated efficiency. Average combined efficiency assumed in the calculation is 90.16%.

The hydraulic parameters discussed above have been summarized in the following table (**Table 3.1**). The head loss calculation is given in **Annexure 3.3**.

Table 3.1 - Parameters for Energy Calculations

Parameters	Value
Head water Level (HWL)	1959.40 M
Centre line of the Turbine	1513.60 M
Maximum Gross Head	445.80 M
Head Loss at Rated Capacity	13.37 M
Net Head at Rated Capacity	432.43 M
Turbine Efficiency	92 %
Generator Efficiency	98 %
Combined Efficiency	90.16 %
Plant Availability	95 %

Maximum Load	100 %
Minimum Load	33 %
Minimum Flow Downstream (For environmental purpose)	0.231 m^3/s

3.4 Dependable Energy

The 90% and 50% dependable energy is calculated based on hydrologic year. 90% and 50% dependable years have been selected based on 32 years annual flow series. Then the energy has been estimated in the selected 90% and 50% dependable years. As described in Hydrology Section, the 90% and 50% hydrologic years are 1984-85 and 1981-82 respectively.

The 90% and 50% dependable energy are the energy generated by the plant with 95% plant availability in the year 1984-85 and 1981-82 respectively.

3.5 Optimization of installed capacity and unit-size studies

For optimization of the installed capacity, the annual energy has been calculated for various installed capacities ranging from 33.50 MW – 71.00 MW, with an incremental installed capacity of 2.5 MW that is about 5% of the installed capacity as per the Central Electricity Regulatory Commission, India (CERC) guidelines. In calculating the energy, 95% plant availability has been considered. The annual generation for different installed capacities is given in **Annexure 3.4**. The average annual energy generation, the ratio of incremental increase in energy to increase in installed capacity, plant load factor have been estimated for various installed capacities (IC) (at 95% plant availability).

The incremental energy per MW for various installed capacities is shown in the **Figure 3.2** given below:

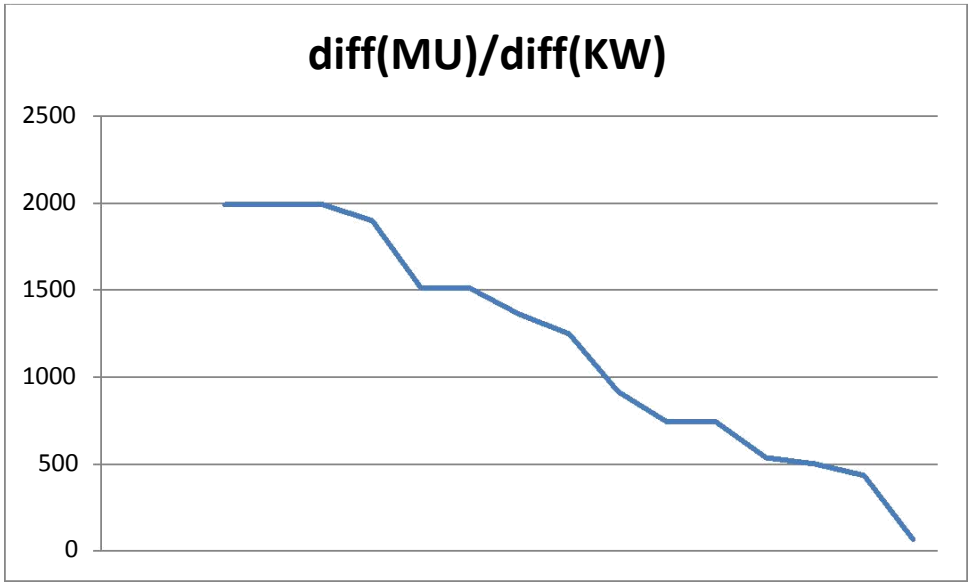


Figure 5.2: Installed Capacity vs. Incremental Energy/Incremental IC

It is found that for installed capacity higher than 51 MW, the ratio of incremental energy per incremental installed capacity falls much below 3. Furthermore, the average plant load factor (PLF) for installed capacity of 51 MW is 60%; which is reasonable. It is therefore proposed to have an installed capacity of 51 MW. Two vertical pelton turbines, catering for high head and low discharge, of 25.5 MW capacity each, are proposed. Each pelton turbine will have 3 jets for utilizing most of the minimum flow. Providing two units ensure higher plant availability, flexibility in operation and maintenance and utilization of smaller inflows during the non-monsoon periods. From economic consideration, three units configuration is not proposed since the cost of E&M equipment and civil works would be high.

3.6 Availability of power and energy, peaking capabilities

The energy generation for all twelve months in various dependable years for installed capacity of 51 MW is given in **Annexure 3.5**. This indicates that the primary energy (annual) with 95% plant availability is **218.18 GWhr** corresponding to 90% dependable year (1984-85). While calculating the secondary energy, which is the energy generated over and above of primary energy, the total energy has been calculated corresponding to 50% hydrologic dependable year, which is year 1981-82. 100% plant availability and 10% overloading have been considered in calculating the total energy. The secondary energy available is 69.61 GWhr.

Table 3.2 gives the total power potential and energy generation in different dependable years.

Table 3.2 – Power Potential in Different Dependable Years

Year	Unit	Maximum Installed Capacity	Probability of exceedence based on available flow	Primary Energy Generation	Plant Load Factor
	No	(MW)	(%)	(MU)	(%)
1984-85	2	51	90	215.56	48.97%

Energy loss due to forced outage has not been considered in the energy generation calculation since these outages are mainly due to high concentration of silt load expected to pass through the turbine during monsoon and dependent on the maximum limit of silt load for which the turbine is designed. A study between the losses in energy production due to outages against the cost involved for replacement of turbine components and the replacement cycles due to silt damage may be carried out during tendering/ detailed design stage on obtaining sufficient silt data.

4. Hydraulic Structures Associated with JSHEP

Structures and Layout

Jakhol Sankri Hydro Electric Project layout consists of the following Civil Structures:

- Barrage across river Supin near Jakhol village.
- Intake, Approach Tunnel and Underground Desilting Chamber on left bank.
- Head Race Tunnel (HRT) on the left bank and terminating at Surge Shaft.
- Underground restricted orifice type Surge Shaft.
- Pressure Shaft & surface Penstock.
- Underground Power House with 2 units of vertical Pelton type turbines near village Sankri.
- Tailrace Tunnel (TRT).
- Underground Cavern for GIS

In addition, River Diversion arrangement for construction of Barrage comprising of coffer dams with 3 nos. of 1650 mm. diameter steel pipes has also been proposed.

The proposed civil structures have been planned to divert design discharge of 15.70 m^3/s inclusive of water required for silt flushing arrangement, where the sediment size greater than 0.2 mm shall be excluded from the water diverted to HRT. The clear water shall then be carried through lined HRT, Underground Surge Shaft, Surface Penstock and Pressure Shaft to the two generating units of 25.5 MW each located in an Underground Power House. The diverted water coming out of the Power House shall be released back into the River Supin by a D shaped 3.5m (W) X 3.75m (H) lined TRT of length 155.52 meter.

Annexures 6.1 & 6.2 provide some simple design details of Desilting Chamber and Economical Diameter of HRT.

5. Conclusion

- The Dependable Year corresponding to 90% dependability is found out to be 1984-85.
- The Design Inflow flood for barrage structure for a return period of 100 years is estimated to be 287 m3/s after applying a safety factor of 1.15.
- Head Losses between MWL of Reservoir and centerline of Turbines is calculated to be 13.37 m.
- Installed capacity of the Power Plant was calculated to be 51MW (2X25.5 MW) at 95% plant availability throughout the year.
- Dimensions for Desilting Chamber were calculated as

  Number of chambers in Desilting tank = 2
  Length of the each chamber = 100 m
  Depth of the chamber = 8 m
  Width of the chamber = 5 m

- Economical Diameter of Head Race Tunnel was Calculated to be 3.00m and of shape Modified Horse Shoe.

6. Future Scope

Simple Hydrological Design of following structures can be done:

- Barrage across river Supin near Jakhol village.
- Intake, Approach Tunnel and Underground Desilting Chamber on left bank. .
- Underground restricted orifice type Surge Shaft.
- Pressure Shaft & surface Penstock.
- Underground Power House with 2 units of vertical Pelton type turbines near village Sankri.
- Tailrace Tunnel (TRT).
- Underground Cavern for GIS

7. References

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- Raw Data from SJVN Office, B.C.S., Shimla(H.P.)
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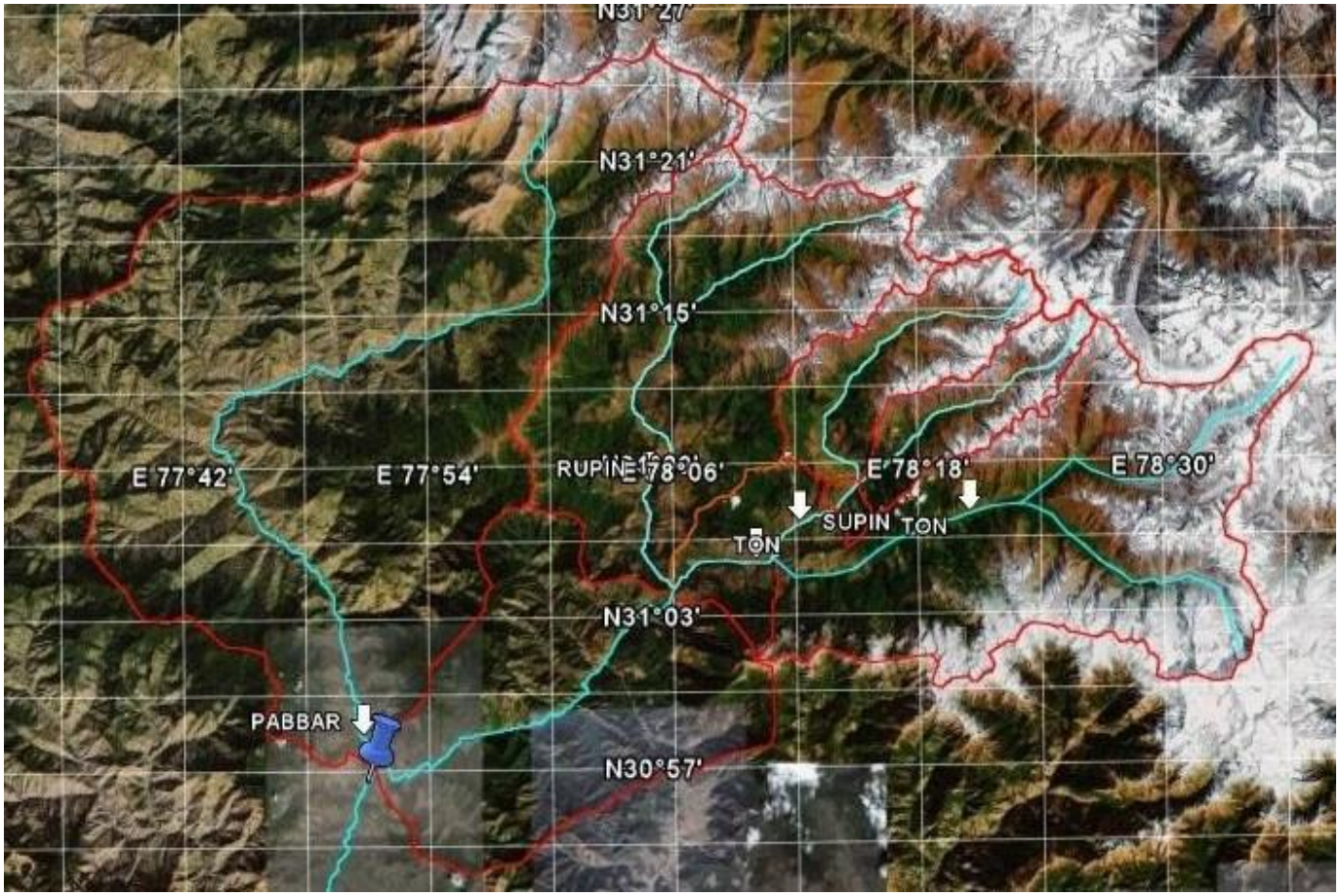
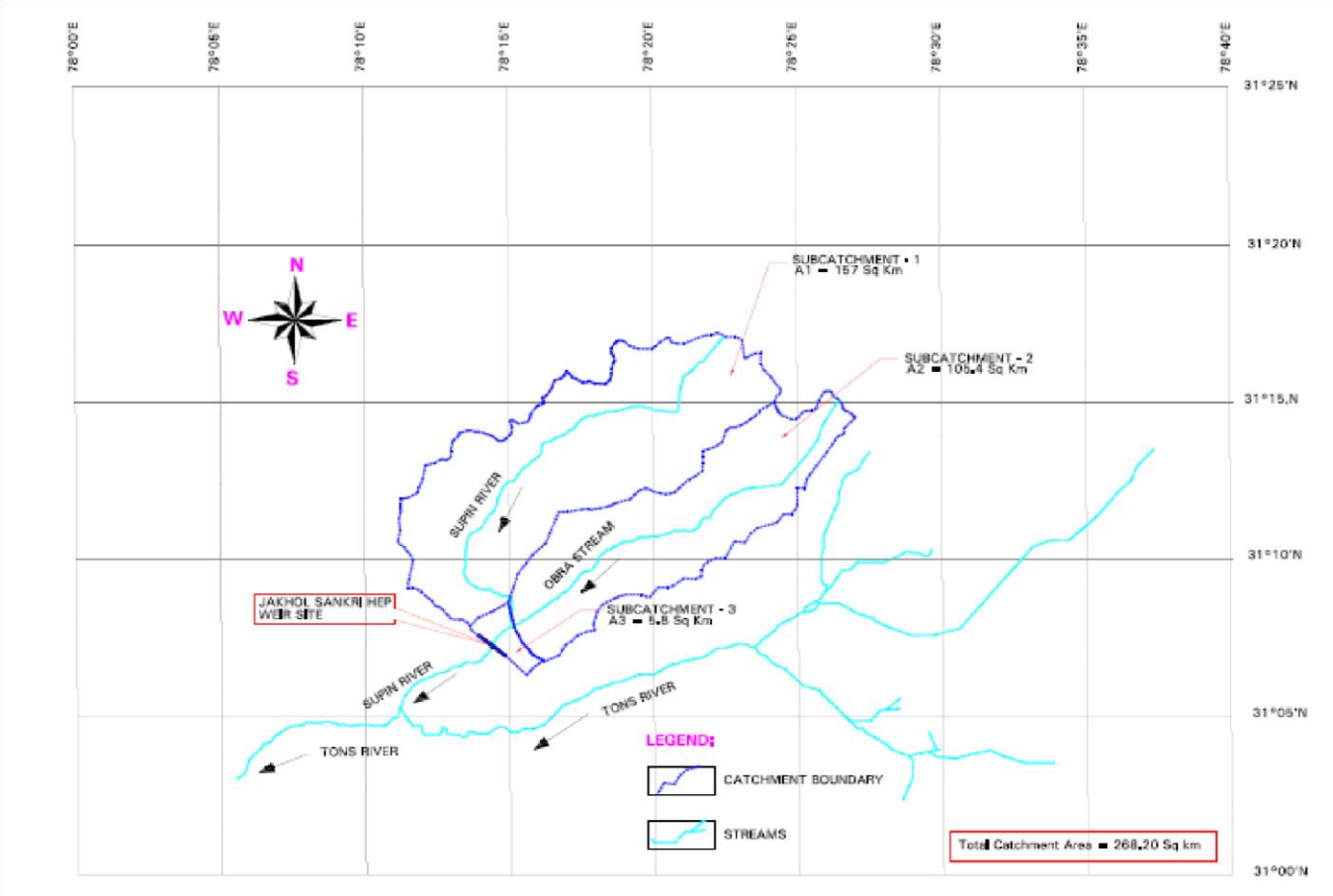
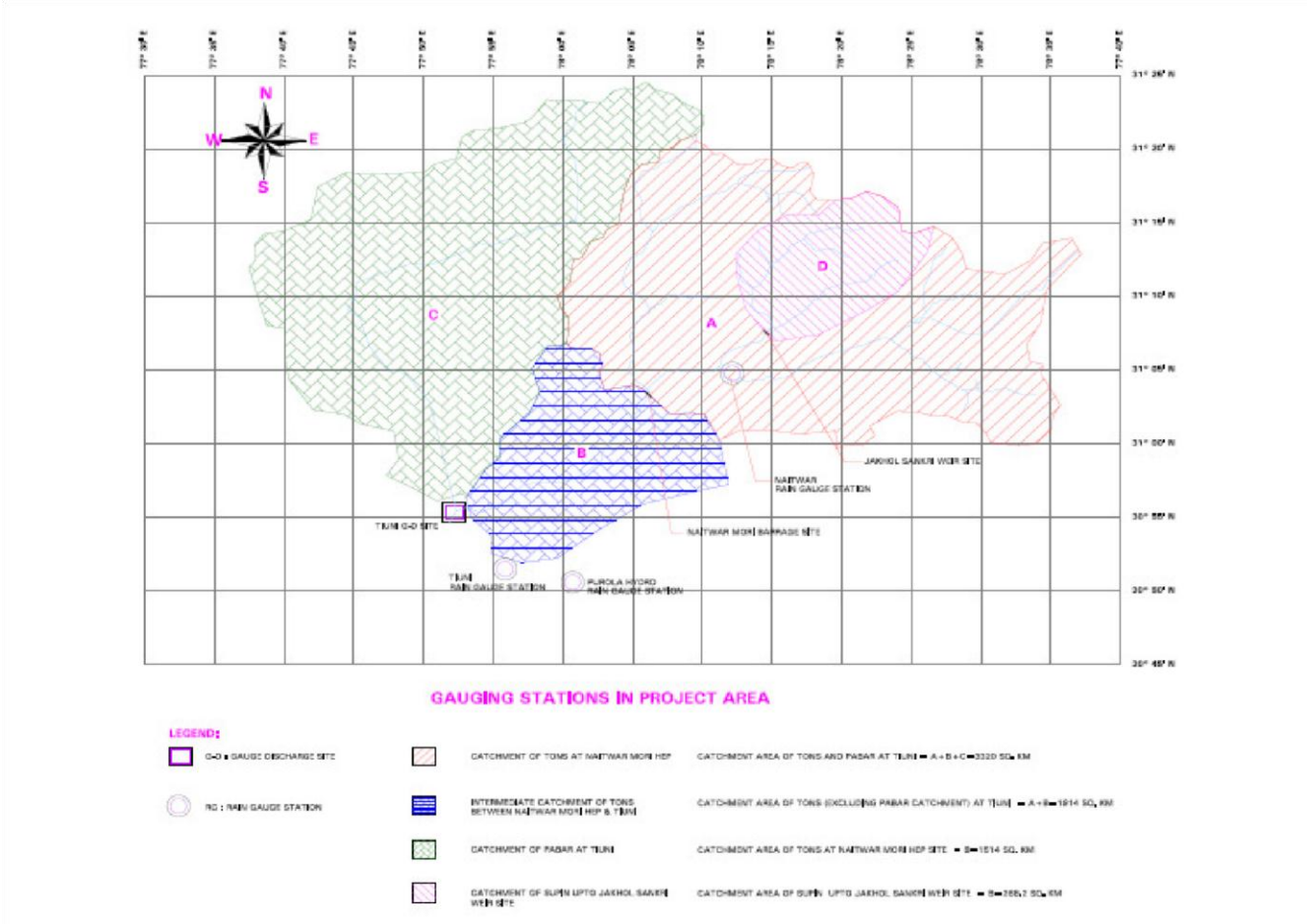
4.1a: Supin Catchment at Jakhol (GOOGLE MAP)



4.1b Catchment Area Map of Jakhol Sankri HEP



Annexure 4.2 Gauging stations in Project Area



Annexure 4.3a :Monthly Rainfall Data at Purola (mm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
1980													
1981													
1982													
1983													
1984													
1985		12.00		43.00	129.00	56.50	394.00		194.50	172.50			1001.50
1986													
1987	46.00	102.50	52.00	34.50	250.90			188.80	73.50	24.50		15.00	787.70
1988	41.20		240.40	9.70	33.20		367.70	284.80			0.00	163.10	1140.10
1989	113.00	38.50	47.70	18.80	69.20	68.20	294.20	281.80	277.70	0.00	57.50	102.00	1368.60
1990	7.00	84.00	208.60	17.50	62.30	91.20	206.70	314.50	85.00	14.00		123.00	1213.80
1991	30.00	82.00	90.00		0.00			172.00	79.00	0.00	0.00	55.00	508.00
1992													
1993													
1994													
1995													
1996													
1997													
1998													
1999													
2000													
2001													
2002													
2003													
2004													
2005													
Average	**47.44**	**63.80**	**127.74**	**24.70**	**90.77**	**71.97**	**315.65**	**248.38**	**141.94**	**42.20**	**19.17**	**91.62**	**1003.28**
Min	**7.00**	**12.00**	**47.70**	**9.70**	**0.00**	**56.50**	**206.70**	**172.00**	**73.50**	**0.00**	**0.00**	**15.00**	**508.00**
Max	**113.00**	**102.50**	**240.40**	**43.00**	**250.90**	**91.20**	**394.00**	**314.50**	**277.70**	**172.50**	**57.50**	**163.10**	**1368.60**

Daily Maximum Rainfall = 125 mm

Annexure 4.3b: Monthly Rainfall Data at Naitwar (mm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
1980													
1981													
1982					72.80	36.10	188.40	289.20	84.00	25.00	0.00	61.00	756.50
1983	101.60	71.10	91.30	74.40	115.50	86.00	288.00	430.30	298.40	63.30			1619.90
1984			21.30	65.60	1.20	173.60	220.30	296.90	235.50	0.00	0.00	19.90	1034.30
1985	66.60	19.50	18.50	55.70	104.00	96.00	445.50	296.30	227.20				1329.30
1986	37.00	397.00	585.20	356.00	49.70	116.80						68.30	1610.00
1987	68.20	89.90	31.70	62.80	199.70	13.40	129.30	268.20	82.80	0.00	0.00	19.20	965.20
1988	45.90	109.80	319.30	30.70	30.70	303.90	334.30	314.30	8.30	0.00	215.80	44.40	1757.40
1989													
1990													
1991	76.40	50.20	98.70	63.80	29.80	195.30	229.40	138.40	0.00	0.00	0.00	0.00	882.00
1992	0.00	0.00	0.00	14.70	59.30	438.40	323.20	160.50	0.00	8.60	0.00	151.20	1155.90
1993	71.90	207.50	22.20	32.40	59.30	359.10	220.00	322.00	0.00	20.50	0.00	119.20	1434.10
1994	90.30	23.70	92.40	97.00	198.00	675.00	315.00	128.00	10.00	5.00	60.00	215.00	1909.40
1995	225.00	140.00	135.00	45.00		407.90	404.20	187.00	13.00	15.00	37.20	77.00	1686.30
1996	143.60	95.00	74.80	62.00	218.00	273.00	420.00	211.10	0.00	15.00	0.00	47.00	1559.50
1997	55.00	40.00	113.00	151.00	100.00	309.60	177.30	113.00	12.50	9.50	19.50	2.50	1102.90
1998	148.00	25.00	34.00	32.00	61.00	65.00	235.00	109.50	151.00	42.00			902.50
1999	0.00			2.00	27.00	129.00	38.00		0.00	0.00	8.00	130.00	334.00
2000		20.00	11.00	8.00	91.00	126.00	103.00	34.00	0.00	0.00		35.00	428.00
2001	14.00	26.00	25.00	60.50	69.00	51.00		11.00	14.00	0.00	16.80		287.30
2002	26.50	12.00			12.50	28.00	218.00	136.00	0.00	22.00			455.00
2003	62.00	33.00		8.00	47.00	160.00	174.00	83.50	0.00	0.00	5.00	22.00	594.50
2004	0.00	17.50		8.00	38.00	53.00	117.00	27.00		40.00			300.50
2005	25.00			4.00		171.00		18.00	40.00				258.00
Average	**66.16**	**76.51**	**104.59**	**61.68**	**79.18**	**193.96**	**241.05**	**178.71**	**58.84**	**13.99**	**25.88**	**67.45**	**1016.48**
Min	**0.00**	**0.00**	**0.00**	**2.00**	**1.20**	**13.40**	**38.00**	**11.00**	**0.00**	**0.00**	**0.00**	**0.00**	**258.00**
Max	**225.00**	**397.00**	**585.20**	**356.00**	**218.00**	**675.00**	**445.50**	**430.30**	**298.40**	**63.30**	**215.80**	**215.00**	**1909.40**

Daily Maximum Rainfall = 210 mm

Annexure 4.3c: Monthly Rainfall Data at Purola(Hydro) (mm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
1980						236.90	707.30	159.00	171.00	83.00	4.30	18.00	1379.50
1981	102.50	32.00	193.00	45.00	202.00	124.00	316.50	213.00	70.00	0.00	90.50	23.00	1411.50
1982	102.00	92.00	219.50	135.00	137.00	52.50	180.50	211.50	70.50	40.00	0.00	41.00	1281.50
1983	0.00	86.00	182.00	122.00	137.50	25.00	184.50	305.20	122.00	63.00	0.00	15.00	1242.20
1984	18.00	136.00	0.00	52.00	6.00	61.20	223.70	223.40	177.00	0.00	0.00	22.00	919.30
1985	104.00	12.00	13.00	43.00	67.00	54.70	417.50	170.20	199.50		0.00		1080.90
1986	10.50	76.00	125.70	105.00	135.90	85.50	201.90	244.60	75.00	79.50	19.50	63.00	1222.10
1987	52.50	106.50	62.00	43.00	260.40	65.50	54.00	197.30	86.00	27.70	0.00	15.00	969.90
1988	41.20	125.20	182.60	9.70		81.10	390.00	359.30			0.00	163.10	1352.20
1989													
1990													
1991	30.00	57.00	99.00	93.00	51.00	59.00	209.00	171.00	107.00				876.00
1992	167.00	69.00	64.00	10.00		93.00	454.00	285.00	98.00	0.00	0.00	0.00	1240.00
1993	77.00	59.00	177.00	26.00	26.00	90.00	296.00	84.00	231.00	0.00	14.00	0.00	1080.00
1994	75.00	0.00	25.00	81.00	68.00	83.10	492.00	365.00					1189.10
1995		173.00	29.00	33.00	31.00	36.00	251.60	215.20	56.10	7.50	0.00	0.90	833.30
1996	81.00	144.00	114.20	62.30	48.00	251.40	194.00	265.00	138.60	52.00	0.00	0.00	1350.50
1997	66.00	1.60	56.00	119.90	64.20	66.90	156.70	302.00	150.00	104.00	83.00	92.00	1262.30
1998	8.00	93.00	125.00	37.00	71.00	222.00	177.00	257.00	239.00	243.00	4.00	0.00	1476.00
1999	72.00	42.00	2.00	0.00	71.00	189.00	330.00	329.00	102.00	7.00	0.00	0.90	1144.90
2000		121.00		31.00	80.00	157.00	279.00	68.00	81.00	0.00	1.00	0.00	818.00
2001	45.00	9.00	144.00	34.00	47.40	202.00	328.00	263.00	39.00	0.00	0.00	31.00	1142.40
2002	69.00	150.00	123.00	77.00	37.00	183.00	52.00	397.00	194.00	10.00			1292.00
2003	34.00			57.20	38.90	36.80	376.20	258.00	111.60	12.40			925.10
2004	140.20	24.60	0.00	66.40	48.80	129.60	88.80	222.00	55.60	91.40			867.40
2005	16.20			14.20	23.00		437.80						491.20
Average	**62.43**	**76.61**	**96.80**	**56.38**	**78.62**	**112.40**	**283.25**	**241.94**	**122.57**	**43.18**	**12.02**	**28.52**	**1118.64**
Min	**0.00**	**0.00**	**0.00**	**0.00**	**6.00**	**25.00**	**52.00**	**68.00**	**39.00**	**0.00**	**0.00**	**0.00**	**491.20**
Max	**167.00**	**173.00**	**219.50**	**135.00**	**260.40**	**251.40**	**707.30**	**397.00**	**239.00**	**243.00**	**90.50**	**163.10**	**1476.00**

Daily Maximum Rainfall = 127 mm

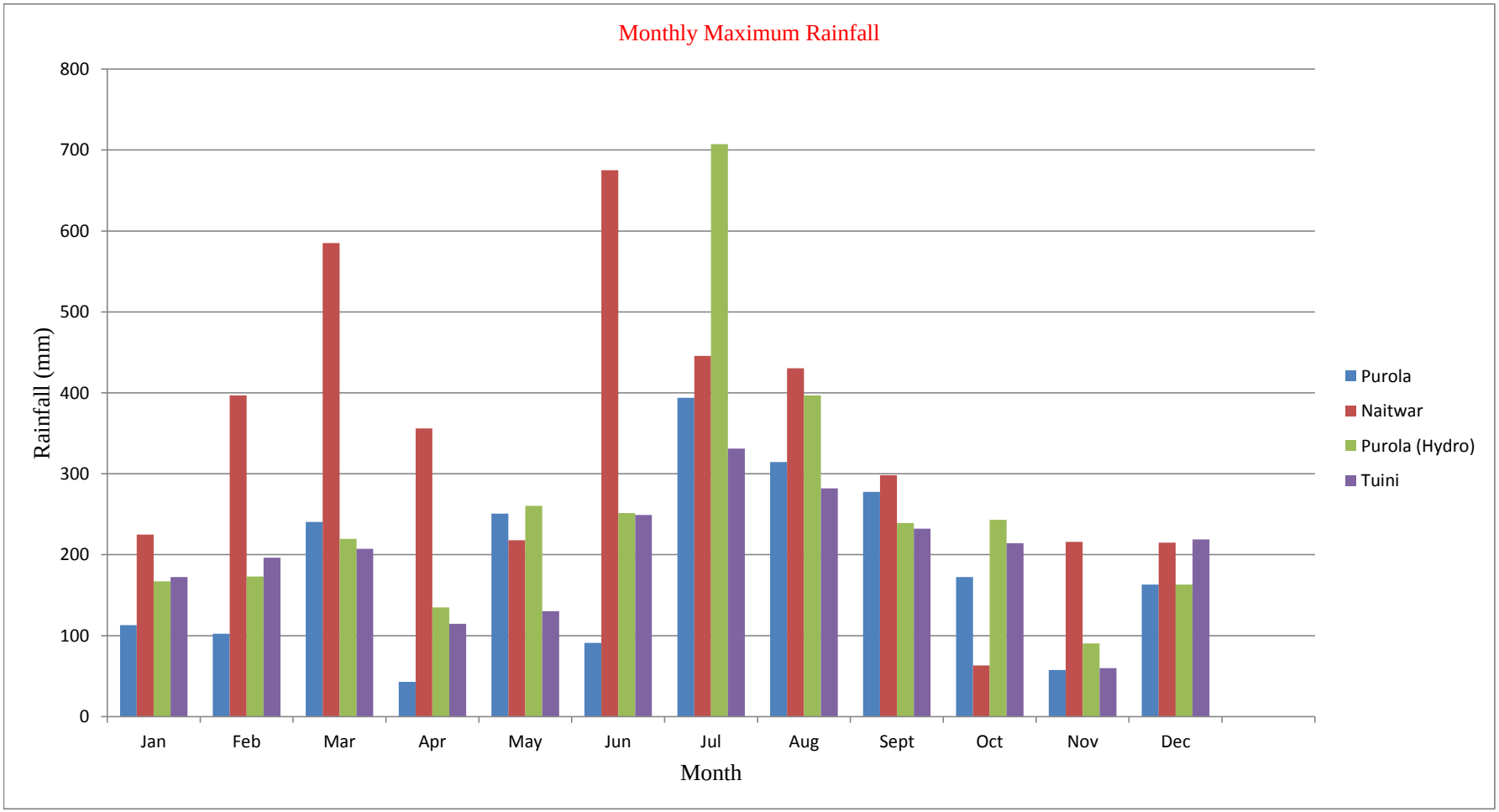
Annexure 4.3d: Monthly Rainfall Data at Tiuni (mm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
1980						30.90	142.60	125.40	34.50	0.00	60.00	22.00	415.40
1981	140.00	101.50	207.20	84.60	129.70	39.30	99.70	106.10	22.20	51.60	2.30	57.20	1041.40
1982	120.30	72.00	176.40	43.00	114.30	56.60	153.80	211.80	69.80	50.60	0.00	10.80	1079.40
1983	4.00	196.20	14.60	51.80	0.20	72.40	144.50	172.60	91.00	0.00	0.00	43.10	790.40
1984	63.70	12.40	13.90	37.20	21.80	66.40	221.40	127.60	74.90	214.40	3.40	101.10	958.20
1985	6.20	79.20	121.80	98.00	130.40	41.20	234.20	206.10	58.10	91.20	35.20	68.60	1170.20
1986		47.40	111.70	35.50	44.00	249.00	25.30						512.90
1987						67.30	232.60	242.20			0.00	219.00	761.10
1988													
1989													
1990	19.00	107.40	57.00	58.60	23.60	88.60	31.20	108.90	54.10	0.00	5.40	45.60	599.40
1991	172.40	49.00	59.00	2.20	34.60	70.80	221.00	210.50	105.90	6.60			932.00
1992	120.30	66.40	186.70	4.60	1.20	22.00	322.20	24.00	232.10	0.00	18.50	0.00	998.00
1993	65.60	152.90		105.50	73.10	91.40	331.10	213.70		2.00		15.00	1050.30
1994	67.00	153.50	47.00	114.50	0.00	68.50	156.20	256.70	167.80	10.00		32.00	1073.20
1995	39.20	103.50		13.50	37.00	80.30	41.50	282.10	196.50	37.50	0.00	0.00	831.10
1996	63.00	92.00	22.00	92.70	59.20	48.60	183.20	162.90	30.80	21.20	19.60	69.10	864.30
1997	5.00	55.00	61.40	4.20	15.00	122.60	39.60	59.40	154.40	210.60	0.00	0.00	727.20
1998	26.80			2.20	94.00	23.40	213.70	177.40	50.90	2.20	0.00	5.20	595.80
1999	42.70	74.30	50.90	16.00	47.80	164.60	175.10	49.30	12.80	0.00	4.00	0.00	637.50
2000	16.00	1.20	36.60	14.00	20.20	165.60		229.40	22.80	8.00	0.00	11.00	524.80
2001	37.60	145.80	102.40	21.60	49.60	83.60				0.00	0.00	3.80	444.40
2002	33.60	121.60	75.80	54.80	14.40	21.60	176.40	266.80	101.20	0.00	7.60	56.40	930.20
2003	117.60	14.60	1.00	41.60	24.20	74.40	32.00	262.40	83.40				651.20
2004													
2005													
Average	**61.05**	**86.63**	**79.14**	**44.81**	**46.72**	**79.50**	**158.87**	**174.77**	**86.84**	**37.15**	**9.18**	**39.99**	**799.47**
Min	**4.00**	**1.20**	**1.00**	**2.20**	**0.00**	**21.60**	**25.30**	**24.00**	**12.80**	**0.00**	**0.00**	**0.00**	**415.40**
Max	**172.40**	**196.20**	**207.20**	**114.50**	**130.40**	**249.00**	**331.10**	**282.10**	**232.10**	**214.40**	**60.00**	**219.00**	**1170.20**

Daily Maximum Rainfall = 121.8 mm

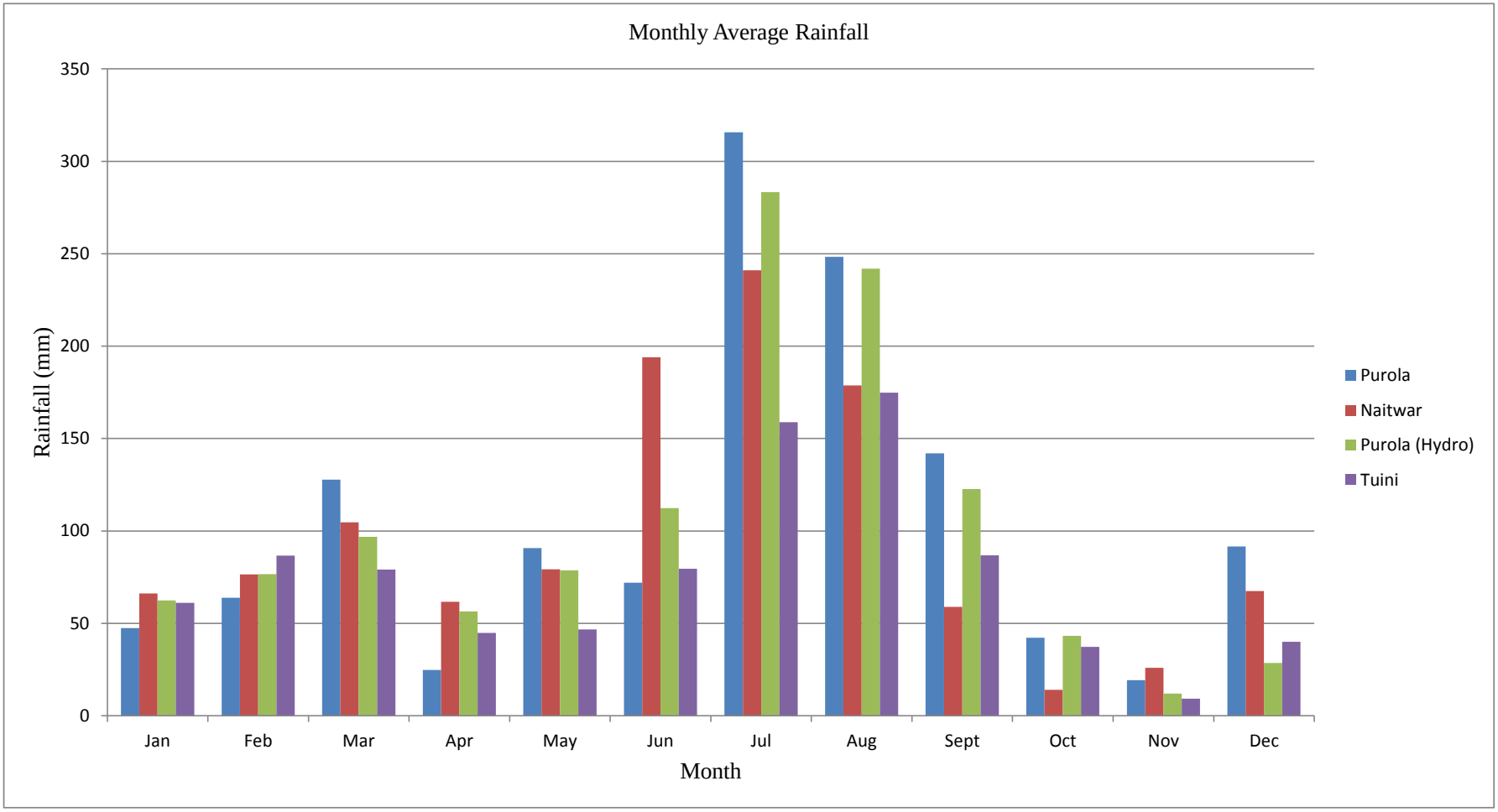
Annexure 4.3e: Monthly Maximum Rainfall

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Purola	113	102.5	240.4	43	250.9	91.2	394	314.5	277.7	172.5	57.5	163.1
Naitwar	225	397	585.2	356	218	675	445.5	430.3	298.4	63.3	215.8	215
Purola (Hydro)	167	173	219.5	135	260.4	251.4	707.3	397	239	243	90.5	163.1
Tuini	172.4	196.2	207.2	114.5	130.4	249	331.1	282.1	232.1	214.4	60	219



Annexue 4.3f: Monthly Maximum Rainfall

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Purola	47.44	63.8	127.74	24.7	90.76667	71.96667	315.65	248.38	141.94	42.2	19.16667	91.62
Naitwar	66.15789	76.51111	104.5875	61.68	79.175	193.9591	241.0474	178.71	58.835	13.99474	25.87857	67.44667
Purola (Hydro)	62.4	76.6	96.8	56.4	78.6	112.4	283.3	241.9	122.6	43.2	12	28.5
Tuini	61.1	86.6	79.1	44.8	46.7	79.5	158.9	174.8	86.8	37.2	9.2	40



Annexure 4.4a: Daily Dishcarge Data (in m3/s) for Tons at Tiuni gauge-discharge station

Station Name : Tiuni **River : Tons**

Year	1980				1981				1982				1983			
Day	Jul	Aug	Sep	Oct	Jul	Aug	Sep	Oct	Jul	Aug	Sep	Oct	Jul	Aug	Sep	Oct
1	243.40	211.00	194.90	138.10	215.70	305.50	155.10	137.60	782.50	256.00	228.60	91.66	239.90	279.80	329.20	191.80
2	237.10	223.20	191.70	135.10	193.90	384.60	152.90	125.60	197.90	282.80	240.70	89.93	257.00	258.30	331.80	196.60
3	227.90	230.50	183.10	133.70	177.10	345.00	150.40	117.70	208.20	220.40	227.30	87.33	245.60	265.40	356.90	197.60
4	266.10	387.10	175.40	132.80	163.30	364.00	147.00	111.90	214.40	306.30	225.90	84.73	245.80	266.40	351.70	199.20
5	248.90	336.00	174.90	132.40	148.40	446.00	144.00	104.90	217.30	308.70	206.20	79.80	253.10	247.80	344.60	194.80
6	251.10	303.70	178.50	132.40	140.70	444.10	143.60	101.90	214.40	246.60	206.20	82.60	224.70	241.20	337.60	193.80
7	215.60	228.30	180.90	131.10	149.50	688.60	143.50	100.90	203.30	236.20	205.90	83.22	203.30	277.80	358.70	190.40
8	223.80	265.30	178.70	129.60	165.40	598.80	144.40	98.07	193.10	231.30	217.00	82.91	153.70	255.50	356.40	168.40
9	293.20	243.70	181.30	135.80	164.70	514.40	141.20	96.16	206.20	225.90	165.10	81.55	168.70	232.90	354.20	197.20
10	394.50	360.00	186.00	130.50	163.30	430.10	142.70	95.21	199.80	219.40	190.10	81.55	176.60	218.80	353.50	163.80
11	285.30	216.10	183.50	121.50	189.90	389.50	130.70	93.41	204.30	213.10	167.80	72.81	156.10	211.80	353.70	161.90
12	423.80	186.20	180.40	95.25	192.60	360.00	118.50	93.41	202.80	231.70	164.40	72.45	157.40	223.10	355.20	156.40
13	360.40	199.90	174.80	102.60	192.20	312.50	117.20	92.08	201.00	288.50	159.10	69.32	157.00	226.10	337.40	159.00
14	450.80	191.40	180.60	101.90	222.40	297.50	114.60	91.21	188.70	362.90	172.40	67.38	177.90	204.10	354.30	155.00
15	335.30	189.60	167.50	100.90	210.40	412.50	116.90	89.29	207.00	368.40	162.70	66.09	186.90	237.40	361.00	156.00
16	219.30	189.90	167.50	100.00	224.00	375.00	117.70	86.40	244.90	396.60	140.50	65.07	184.50	249.60	365.40	151.50
17	262.60	180.00	167.00	102.00	229.30	340.10	116.70	85.48	243.30	382.50	138.90	63.98	184.50	234.50	352.30	145.00
18	235.10	176.20	157.50	105.50	218.90	332.50	111.40	84.10	225.50	312.00	131.60	63.98	182.10	242.50	324.10	128.50
19	196.10	168.60	158.50	102.00	225.10	273.80	115.50	84.10	246.30	295.50	134.80	62.70	185.60	250.60	287.90	104.00
20	200.20	163.60	157.20	102.00	212.70	252.50	124.60	81.68	247.70	285.50	136.40	62.31	188.80	267.90	226.40	97.50
21	186.60	163.10	158.20	100.00	211.40	219.20	114.50	81.29	234.50	261.60	129.60	62.31	249.10	278.80	195.30	95.50
22	210.30	167.10	155.70	95.25	260.70	210.50	109.60	80.83	242.00	208.90	130.00	61.45	197.90	279.60	181.40	93.00
23	183.60	207.20	151.80	92.50	291.10	209.30	105.20	80.37	230.80	257.30	127.50	61.29	214.80	282.10	169.20	97.50
24	193.90	200.80	143.00	89.00	344.20	190.30	102.80	79.43	223.30	263.30	117.30	61.37	252.30	297.40	170.60	89.72
25	224.80	172.90	148.10	89.00	411.60	184.50	113.60	79.43	260.90	247.40	103.20	60.01	226.50	298.70	169.80	84.22
26	236.70	171.10	145.50	89.36	379.50	186.40	118.20	79.43	306.10	263.20	101.10	59.28	255.10	313.60	192.50	81.93
27	463.50	260.20	144.30	89.36	258.30	192.10	116.20	79.43	252.70	262.70	93.97	60.01	281.00	327.70	194.90	78.19
28	313.70	219.30	143.70	85.64	373.70	179.80	114.40	79.00	249.70	328.00	95.78	61.47	286.10	353.60	191.70	78.19
29	319.80	199.30	141.80	83.43	545.30	178.30	144.50	78.58	235.50	285.10	92.16	60.74	304.30	365.00	172.50	75.92
30	406.60	188.20	137.30	85.00	487.40	170.50	183.50	78.15	237.00	285.90	91.56	59.28	287.30	348.80	169.00	95.86
31	300.50	173.20		83.03	360.60	156.20		77.73	271.80	262.20		59.28	287.20	338.40		75.87
Average Q(m3/s)	**277.76**	**218.47**	**166.31**	**107.96**	**249.14**	**320.78**	**129.04**	**91.77**	**244.93**	**277.29**	**156.79**	**70.25**	**218.41**	**270.17**	**286.64**	**137.24**
Min Q	**183.60**	**163.10**	**137.30**	**83.03**	**140.70**	**156.20**	**102.80**	**77.73**	**188.70**	**208.90**	**91.56**	**59.28**	**153.70**	**204.10**	**169.00**	**75.87**
Max Q	**463.50**	**387.10**	**194.90**	**138.10**	**545.30**	**688.60**	**183.50**	**137.60**	**782.50**	**396.60**	**240.70**	**91.66**	**304.30**	**365.00**	**365.40**	**199.20**
Volume (mcm)	**743.95**	**585.16**	**431.08**	**289.16**	**667.29**	**859.17**	**334.46**	**245.79**	**656.03**	**742.69**	**406.41**	**188.17**	**585.00**	**723.62**	**742.97**	**367.57**

Annexure 4.4a: Daily Dishcarge Data (in m3/s) for Tons at Tiuni gauge-discharge station

Station Name : Tiuni **River : Tons**

Year	1984				1985				1986				1987			
Day	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**
1	118.00	128.26	225.80	73.08	87.21	212.00	294.00	96.00	162.40	277.30	179.40	96.87	159.30	166.50	127.30	72.40
2	104.00	171.00	224.30	74.36	104.40	424.00	295.00	96.00	157.80	301.50	177.10	95.08	151.60	171.60	130.20	71.97
3	110.00	171.00	231.90	73.69	114.00	292.00	230.00	104.80	143.40	277.10	189.30	89.10	156.60	182.00	125.00	71.97
4	98.00	156.00	227.30	73.08	120.00	222.00	212.30	94.00	163.10	301.50	174.60	86.63	160.00	171.40	104.60	69.95
5	131.60	142.00	201.30	73.08	124.00	224.30	180.00	92.00	183.30	246.50	140.40	90.59	163.10	159.00	119.90	66.56
6	128.00	141.00	170.60	72.47	136.00	257.40	158.00	94.00	191.90	252.60	140.00	91.08	166.10	168.60	119.90	63.69
7	190.00	138.00	162.90	71.85	122.00	246.00	136.00	112.00	303.10	264.70	138.20	88.12	158.40	173.50	112.30	63.29
8	156.00	191.00	147.60	71.24	123.90	230.00	124.00	106.00	268.90	252.60	137.00	88.07	160.40	164.20	124.60	61.69
9	123.00	130.00	132.30	70.62	175.40	198.00	120.00	116.00	298.00	301.00	140.00	91.69	177.50	159.00	169.20	63.24
10	97.17	134.00	135.40	70.62	146.20	218.00	114.00	104.00	292.00	252.00	128.20	86.28	167.70	174.30	110.20	65.42
11	102.00	146.00	138.40	69.78	121.70	332.00	109.00	546.00	231.30	676.80	126.80	82.67	169.20	150.80	99.11	52.61
12	82.00	163.00	146.10	68.17	166.30	335.10	122.00	254.00	259.60	309.50	122.50	95.29	177.50	147.20	88.63	52.61
13	70.00	238.00	140.00	68.17	174.00	284.90	172.00	194.00	245.40	746.50	119.80	97.10	170.60	135.50	92.68	51.06
14	70.00	420.00	117.00	66.94	182.00	319.70	346.00	202.00	263.90	337.10	119.10	96.92	215.10	143.80	92.68	49.94
15	84.00	332.00	101.60	65.35	169.30	420.00	276.00	210.00	260.50	276.20	117.70	91.44	205.40	132.90	84.63	49.48
16	86.00	218.00	101.60	65.72	251.30	281.20	254.00	198.00	255.80	286.30	122.00	118.10	185.80	119.90	83.58	47.37
17	96.00	198.00	98.57	64.49	408.00	292.00	232.00	159.00	249.90	271.10	124.90	114.80	177.50	117.70	83.66	47.17
18	239.00	218.00	93.57	63.08	395.20	284.00	234.00	150.00	259.80	255.90	118.70	66.08	182.30	120.20	81.68	50.10
19	190.00	218.00	88.61	63.88	327.10	319.00	230.00	142.00	267.60	264.80	96.74	66.08	182.30	126.90	82.52	54.40
20	218.30	185.00	81.71	62.21	370.00	282.00	214.00	127.00	280.40	295.30	92.76	67.25	175.80	129.70	80.98	70.61
21	250.00	180.00	70.98	62.21	240.00	282.00	198.00	892.70	285.60	260.50	91.60	68.47	176.80	131.70	84.06	56.54
22	238.00	178.00	63.32	61.87	227.10	276.00	190.00	892.60	301.80	289.70	88.19	62.37	171.60	156.50	82.50	55.65
23	210.00	190.00	55.66	59.54	199.50	256.00	183.50	892.60	300.00	226.00	83.65	69.03	183.20	146.60	80.75	53.86
24	190.00	218.00	47.99	58.71	227.90	234.00	194.00	892.50	286.20	209.10	88.22	62.03	203.60	201.40	79.45	49.72
25	158.00	168.00	40.33	59.54	226.20	222.00	184.00	892.50	286.20	198.80	89.80	66.27	208.60	171.50	73.54	43.53
26	158.00	218.00	29.60	58.71	359.80	188.00	170.00	892.40	324.00	198.20	91.19	63.00	213.90	151.70	73.74	39.11
27	142.00	204.00	31.13	58.04	305.00	185.00	136.00	892.30	379.00	186.40	95.22	63.31	212.20	133.70	75.38	38.26
28	158.00	230.00	21.94	57.21	156.30	184.00	112.00	892.30	303.60	180.40	99.26	61.92	195.10	138.40	75.38	38.90
29	155.00	218.00	14.27	57.21	220.40	188.00	101.00	892.30	292.00	193.50	100.60	61.50	180.70	165.60	74.92	58.37
30	133.00	194.00	18.87	56.37	220.70	198.00	101.00	892.20	265.90	180.40	98.53	61.50	177.10	151.60	75.15	38.17
31	115.00	216.00		57.21	312.60	212.00		892.00	271.70	180.40		59.29	175.00	137.60		37.55
Average Q(m3/s)	**141.94**	**195.23**	**112.02**	**65.44**	**210.11**	**261.25**	**187.39**	**419.78**	**259.16**	**282.25**	**121.05**	**80.58**	**179.35**	**151.65**	**96.27**	**55.01**
Min Q	**70.00**	**128.26**	**14.27**	**56.37**	**87.21**	**184.00**	**101.00**	**92.00**	**143.40**	**180.40**	**83.65**	**59.29**	**151.60**	**117.70**	**73.54**	**37.55**
Max Q	**250.00**	**420.00**	**231.90**	**74.36**	**408.00**	**424.00**	**346.00**	**892.70**	**379.00**	**746.50**	**189.30**	**118.10**	**215.10**	**201.40**	**169.20**	**72.40**
Volume (mcm)	**380.17**	**522.92**	**290.36**	**175.26**	**562.77**	**699.72**	**469.87**	**1124.34**	**694.15**	**755.97**	**313.76**	**215.82**	**480.38**	**354.91**	**249.54**	**144.08**

Annexure 4.4a: Daily Dishcarge Data (in m3/s) for Tons at Tiuni gauge-discharge station

Station Name : Tiuni **River : Tons**

Year	1988				1989				1990				1991			
Day	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**
1	146.10	321.80	170.50	240.20	187.60	379.20	359.50	167.70	334.80	331.80	372.40	267.90	298.50	298.30	332.20	198.10
2	131.20	366.60	171.90	235.50	142.90	401.70	560.70	167.20	322.00	387.50	343.00	257.60	298.30	294.20	341.50	196.10
3	120.00	533.10	150.10	235.50	111.20	338.60	561.50	168.80	311.20	334.30	323.20	250.40	294.20	323.20	350.80	194.00
4	128.40	310.10	154.50	211.60	106.50	270.80	397.40	190.40	283.20	413.20	343.20	250.60	298.30	298.50	324.90	191.70
5	168.00	296.40	158.10	169.30	139.30	212.70	353.50	171.10	280.80	331.30	341.30	250.50	293.60	324.60	314.30	187.10
6	162.00	271.30	150.60	186.70	138.80	203.60	323.70	169.20	287.30	333.90	480.40	243.60	291.20	323.10	318.10	182.60
7	170.70	251.20	149.50	183.80	144.30	200.70	307.80	160.40	307.90	415.60	444.00	238.00	278.80	304.20	294.10	180.30
8	109.70	271.30	144.70	180.20	147.70	198.40	283.90	158.50	316.60	420.70	422.20	236.90	265.30	282.30	317.10	188.40
9	109.90	308.30	140.30	80.00	162.70	192.80	245.70	152.30	310.80	307.00	391.80	230.50	270.00	292.10	279.70	193.00
10	121.00	246.60	130.90	166.40	199.50	206.40	197.70	145.80	691.80	534.50	361.90	222.20	284.20	275.10	279.60	196.80
11	123.40	233.30	127.40	160.80	203.60	197.20	186.10	146.50	483.90	489.50	359.40	222.10	271.40	261.40	285.00	194.80
12	115.80	305.80	122.50	153.90	227.40	292.50	182.60	146.00	422.70	512.00	343.30	191.40	271.10	232.20	271.30	198.40
13	267.00	318.00	119.00	150.30	241.10	302.30	173.60	137.30	333.20	496.40	341.80	179.90	266.10	219.80	263.50	195.30
14	261.50	277.10	110.60	155.20	305.10	340.00	218.80	140.30	318.90	516.20	320.50	222.80	276.10	211.00	289.40	192.20
15	289.10	274.30	124.10	155.80	308.40	292.30	226.90	135.40	333.10	562.70	300.10	190.80	269.60	210.80	387.00	192.80
16	229.50	233.30	124.90	155.80	265.50	322.00	227.80	129.90	338.90	538.50	279.00	174.50	257.20	236.00	310.10	191.80
17	237.00	268.40	118.80	148.10	244.00	253.00	215.90	128.10	493.80	578.20	278.70	167.70	258.20	239.80	276.90	190.90
18	232.60	245.20	116.20	148.00	230.80	231.40	219.70	128.30	412.80	476.80	279.30	174.50	394.90	255.70	272.50	190.00
19	448.80	231.30	116.20	138.70	211.90	230.20	213.80	126.30	325.90	449.30	300.20	167.90	329.20	271.30	267.40	190.00
20	261.90	252.10	114.50	138.60	214.20	242.90	211.10	126.00	287.70	482.00	267.50	159.20	292.90	261.20	244.90	188.70
21	250.20	305.00	116.60	115.70	228.40	243.70	213.60	122.60	306.80	514.50	280.20	158.60	296.40	291.20	244.90	187.30
22	670.20	246.60	119.30	115.00	272.30	263.30	206.70	121.20	414.40	523.30	279.10	157.40	323.10	350.30	241.00	184.70
23	403.40	255.80	171.90	115.00	213.00	278.40	203.20	121.90	308.90	418.60	276.60	152.50	300.60	332.20	231.90	165.70
24	400.80	205.90	469.20	108.00	349.90	292.60	203.00	121.40	290.70	390.60	269.60	150.90	297.00	314.30	230.20	160.70
25	321.30	217.90	436.10	101.90	233.70	357.70	201.90	121.30	332.10	372.10	259.50	150.40	279.10	422.10	222.20	146.80
26	268.40	219.30	241.30	95.44	292.70	238.80	189.90	121.30	405.40	344.50	243.30	146.60	338.20	375.90	218.40	140.90
27	268.40	192.40	241.80	92.33	281.80	328.10	189.40	119.20	332.80	331.60	235.50	144.10	309.10	282.20	208.40	138.80
28	251.50	215.80	165.19	88.46	298.30	1003.00	190.20	119.20	385.20	378.60	227.20	144.80	309.10	295.10	209.60	136.60
29	251.50	214.30	296.20	83.07	338.10	519.50	188.40	117.50	405.40	373.60	216.50	145.60	292.90	324.50	206.70	132.50
30	177.20	213.90	249.20	83.00	408.70	397.70	185.90	115.70	333.10	380.10	232.10	145.80	323.10	357.60	203.80	132.60
31	184.90	183.70		77.76	542.70	374.70		115.70	338.40	370.40		144.50	307.90	350.30		128.10
Average Q(m3/s)	**234.88**	**267.29**	**174.07**	**144.20**	**238.45**	**309.88**	**254.66**	**139.11**	**356.47**	**429.33**	**313.76**	**191.62**	**294.70**	**293.89**	**274.58**	**177.02**
Min Q	**109.70**	**183.70**	**110.60**	**77.76**	**106.50**	**192.80**	**173.60**	**115.70**	**280.80**	**307.00**	**216.50**	**144.10**	**257.20**	**210.80**	**203.80**	**128.10**
Max Q	**670.20**	**533.10**	**469.20**	**240.20**	**542.70**	**1003.00**	**561.50**	**190.40**	**691.80**	**578.20**	**480.40**	**267.90**	**394.90**	**422.10**	**387.00**	**198.40**
Volume (mcm)	**629.11**	**715.92**	**451.19**	**386.21**	**638.68**	**829.98**	**660.09**	**372.60**	**954.76**	**1149.92**	**813.27**	**513.23**	**789.32**	**787.15**	**711.71**	**474.14**

Annexure 4.4a: Daily Dishcarge Data (in m3/s) for Tons at Tiuni gauge-discharge station

Station Name : Tiuni **River : Tons**

Year	1992				1993				1994				1995			
Day	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**
1	249.90	429.40	361.60	180.50	160.70	292.60	176.00	134.60	272.90	645.80	458.20	154.60	194.40	389.00	414.60	132.60
2	268.10	426.70	442.20	179.50	147.50	198.70	174.80	131.00	259.90	484.30	454.10	155.40	194.40	858.60	443.30	125.90
3	217.20	458.20	418.70	178.60	108.20	217.90	272.10	131.00	259.90	620.50	460.90	151.90	193.70	1003.00	311.00	125.90
4	189.50	485.70	382.30	176.50	130.60	197.60	266.60	138.20	297.90	590.90	631.90	149.00	192.80	738.80	922.30	113.10
5	179.20	602.60	333.80	170.80	159.80	206.20	233.20	127.10	327.50	483.20	1480.00	143.90	194.00	419.10	1492.00	108.80
6	208.10	558.40	338.10	150.90	198.00	203.40	290.40	126.20	320.50	433.50	593.00	134.00	180.00	324.60	1072.00	109.30
7	230.60	509.10	518.60	86.66	205.80	224.10	307.20	131.20	269.20	483.90	463.60	128.40	172.60	313.30	760.00	102.20
8	268.80	608.90	377.80	85.19	215.80	194.80	296.50	127.20	292.30	413.90	401.60	124.40	166.50	453.80	687.30	102.20
9	264.80	653.10	339.10	82.70	221.30	199.20	193.00	123.80	250.30	398.00	405.60	124.40	166.50	772.00	508.20	103.10
10	256.80	460.10	460.40	84.04	239.30	202.20	205.40	109.20	273.20	534.40	398.10	120.80	170.40	672.20	479.50	79.70
11	264.40	522.10	515.60	83.89	676.00	199.40	210.90	87.60	254.90	465.10	413.50	135.10	164.10	480.40	400.40	72.71
12	269.40	432.60	425.20	83.53	645.30	199.40	218.30	80.72	304.40	671.40	371.10	133.00	170.70	467.70	397.10	72.18
13	279.30	526.10	420.90	81.65	409.20	204.80	432.60	75.94	281.20	481.70	354.30	129.90	210.00	450.80	380.30	69.90
14	310.20	430.80	388.40	82.38	252.90	204.20	449.80	79.24	249.20	446.80	348.50	129.90	396.10	455.80	383.40	72.52
15	318.70	411.10	342.90	78.16	230.40	191.80	325.00	80.87	247.30	459.00	337.70	134.30	353.00	448.10	364.20	69.18
16	355.10	411.10	350.80	78.44	731.10	190.80	290.20	78.91	244.00	773.20	335.50	130.90	334.40	436.60	351.60	65.83
17	434.00	597.80	365.50	80.35	542.20	223.70	227.00	71.30	207.60	594.40	328.70	125.80	204.20	429.10	346.80	64.28
18	465.00	610.10	335.40	75.50	553.40	204.70	187.20	64.95	237.90	425.00	312.20	122.50	209.60	451.80	342.10	65.96
19	438.50	534.60	190.60	72.26	348.20	161.80	179.60	52.75	594.50	374.50	308.90	118.20	194.50	440.40	335.90	65.29
20	637.10	513.80	190.40	73.35	306.80	153.70	171.30	54.57	1590.00	369.80	282.50	112.90	365.80	436.40	300.40	66.14
21	646.40	461.90	190.50	70.72	231.60	146.20	167.10	55.75	1701.00	363.80	257.40	107.00	388.70	471.10	257.30	65.97
22	919.80	486.50	190.80	71.21	306.60	140.90	171.20	57.39	1355.00	339.70	209.10	100.90	318.10	447.10	220.40	65.97
23	574.70	472.40	185.60	77.65	355.00	135.50	160.30	56.39	629.70	481.10	208.30	95.51	498.80	412.40	201.40	64.59
24	593.00	416.20	186.00	76.48	203.60	132.40	178.00	58.74	556.60	693.50	185.60	90.14	776.20	434.50	189.00	65.77
25	599.00	387.20	184.20	76.48	156.60	136.10	167.90	57.75	414.20	586.00	171.40	87.91	407.30	490.60	173.60	65.70
26	611.40	389.70	188.20	77.33	360.90	137.60	153.10	58.74	401.10	577.90	166.60	89.19	289.10	445.40	164.40	64.59
27	465.50	404.60	186.50	75.75	335.60	146.20	134.50	55.86	502.90	650.70	166.80	90.36	291.20	432.80	162.80	64.64
28	482.50	390.20	184.80	72.03	353.30	134.10	134.30	56.02	545.70	605.70	164.70	91.80	806.00	432.80	135.60	63.47
29	788.20	410.40	183.10	75.33	351.60	134.10	139.00	57.70	452.70	501.50	162.70	90.67	404.50	426.70	130.30	63.47
30	497.40	386.40	180.60	72.55	346.40	155.20	129.60	58.93	586.00	498.70	158.90	90.67	369.10	480.80	134.90	62.53
31	467.80	375.60		70.24	344.60	160.40		58.74	645.80	500.10		88.27	318.10	510.70		62.09
Average Q(m3/s)	**411.30**	**476.24**	**311.95**	**96.15**	**317.04**	**181.60**	**221.40**	**85.11**	**478.24**	**514.45**	**366.38**	**118.77**	**299.83**	**497.63**	**415.40**	**80.50**
Min Q	**179.20**	**375.60**	**180.60**	**70.24**	**108.20**	**132.40**	**129.60**	**52.75**	**207.60**	**339.70**	**158.90**	**87.91**	**164.10**	**313.30**	**130.30**	**62.09**
Max Q	**919.80**	**653.10**	**518.60**	**180.50**	**731.10**	**292.60**	**449.80**	**138.20**	**1701.00**	**773.20**	**1480.00**	**155.40**	**806.00**	**1003.00**	**1492.00**	**132.60**
Volume (mcm)	**1101.63**	**1275.56**	**808.58**	**257.53**	**849.17**	**486.41**	**573.88**	**227.95**	**1280.91**	**1377.91**	**949.66**	**318.10**	**803.07**	**1332.84**	**1076.73**	**215.62**

Annexure 4.4a: Daily Dishcarge Data (in m3/s) for Tons at Tiuni gauge-discharge station

Station Name : Tiuni **River : Tons**

Year	1996				1997				1998				1999			
Day	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**
1	214.90	314.80	309.50	224.40	116.20	530.10	123.50	138.90	152.70	147.00	131.00	176.60	138.30	188.10	139.70	135.10
2	219.00	424.30	283.80	191.30	121.20	543.10	100.30	140.80	159.90	139.20	126.20	169.60	144.50	232.60	137.70	133.50
3	209.70	474.60	320.20	205.20	121.30	1506.00	209.00	143.00	179.80	135.30	154.70	158.10	149.40	218.10	138.80	131.80
4	200.90	300.70	330.00	211.20	123.00	616.40	210.60	144.90	191.20	134.20	150.20	151.70	154.00	236.60	135.90	129.80
5	207.90	285.40	306.10	203.70	121.00	179.50	211.90	144.90	204.90	128.00	149.70	140.40	149.30	194.70	133.20	128.40
6	201.50	330.00	290.20	215.70	112.80	161.30	208.90	145.30	166.60	126.20	149.70	139.50	154.40	195.40	135.80	130.30
7	195.30	209.10	300.20	241.00	126.60	197.10	250.80	148.20	163.20	141.30	146.50	146.90	157.20	198.60	130.70	127.60
8	199.80	199.90	638.70	179.30	158.00	186.90	239.90	145.80	148.90	149.60	138.80	142.60	156.30	205.90	135.30	125.30
9	196.80	194.30	327.30	169.10	164.60	184.10	206.70	145.60	154.90	134.20	137.70	140.30	155.40	206.10	131.40	123.10
10	194.80	218.20	562.10	164.90	168.40	185.40	177.00	145.00	161.10	144.20	150.70	137.90	161.70	362.30	135.90	124.60
11	209.60	206.30	506.80	175.40	169.60	184.10	248.80	142.30	158.30	180.20	153.30	137.50	157.40	344.30	142.10	126.90
12	212.60	248.80	426.70	173.30	174.20	559.70	240.20	139.70	153.50	176.40	157.90	133.00	113.10	252.70	164.10	128.60
13	210.60	354.20	307.20	129.60	175.80	413.80	231.70	133.20	159.60	164.40	161.90	124.10	121.60	227.80	165.60	130.10
14	208.20	6448.00	307.90	158.90	171.80	406.80	205.10	130.90	148.20	158.30	157.60	121.50	110.00	159.90	161.50	128.30
15	210.60	437.60	316.70	85.15	174.10	390.00	213.20	126.00	140.20	159.30	151.20	119.80	111.10	146.60	157.20	124.40
16	209.10	453.50	304.60	66.06	174.80	429.10	211.90	122.20	151.00	201.00	146.80	118.30	112.90	141.60	149.00	123.00
17	203.20	361.60	302.60	55.98	174.90	392.10	211.80	127.00	159.00	187.00	142.00	120.30	123.20	136.70	146.40	125.40
18	222.90	209.00	299.60	57.68	163.20	394.40	198.70	123.20	149.60	164.30	139.00	465.10	119.50	157.10	143.10	126.60
19	223.80	294.50	297.30	59.90	170.80	407.60	189.00	122.30	279.50	166.10	141.30	162.70	125.90	162.30	138.10	127.60
20	210.60	296.20	295.60	58.86	165.20	257.50	189.90	121.50	260.60	174.40	140.00	170.60	165.90	190.00	139.00	127.60
21	213.70	298.50	295.10	59.46	174.80	245.80	197.30	121.80	266.60	159.40	138.10	175.30	218.50	199.40	1449.00	127.10
22	452.30	640.70	275.70	66.31	177.20	212.30	194.90	121.10	240.20	296.90	339.40	175.00	224.00	199.40	137.60	125.90
23	219.50	576.40	276.00	68.97	175.80	221.70	193.90	122.90	205.40	267.20	422.80	172.80	166.00	176.20	151.10	122.90
24	214.50	761.30	268.30	68.02	175.90	208.50	195.30	121.10	173.10	250.90	381.80	166.60	180.00	161.20	150.70	122.90
25	217.90	658.90	261.00	67.18	485.00	208.20	189.50	116.20	153.70	222.40	352.70	160.40	174.00	156.30	149.60	119.00
26	419.80	292.10	256.00	66.45	458.00	209.40	146.50	117.00	161.30	186.40	173.00	152.40	158.00	13.02	148.60	115.00
27	289.30	267.40	247.70	66.45	362.30	202.60	188.70	116.60	162.20	148.60	180.10	147.80	154.60	157.70	145.60	113.00
28	285.80	237.20	245.30	59.64	491.80	249.70	193.20	114.30	151.90	129.10	197.20	141.00	167.70	156.00	137.60	111.00
29	292.80	227.90	211.80	59.00	482.60	206.70	143.20	117.10	145.90	134.60	190.40	136.80	200.10	152.90	139.50	107.90
30	306.20	222.50	226.70	56.61	424.00	175.90	140.20	119.30	149.80	126.80	181.50	133.90	220.20	148.80	137.30	106.30
31	305.30	402.40		57.25	457.40	154.50		119.60	151.00	135.50		126.20	199.80	144.80		104.40
Average Q(m3/s)	**238.03**	**543.43**	**319.89**	**120.06**	**222.98**	**336.14**	**195.39**	**130.25**	**174.32**	**166.72**	**182.77**	**156.93**	**156.26**	**187.84**	**186.90**	**123.66**
Min Q	**194.80**	**194.30**	**211.80**	**55.98**	**112.80**	**154.50**	**100.30**	**114.30**	**140.20**	**126.20**	**126.20**	**118.30**	**110.00**	**13.02**	**130.70**	**104.40**
Max Q	**452.30**	**6448.00**	**638.70**	**241.00**	**491.80**	**1506.00**	**250.80**	**148.20**	**279.50**	**296.90**	**422.80**	**465.10**	**224.00**	**362.30**	**1449.00**	**135.10**
Volume (mcm)	**637.54**	**1455.52**	**829.15**	**321.58**	**597.22**	**900.31**	**506.44**	**348.86**	**466.89**	**446.55**	**473.75**	**420.31**	**418.52**	**503.12**	**484.45**	**331.21**

Annexure 4.4a: Daily Dishcarge Data (in m3/s) for Tons at Tiuni gauge-discharge station

Station Name : Tiuni **River : Tons**

Year	2000				2001				2002				2003			
Day	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**
1	160.20	218.90	144.90	102.80	137.80	148.60	155.90	56.89	146.40	109.60	202.00	80.31	140.90	178.00	142.30	138.00
2	141.50	193.30	137.90	97.83	143.50	137.10	149.60	59.56	150.90	105.30	197.30	75.39	137.70	216.40	145.80	139.00
3	131.50	165.20	132.20	92.84	149.70	137.10	142.30	60.45	155.60	111.70	185.30	73.97	133.60	289.30	235.50	139.90
4	124.50	127.50	126.50	87.92	146.70	146.10	138.30	59.54	158.50	117.60	180.30	71.84	130.70	315.00	203.70	140.80
5	124.50	116.80	118.40	78.40	144.60	155.90	131.90	58.64	153.40	163.20	165.40	69.70	134.60	281.00	155.00	139.90
6	124.50	120.00	116.40	79.60	149.80	145.20	125.00	57.73	148.20	146.40	154.40	68.28	130.70	287.60	214.20	139.00
7	127.50	116.80	120.40	67.60	156.10	143.40	116.80	56.83	141.70	150.00	146.00	66.86	134.60	259.90	203.70	140.90
8	126.00	99.65	120.60	66.40	157.10	153.80	105.90	55.92	135.30	173.40	187.70	64.80	138.80	415.20	165.90	139.60
9	119.00	93.54	118.60	64.00	159.20	160.20	107.60	53.05	131.80	178.10	181.90	62.84	143.20	251.50	164.80	137.90
10	134.30	129.00	125.00	61.60	148.70	151.70	105.70	50.46	127.20	184.40	1563.00	61.95	138.80	248.40	172.30	137.00
11	129.70	155.60	134.50	62.60	194.30	197.10	97.07	49.24	132.70	175.80	142.80	59.87	131.70	213.70	187.90	134.80
12	163.50	135.40	129.10	61.60	308.00	177.00	106.80	48.53	133.80	184.60	159.00	58.75	135.80	220.80	169.10	136.00
13	148.70	135.40	121.70	59.60	252.70	205.70	98.00	46.72	135.30	209.60	345.10	56.51	140.90	196.30	154.20	132.40
14	191.70	137.40	115.40	59.60	204.00	178.00	90.96	46.72	138.90	298.90	257.80	55.38	189.00	224.90	149.00	131.50
15	162.20	144.00	112.00	58.40	194.60	211.70	86.90	44.82	137.10	324.10	212.60	54.26	198.10	217.80	149.50	129.40
16	277.50	149.80	109.10	58.40	198.00	215.80	75.83	42.97	137.90	201.30	167.40	54.25	234.70	189.10	176.60	128.20
17	307.70	145.60	113.70	57.20	199.30	203.80	73.06	41.03	143.10	158.40	151.10	54.27	200.90	176.00	164.80	127.50
18	343.30	148.00	112.80	56.20	182.90	183.80	93.94	38.90	148.30	131.20	156.00	52.01	160.30	155.50	161.60	126.20
19	231.70	136.50	115.60	55.20	175.60	181.70	71.70	38.40	151.90	157.20	155.40	50.01	148.00	210.10	148.20	125.70
20	248.80	153.70	109.40	53.20	171.20	179.80	67.66	37.61	154.80	165.10	150.20	49.09	149.70	165.70	141.40	125.10
21	368.90	150.00	111.50	52.20	179.00	177.30	63.11	38.12	153.80	177.80	143.70	48.18	183.70	165.80	138.10	125.10
22	420.40	157.00	111.80	47.20	187.10	181.10	59.60	39.03	148.90	155.00	139.90	47.54	155.30	160.00	139.80	124.10
23	350.60	145.80	108.00	42.88	203.80	180.50	55.84	38.16	147.50	153.80	134.10	46.22	144.90	153.60	164.20	122.20
24	243.70	137.80	104.70	41.00	197.40	177.30	51.13	37.76	142.90	165.20	128.90	45.02	167.50	151.40	165.90	121.30
25	201.00	132.40	105.80	40.00	191.40	173.30	54.06	31.32	137.20	173.30	118.00	44.53	153.80	153.20	161.60	120.40
26	239.30	126.30	102.50	39.20	188.00	176.90	56.00	36.94	134.80	210.90	106.00	43.47	165.60	164.10	148.90	119.50
27	229.30	121.30	102.00	38.20	194.30	181.60	58.65	36.94	131.80	235.30	96.77	42.99	265.10	228.40	147.40	118.50
28	309.10	115.20	106.00	37.60	193.30	170.90	55.14	36.11	129.70	191.50	88.98	42.03	278.80	215.20	139.60	117.80
29	323.30	118.80	102.00	38.20	185.70	165.10	52.05	35.70	123.40	154.80	84.94	42.36	210.90	290.10	133.80	116.10
30	274.10	130.20	109.00	37.60	176.50	173.20	52.05	35.26	119.40	158.50	86.29	41.28	154.80	203.60	138.00	113.40
31	246.20	135.30		38.75	158.20	167.40		34.50	114.00	180.60		40.80	152.90	164.80		111.80
Average Q(m3/s)	**216.91**	**138.46**	**116.58**	**59.16**	**181.56**	**172.20**	**89.95**	**45.29**	**140.20**	**174.28**	**206.28**	**55.64**	**164.06**	**218.14**	**162.76**	**129.00**
Min Q	**119.00**	**93.54**	**102.00**	**37.60**	**137.80**	**137.10**	**51.13**	**31.32**	**114.00**	**105.30**	**84.94**	**40.80**	**130.70**	**151.40**	**133.80**	**111.80**
Max Q	**420.40**	**218.90**	**144.90**	**102.80**	**308.00**	**215.80**	**155.90**	**60.45**	**158.50**	**324.10**	**1563.00**	**80.31**	**278.80**	**415.20**	**235.50**	**140.90**
Volume (mcm)	**580.97**	**370.85**	**302.18**	**158.44**	**486.30**	**461.21**	**233.15**	**121.29**	**375.51**	**466.78**	**534.67**	**149.02**	**439.43**	**584.27**	**421.87**	**345.51**

Annexure 4.4a: Daily Dishcarge Data (in m3/s) for Tons at Tiuni gauge-discharge station

Station Name : Tiuni **River : Tons**

Year	2004				2005				2006			
Day	Jul	Aug	Sep	Oct	Jul	Aug	Sep	Oct	Jul	Aug	Sep	Oct
1	122.10	211.80	123.60	89.64	164.80	237.30	94.19	131.90	61.81	160.00	156.40	67.76
2	127.10	163.50	119.60	87.68	154.00	215.00	90.76	127.30	60.16	180.20	161.00	66.82
3	121.40	129.80	118.60	89.64	150.90	263.00	85.62	123.50	68.41	187.50	151.90	65.83
4	124.10	124.50	113.70	91.60	150.90	244.40	80.47	121.40	67.59	232.30	141.70	62.72
5	116.90	128.50	109.80	93.45	178.70	218.10	87.33	119.70	76.66	277.60	120.00	60.63
6	107.20	120.40	105.80	92.53	470.30	201.00	85.62	117.60	112.20	265.40	106.40	59.60
7	109.50	121.80	102.90	91.60	357.40	189.80	78.76	115.10	106.40	288.20	87.36	58.56
8	105.30	195.90	106.80	87.89	250.60	170.60	83.80	112.10	120.00	360.70	84.69	58.56
9	98.02	136.60	105.00	86.74	192.00	158.30	79.80	109.60	117.50	320.80	82.80	57.56
10	95.73	136.20	102.00	85.69	184.90	150.40	84.90	107.10	135.00	287.90	81.32	57.68
11	87.28	218.20	110.90	84.04	180.00	150.40	81.00	106.30	150.00	268.60	83.15	56.75
12	89.39	166.40	107.90	84.42	193.80	151.30	86.20	105.60	142.60	215.20	83.58	55.84
13	96.09	200.10	103.90	92.13	185.80	152.10	103.60	104.80	135.00	223.70	84.71	54.20
14	90.66	176.20	101.90	94.50	225.00	144.20	93.88	104.00	161.00	187.60	87.04	53.33
15	86.97	177.70	106.90	91.34	254.60	140.70	85.07	103.10	114.60	198.30	84.70	51.98
16	105.20	165.50	111.70	89.64	258.90	164.40	92.66	101.60	87.29	201.80	82.78	51.00
17	92.69	163.20	116.20	88.73	270.60	259.90	105.50	98.73	130.50	201.80	83.54	49.35
18	95.96	183.70	110.80	87.82	291.30	236.00	168.40	96.39	178.20	192.40	81.26	48.48
19	89.42	167.30	108.80	87.84	244.90	176.70	156.00	94.08	215.40	177.00	79.08	47.78
20	85.17	160.20	105.00	86.65	222.80	143.40	126.60	91.77	381.40	169.80	86.34	47.01
21	76.92	152.40	103.00	84.53	184.00	130.50	114.30	89.88	251.30	184.80	84.32	47.01
22	66.59	215.70	105.80	87.35	166.30	123.60	106.40	89.04	206.30	178.90	81.24	46.31
23	100.80	228.40	107.90	85.47	169.60	119.50	100.60	87.38	213.50	194.80	79.51	45.68
24	64.00	208.60	104.00	84.51	171.60	115.60	135.20	86.20	192.30	204.00	78.43	45.68
25	58.28	172.20	100.90	83.56	162.40	112.80	144.90	85.37	187.70	191.30	77.34	44.35
26	76.86	170.00	97.87	86.56	149.90	111.00	151.40	83.51	196.10	183.20	75.80	43.72
27	79.33	163.40	95.85	84.38	326.00	108.20	147.10	82.62	226.20	162.90	74.51	43.72
28	117.70	139.80	94.85	82.33	234.90	106.70	148.20	80.83	244.00	160.00	73.32	43.12
29	193.10	132.30	92.81	81.33	389.40	104.50	142.90	79.50	267.40	153.00	77.86	42.60
30	182.70	123.60	90.57	83.32	279.40	102.80	136.40	79.50	204.70	149.30	69.67	42.09
31	235.00	130.90		81.29	249.40	99.33		77.55	171.80	138.20		41.72
Average Q(m3/s)	**106.37**	**164.03**	**106.18**	**87.36**	**227.91**	**161.34**	**109.25**	**100.42**	**160.74**	**209.59**	**92.73**	**52.18**
Min Q	**58.28**	**120.40**	**90.57**	**81.29**	**149.90**	**99.33**	**78.76**	**77.55**	**60.16**	**138.20**	**69.67**	**41.72**
Max Q	**235.00**	**228.40**	**123.60**	**94.50**	**470.30**	**263.00**	**168.40**	**131.90**	**381.40**	**360.70**	**161.00**	**67.76**
Volume (mcm)	**284.90**	**439.33**	**275.21**	**233.99**	**610.42**	**432.13**	**283.18**	**268.97**	**430.53**	**561.36**	**240.34**	**139.75**

Annexure 4.4a: Daily Dishcarge Data (in m3/s) for Tons at Tiuni gauge-discharge station

Station Name : Tiuni **River : Tons**

Year	2007				2008											
Day	Jul	Aug	Sep	Oct	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	118.10	115.60	139.50	93.40	33.26	35.17	45.75	45.26	74.50	84.88	314.95	346.47	191.97	159.85	73.97	32.98
2	151.90	115.60	275.30	87.50	32.87	35.55	45.75	46.25	73.50	87.36	274.40	322.45	188.21	148.10	61.49	33.63
3	214.10	219.80	171.70	82.78	32.48	35.17	44.66	46.75	74.40	86.32	244.04	336.68	168.22	148.14	53.02	35.94
4	222.40	271.60	183.70	66.77	32.87	34.79	45.19	47.32	82.50	96.75	244.18	289.68	168.24	149.90	47.83	36.67
5	185.10	330.40	137.50	70.01	32.46	39.06	45.19	47.32	91.50	103.00	204.13	377.24	192.00	146.05	51.89	36.67
6	145.00	211.70	129.10	65.15	32.87	39.49	45.19	50.50	87.00	97.79	317.68	314.98	144.68	146.05	41.17	37.14
7	142.30	263.10	129.00	61.22	33.27	40.34	45.75	49.44	71.69	111.32	234.34	320.71	128.12	146.05	39.01	37.61
8	134.80	184.30	127.90	59.47	34.03	39.49	46.83	46.79	61.96	119.68	302.68	377.19	130.48	142.20	38.62	36.20
9	176.90	180.00	123.00	61.56	34.41	40.34	46.29	46.28	63.58	137.34	562.01	384.19	137.62	140.10	37.44	34.20
10	172.80	178.00	124.20	59.40	41.55	39.85	47.38	45.26	62.48	131.93	359.24	332.34	135.27	134.50	37.05	33.60
11	136.70	179.90	119.50	58.47	39.94	39.35	46.84	46.89	61.38	131.93	324.38	330.55	132.91	126.80	36.68	33.60
12	136.80	225.50	111.90	58.47	37.89	38.86	46.84	55.88	59.19	192.34	171.03	337.71	123.26	121.20	35.96	33.30
13	142.30	244.90	106.60	57.55	36.34	38.86	45.06	55.88	61.39	191.51	465.28	526.55	119.90	112.45	35.59	33.30
14	117.10	216.80	104.30	54.77	35.96	37.92	56.64	52.72	63.59	189.45	320.32	563.98	125.65	102.30	35.27	32.99
15	111.10	186.20	102.50	54.77	34.41	37.92	48.66	49.56	65.79	198.74	297.81	547.21	118.47	94.25	34.63	32.68
16	103.00	180.10	99.62	53.85	34.41	37.47	46.89	50.26	71.11	199.72	229.59	463.38	117.70	92.50	33.99	32.68
17	104.30	149.00	97.72	52.90	34.40	37.47	45.76	50.26	79.62	183.25	281.88	448.80	132.97	94.25	33.99	32.35
18	106.40	141.20	97.53	51.95	38.26	37.10	47.44	58.16	81.44	199.34	281.34	408.69	296.50	91.10	33.68	32.35
19	100.00	155.30	100.10	50.97	37.87	37.10	44.63	58.16	80.53	234.33	291.60	380.69	734.30	91.10	33.68	32.68
20	104.10	172.80	96.69	50.00	38.64	37.48	45.26	58.16	90.69	199.34	291.60	353.80	502.78	89.35	34.00	32.68
21	105.60	214.20	104.10	49.01	37.10	38.99	45.26	47.32	75.84	144.31	337.83	342.49	432.21	80.95	33.65	33.01
22	192.70	161.60	114.20	48.02	37.11	40.05	44.64	58.50	84.07	184.87	312.86	348.23	377.52	36.40	33.65	33.34
23	161.00	142.70	94.70	49.01	37.11	41.11	44.65	62.56	95.95	140.88	279.02	406.71	334.01	87.95	33.65	33.34
24	174.50	137.20	85.91	47.63	36.70	41.11	44.65	55.42	101.41	99.62	276.44	374.82	290.16	84.80	33.33	33.01
25	137.90	138.10	84.84	46.24	36.70	40.71	43.64	57.46	98.68	275.00	280.64	346.48	280.43	83.75	33.01	32.68
26	131.30	131.40	97.73	44.65	36.70	40.03	43.14	59.42	99.59	231.89	280.64	326.48	229.81	82.35	33.01	32.67
27	129.00	131.40	102.20	44.11	36.70	38.38	43.14	58.44	86.47	285.11	298.34	276.47	209.07	80.95	32.68	32.33
28	125.50	165.80	95.53	43.63	35.55	44.63	44.11	58.44	85.53	224.00	337.73	229.53	192.94	82.35	32.34	31.98
29	123.10	139.50	94.60	42.67	35.55	46.86	44.69	61.53	83.75	306.80	341.82	236.82	174.99	80.95	32.34	31.64
30	132.60	138.90	91.80	43.63	35.55		44.69	61.53	76.61	308.77	302.84	227.93		76.11		31.64
31	118.30	136.20		43.63	35.17		44.69		79.33		431.30	215.66	**224.04**	**110.39**	**40.09**	**33.58**
Average Q(m3/s)	**140.54**	**179.32**	**118.10**	**56.55**	**35.75**	**38.99**	**45.78**	**52.92**	**78.23**	**172.59**	**306.19**	**357.90**	**117.70**	**36.40**	**32.34**	**31.98**
Min Q	**100.00**	**115.60**	**84.84**	**42.67**	**32.46**	**34.79**	**43.14**	**45.26**	**59.19**	**84.88**	**171.03**	**229.53**	**734.30**	**169.25**	**76.05**	**37.61**
Max Q	**222.40**	**330.40**	**275.30**	**93.40**	**41.55**	**46.86**	**56.64**	**62.56**	**101.41**	**308.77**	**562.01**	**563.98**	**580.72**	**295.67**	**103.91**	**89.93**
Volume (mcm)	**376.42**	**480.28**	**306.11**	**151.48**	**95.74**	**97.69**	**122.63**	**137.18**	**209.53**	**447.34**	**820.10**	**958.60**				

Annexure 4.4a: Daily Dishcarge Data (in m3/s) for Tons at Tiuni gauge-discharge station

Station Name : Tiuni **River : Tons**

Year	2008												2010					
Day	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
1	31.34	29.64	28.83	28.54	66.44	38.72	99.18	137.84	235.77	106.65	47.52	35.53	24.37	23.06	27.54	48.27	63.15	72.93
2	31.04	29.65	28.53	28.81	69.60	41.66	74.55	141.72	145.77	100.63	46.14	35.53	24.91	23.37	27.51	44.55	51.02	71.75
3	31.04	29.65	28.53	29.39	53.80	85.79	69.97	136.24	152.90	98.62	44.76	35.08	24.91	22.78	26.93	28.94	58.60	100.13
4	30.76	29.38	28.27	29.39	39.57	107.37	60.05	135.71	147.95	104.69	42.00	35.08	25.45	22.74	26.99	33.36	79.13	70.25
5	31.33	29.30	28.27	29.13	43.98	114.66	49.77	121.24	157.45	119.52	41.32	34.18	24.44	23.08	32.31	32.63	90.92	77.93
6	31.33	29.37	28.00	29.39	38.36	104.94	45.02	106.15	138.11	108.39	40.64	34.18	24.92	23.08	33.36	34.09	81.48	76.22
7	31.03	29.37	28.00	13.51	33.16	67.06	61.68	132.51	97.67	103.95	39.93	33.73	24.39	22.76	30.39	34.07	86.75	80.49
8	30.74	29.09	28.27	29.92	32.76	71.51	74.47	106.06	97.85	92.86	39.93	33.73	23.97	22.76	25.49	38.13	79.37	72.20
9	30.74	29.09	28.54	30.22	30.18	47.00	127.18	111.35	445.84	90.64	39.22	33.29	23.97	38.60	24.40	39.87	66.73	105.24
10	31.03	29.09	28.54	31.13	28.62	66.01	101.55	103.42	770.19	83.95	41.96	33.29	24.38	28.97	24.04	58.56	68.89	85.61
11	31.03	31.01	28.82	33.25	29.19	67.05	133.82	112.21	364.78	79.54	40.59	32.88	24.38	24.90	24.92	67.38	68.84	79.64
12	31.03	30.46	28.82	33.55	35.02	40.36	131.28	109.32	497.94	77.09	39.30	32.87	24.84	24.92	25.45	69.58	63.17	77.08
13	30.74	30.19	28.82	32.34	33.72	70.71	142.08	106.17	403.26	72.42	38.65	32.45	24.39	24.39	25.45	42.47	64.17	69.74
14	31.04	29.65	28.54	32.68	36.98	65.94	365.13	129.66	323.44	74.65	39.30	32.87	27.70	23.74	25.69	39.52	57.18	59.16
15	31.04	29.94	28.26	33.03	59.16	56.41	276.76	176.69	283.19	78.32	43.20	36.76	27.15	23.42	25.94	56.46	37.57	60.01
16	30.75	29.65	28.25	32.69	48.76	47.83	200.00	166.26	273.31	75.87	40.60	28.98	26.59	33.08	26.49	68.83	50.99	65.13
17	30.75	29.08	28.25	31.33	65.88	48.58	186.67	186.66	217.94	75.87	40.60	29.96	26.04	22.75	27.19	75.83	76.79	114.36
18	30.44	28.82	27.98	32.18	99.45	43.32	239.00	175.77	183.83	77.10	39.95	29.94	24.92	22.50	34.30	79.26	54.17	94.30
19	30.75	28.82	28.25	31.73	121.18	40.23	188.94	165.01	158.75	75.87	39.95	28.95	24.38	22.24	41.11	67.43	46.93	81.54
20	30.47	28.54	27.71	51.21	100.74	39.20	159.95	126.78	151.17	73.42	39.25	28.95	23.67	22.23	45.47	57.16	56.15	119.83
21	29.66	28.05	28.54	42.77	97.70	47.09	164.93	111.14	141.69	70.98	40.49	27.73	23.36	22.52	51.77	57.16	59.99	132.59
22	29.90	28.54	29.09	40.84	96.18	58.50	274.43	97.56	134.90	73.41	39.25	26.54	23.05	23.09	54.15	64.00	71.75	125.30
23	29.90	28.82	28.81	32.22	99.19	75.16	128.10	97.56	134.90	61.15	38.63	25.43	22.80	24.01	51.78	51.08	79.98	134.42
24	29.64	29.09	29.36	31.05	75.35	90.21	268.52	96.29	132.20	57.56	38.63	24.93	22.30	25.42	46.86	56.71	70.57	143.53
25	29.64	29.09	29.90	33.34	66.42	94.73	200.11	94.67	128.62	55.40	38.18	24.41	23.11	26.46	45.45	42.95	75.28	143.53
26	29.39	29.38	30.74	34.49	57.60	111.23	187.95	91.05	122.29	53.95	37.22	24.41	23.10	26.99	43.30	40.47	106.50	136.24
27	29.39	29.38	30.18	37.54	47.02	100.73	158.77	104.98	111.67	49.67	37.22	23.89	23.09	26.99	52.49	43.55	103.50	125.30
28	29.39	28.81	29.91	58.38	41.92	98.36	186.13	97.68	122.29	48.23	36.54	24.41	23.38	27.67	53.95	62.04	103.50	114.36
29	29.89		29.65	63.41	41.22	112.59	226.81	94.63	111.67	47.52	36.54	24.41	23.66		55.41	53.40	83.51	112.54
30	29.92		29.36	70.48	40.39	113.38	157.40	154.11	104.11	47.52	36.03	23.97	23.38		56.94	60.47	79.98	143.53
31	29.92		28.81		37.89		159.18	183.85		47.52		24.99	23.38		54.72		76.45	
Average Q(m3/s)	**30.49**	**29.32**	**28.77**	**35.60**	**57.01**	**72.21**	**158.04**	**126.14**	**216.38**	**76.87**	**40.12**	**30.11**	**24.33**	**24.95**	**37.03**	**51.61**	**71.39**	**98.16**
Min Q	**29.39**	**28.05**	**27.71**	**13.51**	**28.62**	**38.72**	**45.02**	**91.05**	**97.67**	**47.52**	**36.03**	**23.89**	**22.30**	**22.23**	**24.04**	**28.94**	**37.57**	**59.16**
Max Q	**31.34**	**31.01**	**30.74**	**70.48**	**121.18**	**114.66**	**365.13**	**186.66**	**770.19**	**119.52**	**47.52**	**36.76**	**27.70**	**38.60**	**56.94**	**79.26**	**106.50**	**143.53**
Volume (mcm)	**81.65**	**70.93**	**77.05**	**92.27**	**152.71**	**187.17**	**423.31**	**337.85**	**560.86**	**205.89**	**103.99**	**80.64**	**65.18**	**60.35**	**99.17**	**133.77**	**191.20**	**254.44**

Annexure 4.4b: Daily Dishcarge Data (in m3/s) for Pabar at Tiuni Gauge-Discharge Station

Station Name : Tiuni **River : Pabar**

Year	1980				1981				1982				1983			
Day	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**
1	54.00	108.00	65.00	37.00	76.00	109.00	47.00	52.00	66.00	74.00	55.50	24.00	116.00	119.00	119.80	33.50
2	73.00	83.00	65.50	36.25	52.79	159.00	46.00	43.50	68.14	62.00	54.50	23.50	118.00	113.00	124.20	46.00
3	59.65	106.00	61.50	36.25	48.00	149.00	45.93	38.25	70.00	56.50	55.88	23.50	126.00	112.00	140.30	57.00
4	87.50	139.50	59.37	34.00	43.00	143.00	46.00	36.00	73.50	62.00	49.50	23.10	124.00	106.10	135.00	71.00
5	70.00	142.50	62.00	34.75	41.00	160.50	41.50	33.25	73.50	105.30	48.75	22.73	121.00	99.00	126.00	80.50
6	68.00	144.50	65.50	35.50	41.00	284.30	41.50	33.25	71.00	64.50	47.50	22.30	105.00	93.00	129.00	79.28
7	60.50	111.20	69.00	34.00	42.00	266.00	41.50	32.50	66.00	60.00	37.75	22.73	97.12	95.00	130.00	77.50
8	59.00	130.00	62.00	34.75	48.50	228.00	41.50	31.75	51.53	64.50	42.50	22.30	87.00	88.00	131.60	77.50
9	101.50	147.00	74.50	41.00	46.14	218.00	41.50	31.00	62.50	66.50	36.34	22.73	77.00	81.00	136.50	75.00
10	119.90	149.00	76.50	34.75	96.00	209.00	43.98	30.25	60.50	62.50	46.00	21.90	77.50	74.00	132.50	73.50
11	101.00	104.00	74.64	33.20	47.00	188.00	40.50	29.75	58.00	59.00	38.75	21.55	79.50	70.12	130.50	72.50
12	149.00	89.50	72.25	30.75	52.00	143.00	40.00	29.75	60.50	70.28	38.75	21.50	85.00	72.00	130.50	76.50
13	136.00	77.00	63.75	30.00	50.00	145.00	38.00	28.25	56.00	78.00	33.25	21.15	86.00	72.50	129.50	76.50
14	191.00	72.26	60.72	29.25	72.00	137.00	38.00	27.50	50.00	86.50	37.00	20.68	93.27	77.00	132.00	75.75
15	139.50	78.50	57.25	29.00	71.00	128.00	37.50	27.05	51.96	174.50	33.25	20.68	93.50	81.00	129.10	75.00
16	105.50	73.50	53.50	31.01	78.64	126.00	37.50	27.05	85.00	205.00	35.40	20.10	90.00	83.00	136.00	77.50
17	136.90	71.50	52.75	29.00	88.00	125.00	35.75	28.25	91.00	174.50	35.75	20.10	86.50	87.00	132.50	75.50
18	106.50	68.00	51.84	32.40	68.00	121.00	37.00	27.25	77.00	127.00	32.75	20.10	83.00	75.40	116.00	76.25
19	89.50	62.50	53.50	31.50	70.00	112.00	39.00	25.00	71.00	94.41	32.00	20.10	75.00	86.00	100.00	75.50
20	118.50	63.00	53.50	31.50	71.00	102.80	39.00	24.50	74.50	91.00	31.00	19.40	74.00	90.00	77.00	75.50
21	89.50	68.41	57.00	29.25	71.40	89.00	36.50	23.75	63.00	68.00	30.00	19.17	101.40	96.00	50.00	74.50
22	102.00	59.00	58.00	27.50	74.00	85.00	35.50	24.13	74.41	66.50	28.00	18.54	87.00	98.00	35.33	73.50
23	83.50	58.50	52.75	26.75	118.00	81.00	35.00	23.25	69.00	88.00	27.96	18.45	86.50	97.00	23.00	74.00
24	96.83	81.00	50.50	26.00	129.00	80.50	32.05	22.50	72.00	78.00	29.01	18.20	87.50	105.50	22.00	73.75
25	94.50	64.50	48.72	25.25	130.50	73.00	39.00	22.50	82.00	80.00	30.00	17.80	83.00	102.50	21.00	74.25
26	102.50	60.00	48.50	25.25	139.00	72.50	48.50	23.25	107.00	72.33	27.96	17.80	94.00	106.00	21.50	73.50
27	147.00	85.50	47.50	25.25	93.00	60.60	47.00	23.25	84.00	89.00	27.96	18.20	105.00	115.00	27.00	41.45
28	122.00	79.82	45.50	22.75	116.00	66.00	42.00	23.25	72.50	100.00	24.75	19.17	126.20	130.00	30.00	72.00
29	147.00	68.50	43.25	23.50	223.00	63.00	56.00	23.75	74.03	89.00	24.75	18.54	124.50	142.00	29.01	72.50
30	163.50	63.50	41.00	28.02	181.80	61.00	74.33	23.75	67.00	100.00	25.09	18.20	129.00	130.00	28.25	72.00
31	125.90	66.50		22.75	129.00	60.00		23.75	87.00	76.00		17.80	120.50	119.00		71.00
Average Q(m3/s)	**106.47**	**89.54**	**56.36**	**30.58**	**84.09**	**130.49**	**40.79**	**28.81**	**70.63**	**88.54**	**35.41**	**20.52**	**98.03**	**97.26**	**90.49**	**70.96**
Min Q	**54.00**	**58.50**	**41.00**	**22.75**	**41.00**	**60.00**	**32.05**	**22.50**	**50.00**	**56.50**	**24.75**	**17.80**	**74.00**	**70.12**	**21.00**	**33.50**
Max Q	**191.00**	**149.00**	**76.50**	**41.00**	**223.00**	**284.30**	**74.33**	**52.00**	**107.00**	**205.00**	**55.88**	**24.00**	**129.00**	**142.00**	**140.30**	**80.50**
Volume (mcm)	**285.18**	**239.82**	**150.97**	**81.92**	**225.22**	**349.51**	**109.26**	**77.18**	**189.18**	**237.15**	**94.83**	**54.95**	**262.57**	**260.51**	**242.36**	**190.06**

Annexure 4.4b: Daily Dishcarge Data (in m3/s) for Pabar at Tiuni Gauge-Discharge Station

Station Name : Tiuni **River : Pabar**

Year	1984				1985				1986				1987			
Day	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**
1	38.00	62.50	93.83	21.30	26.00	91.00	76.00	36.00	46.00	144.00	38.30	44.00	36.00	39.81	39.32	16.92
2	37.50	62.46	99.09	23.55	24.00	122.20	68.00	35.00	46.00	108.00	47.00	37.00	35.00	37.00	39.33	18.50
3	40.50	63.00	99.09	23.00	23.50	119.00	67.00	34.00	45.50	72.00	45.50	34.00	35.97	36.28	32.50	16.75
4	37.50	58.00	96.01	23.00	25.50	84.00	58.50	33.50	45.00	104.00	45.50	30.04	34.64	34.47	31.00	18.50
5	35.00	49.50	75.17	23.00	25.50	78.00	65.47	32.00	45.00	67.00	45.00	36.00	34.00	34.00	30.09	17.62
6	60.69	52.00	82.65	22.46	20.38	65.00	58.00	35.00	45.00	65.00	43.91	37.00	46.60	33.70	30.50	11.78
7	80.00	53.50	63.96	22.46	23.50	61.00	56.50	41.00	47.00	88.00	44.00	34.00	44.13	34.27	31.16	16.42
8	49.00	58.00	37.80	21.37	24.00	57.50	49.50	41.00	55.00	87.00	41.50	39.12	39.38	34.70	37.34	18.18
9	33.45	51.50	36.80	21.37	28.00	35.00	43.00	43.00	55.00	115.00	41.50	38.47	43.06	37.80	59.50	17.76
10	33.36	52.50	52.75	20.28	26.50	32.00	41.00	274.60	51.00	65.00	41.00	32.50	40.56	37.82	45.47	16.97
11	38.01	53.50	54.25	20.28	28.50	32.50	40.00	108.00	46.00	132.00	36.00	34.90	36.00	32.40	41.60	15.50
12	34.10	53.50	60.22	20.28	32.50	49.50	51.00	46.00	58.35	62.00	38.00	39.67	36.50	32.38	22.13	14.67
13	40.00	132.20	59.47	19.74	42.26	45.50	75.50	44.00	51.00	168.00	34.74	37.88	36.11	37.07	12.50	12.68
14	34.10	227.20	43.78	19.74	41.50	57.50	103.50	45.00	55.00	68.00	30.50	38.39	57.66	33.37	22.46	10.61
15	37.25	162.10	31.82	18.65	41.50	67.50	95.00	48.00	43.00	96.00	27.00	35.94	84.69	33.00	21.77	12.91
16	38.00	110.50	39.29	18.11	42.50	57.50	82.50	44.00	43.00	136.30	32.50	36.64	37.51	32.50	17.76	26.00
17	40.50	82.00	48.26	19.19	181.90	46.54	80.00	56.00	40.00	55.00	32.50	37.67	37.00	32.21	15.62	26.00
18	98.00	76.00	51.25	18.11	123.50	49.50	70.00	28.00	41.00	70.00	35.00	22.87	37.18	34.13	13.38	7.05
19	73.00	78.00	49.01	17.53	97.30	43.00	80.00	49.00	40.88	70.00	31.50	25.10	37.00	32.16	16.15	14.02
20	56.00	78.00	37.05	17.81	108.90	43.00	80.00	46.00	46.00	70.00	30.88	27.34	36.55	35.81	16.00	23.44
21	143.60	77.58	33.31	17.81	106.80	91.00	59.00	45.00	44.50	76.00	29.00	28.32	38.00	32.16	21.72	18.48
22	89.00	61.00	30.32	17.23	106.80	102.50	58.14	44.00	46.00	98.00	27.50	24.53	38.00	33.47	15.69	17.00
23	81.00	60.00	27.33	17.57	106.10	98.00	64.00	40.50	88.00	76.04	26.50	24.68	42.00	30.00	16.13	15.11
24	75.00	56.50	26.34	16.94	105.40	86.00	54.00	35.00	122.00	82.00	29.00	23.90	31.67	38.50	14.44	13.67
25	58.00	57.50	23.60	17.23	104.00	78.00	52.00	32.00	250.00	80.00	37.00	23.84	33.67	38.31	12.20	15.05
26	69.00	56.00	19.11	17.23	107.80	68.00	56.00	30.00	250.00	69.00	37.50	24.00	70.00	39.22	12.16	13.69
27	50.00	83.50	17.62	16.65	107.20	65.00	58.50	29.50	560.00	60.00	33.63	22.29	46.67	38.60	12.50	13.41
28	46.60	83.50	15.37	16.35	83.29	59.00	57.00	34.00	96.67	63.00	39.00	22.23	46.76	31.92	17.56	15.03
29	58.00	89.50	11.64	16.06	79.48	55.00	46.00	35.00	96.00	64.00	48.50	22.00	43.55	43.60	16.81	15.03
30	43.00	72.50	18.36	15.77	158.70	56.00	41.00	34.00	92.00	65.00	48.00	22.00	42.78	41.00	12.50	15.03
31	48.00	76.00		15.48	110.00	73.00		31.59	84.50	60.50		20.80	46.06	40.12		12.50
Average Q(m3/s)	**54.68**	**77.08**	**47.82**	**19.21**	**69.77**	**66.72**	**62.87**	**48.70**	**86.27**	**85.03**	**37.25**	**30.87**	**42.09**	**35.54**	**24.24**	**16.01**
Min Q	**33.36**	**49.50**	**11.64**	**15.48**	**20.38**	**32.00**	**40.00**	**28.00**	**40.00**	**55.00**	**26.50**	**20.80**	**31.67**	**30.00**	**12.16**	**7.05**
Max Q	**143.60**	**227.20**	**99.09**	**23.55**	**181.90**	**122.20**	**103.50**	**274.60**	**560.00**	**168.00**	**48.50**	**44.00**	**84.69**	**43.60**	**59.50**	**26.00**
Volume (mcm)	**146.46**	**206.46**	**123.95**	**51.46**	**186.87**	**178.70**	**162.96**	**130.44**	**231.07**	**227.74**	**96.55**	**82.70**	**112.73**	**95.19**	**62.84**	**42.88**

Annexure 4.4b: Daily Dishcarge Data (in m3/s) for Pabar at Tiuni Gauge-Discharge Station

Station Name : Tiuni **River : Pabar**

Year	1988				1989				1990				1991			
Day	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**
1	21.34	109.90	68.56	47.13	35.06	138.00	193.40	29.42	119.00	175.30	136.00	85.28	77.98	90.12	95.72	48.22
2	45.60	139.30	33.30	47.13	31.07	131.10	320.30	60.34	127.50	180.40	134.90	83.74	78.01	85.99	106.70	47.00
3	35.00	446.20	66.29	47.36	27.63	124.10	196.40	59.61	118.70	160.00	127.40	83.19	76.35	85.28	110.40	45.78
4	33.41	136.10	66.29	45.64	26.65	145.10	220.40	61.69	115.80	193.40	126.10	100.30	77.38	68.87	112.50	43.36
5	59.59	155.00	61.95	45.08	26.08	139.80	219.90	61.11	113.70	175.70	126.60	96.91	69.43	80.42	98.37	42.84
6	56.47	116.20	66.67	47.36	25.28	57.75	153.90	61.04	114.00	209.20	215.40	90.63	60.90	103.90	98.36	41.71
7	62.15	130.00	68.19	47.36	26.53	62.79	141.50	59.46	124.10	200.00	198.80	87.52	59.73	160.00	94.04	41.23
8	23.13	131.20	65.48	43.74	35.98	51.06	132.80	59.27	118.60	232.90	201.70	86.60	57.06	73.53	85.24	41.72
9	49.87	143.70	66.04	43.74	38.52	50.45	94.89	58.39	116.60	287.90	141.50	80.59	63.91	84.11	72.24	43.09
10	47.00	179.20	59.75	39.18	36.63	63.92	91.69	58.34	292.60	305.70	132.50	76.08	64.36	79.58	46.68	44.59
11	48.52	170.20	59.70	36.62	37.56	51.80	84.85	55.53	252.20	285.30	130.30	58.69	63.59	73.16	85.04	42.23
12	46.92	176.10	51.71	34.81	42.36	68.21	85.88	54.46	221.20	252.30	127.90	46.15	61.91	62.06	79.13	41.89
13	68.20	118.40	40.57	34.81	52.86	55.30	79.01	54.09	182.50	253.50	129.60	45.12	58.10	55.54	76.98	41.77
14	65.90	118.40	40.46	45.64	49.50	64.38	90.76	53.56	161.00	284.90	125.30	59.45	60.02	47.73	89.37	41.77
15	56.90	118.40	42.07	52.20	63.30	53.07	91.28	53.40	152.80	286.90	123.20	59.46	65.95	47.46	108.20	39.94
16	62.47	83.89	51.58	52.20	54.31	130.70	89.09	49.81	178.20	284.40	121.20	44.96	55.80	45.37	97.59	39.75
17	56.00	61.85	52.33	52.20	43.65	93.66	90.68	50.14	232.60	238.50	121.40	44.26	55.87	45.44	94.67	39.75
18	48.38	63.27	52.32	52.20	42.96	79.79	82.68	50.10	184.20	216.50	119.10	44.28	107.80	50.84	87.09	39.02
19	231.00	152.70	49.12	50.19	42.35	34.77	80.47	49.47	177.50	205.00	125.00	44.30	87.57	62.19	69.50	38.28
20	132.80	174.90	51.01	50.00	41.34	40.91	83.36	49.38	150.80	207.70	121.70	45.86	80.29	50.96	73.58	37.44
21	80.86	174.90	52.33	43.74	36.96	42.25	71.93	49.56	160.60	208.90	113.50	45.86	80.66	73.10	70.60	36.59
22	359.90	178.90	53.52	41.62	41.45	83.34	71.33	48.56	176.70	217.60	112.90	45.81	84.54	90.38	65.00	35.55
23	50.34	167.70	160.60	41.62	42.42	93.69	69.73	48.31	159.90	206.80	103.10	44.82	81.55	101.80	59.22	32.40
24	200.80	167.80	321.70	39.50	82.32	109.30	70.22	47.95	150.40	196.50	101.20	44.31	74.60	94.50	58.55	30.84
25	110.00	158.40	592.60	39.50	49.80	201.10	66.43	47.95	153.20	143.40	103.90	42.99	72.51	136.40	56.83	32.16
26	116.30	154.20	126.10	38.87	47.65	82.55	63.27	47.17	124.80	134.10	99.69	40.59	95.72	115.90	54.72	31.20
27	82.44	129.40	159.50	34.99	50.44	76.75	63.37	47.17	159.80	131.70	97.77	41.29	84.54	70.36	54.00	30.62
28	61.47	129.40	59.45	33.39	51.38	524.60	63.42	45.00	178.90	141.50	92.96	41.01	81.55	106.10	52.84	30.03
29	112.20	88.86	53.88	32.88	79.02	83.89	60.49	45.20	197.90	194.10	90.12	40.73	80.29	90.74	51.64	29.90
30	104.80	71.65	48.38	32.88	82.73	168.60	60.32	45.26	175.90	237.70	85.99	40.62	72.88	92.71	49.03	28.84
31	107.20	63.73		30.19	101.30	215.80		45.15	181.90	144.60		40.51	92.96	90.38		30.82
Average Q(m3/s)	**85.06**	**142.25**	**91.38**	**42.70**	**46.62**	**107.05**	**109.46**	**51.80**	**163.66**	**212.66**	**126.22**	**59.09**	**73.67**	**81.13**	**78.46**	**38.40**
Min Q	**21.34**	**61.85**	**33.30**	**30.19**	**25.28**	**34.77**	**60.32**	**29.42**	**113.70**	**131.70**	**85.99**	**40.51**	**55.80**	**45.37**	**46.68**	**28.84**
Max Q	**359.90**	**446.20**	**592.60**	**52.20**	**101.30**	**524.60**	**320.30**	**61.69**	**292.60**	**305.70**	**215.40**	**100.30**	**107.80**	**160.00**	**112.50**	**48.22**
Volume (mcm)	**227.83**	**381.01**	**236.86**	**114.37**	**124.86**	**286.72**	**283.72**	**138.75**	**438.36**	**569.58**	**327.17**	**158.28**	**197.32**	**217.29**	**203.37**	**102.84**

Annexure 4.4b: Daily Dishcarge Data (in m3/s) for Pabar at Tiuni Gauge-Discharge Station

Station Name : Tiuni **River : Pabar**

Year	1992				1993				1994				1995			
Day	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**
1	60.80	102.10	82.94	55.11	20.10	107.70	53.55	34.21	36.85	269.40	157.00	38.87	69.15	112.00	152.20	32.57
2	64.95	85.42	98.29	54.51	20.10	60.28	54.33	32.89	50.41	175.80	153.30	39.92	69.15	192.80	145.10	31.86
3	45.09	155.40	91.64	53.90	16.59	126.70	110.30	32.89	51.46	233.60	160.20	35.72	68.34	205.50	139.70	31.86
4	42.50	130.30	103.50	53.52	9.23	60.72	66.11	24.87	53.04	225.60	184.10	34.74	68.13	157.00	618.00	30.09
5	45.97	167.30	80.49	52.37	27.63	62.63	63.25	31.79	56.96	198.20	301.40	32.78	61.34	167.90	684.50	30.09
6	61.03	135.30	74.82	51.73	29.82	59.70	73.25	30.94	67.18	169.50	175.70	31.35	57.63	173.30	530.40	29.93
7	63.08	131.90	148.50	46.27	36.42	63.54	89.58	34.05	45.39	177.80	160.80	30.05	55.57	113.50	474.70	28.35
8	59.48	166.80	93.63	43.95	48.46	58.76	85.82	32.47	59.26	154.90	151.80	29.09	53.21	191.80	303.80	27.87
9	71.62	181.20	80.50	43.33	51.02	59.71	67.94	30.15	67.55	132.60	153.20	29.09	57.63	188.50	305.10	26.90
10	66.65	115.90	141.00	42.86	54.99	66.41	75.37	33.78	53.70	171.80	150.90	27.83	54.30	177.40	255.00	25.13
11	62.04	131.20	225.50	36.36	203.10	65.53	75.85	19.26	53.01	164.60	161.00	27.63	48.02	140.90	206.70	25.05
12	78.06	115.30	177.00	29.86	171.40	60.51	80.54	19.05	59.02	185.00	149.30	26.87	51.16	179.20	202.70	24.84
13	85.59	161.90	154.20	24.18	150.80	63.34	172.80	18.83	53.53	153.10	145.80	25.16	59.57	165.80	200.60	24.48
14	72.81	128.50	123.30	24.15	111.90	60.42	157.90	19.44	52.60	162.80	139.20	26.29	46.90	176.20	172.70	22.87
15	71.79	120.90	103.60	30.21	103.60	59.16	118.20	20.24	46.02	177.20	137.30	26.85	50.48	171.30	172.60	22.70
16	86.53	111.50	98.68	21.06	205.00	57.28	88.29	19.78	45.30	260.20	128.00	26.21	37.49	156.40	167.40	22.58
17	91.82	137.90	99.98	29.30	188.40	81.48	81.17	19.78	45.30	146.60	132.90	23.67	26.12	161.10	164.70	22.22
18	97.40	186.10	96.71	23.77	194.10	67.15	55.86	19.47	50.78	106.10	127.40	22.29	25.08	170.90	163.00	21.99
19	93.96	161.20	58.59	21.01	156.30	48.61	82.39	16.24	157.30	77.09	127.40	22.29	26.43	175.40	161.10	21.86
20	133.50	118.60	57.70	21.16	110.50	45.48	47.76	15.24	494.20	64.55	11.93	21.50	57.93	129.80	145.80	17.97
21	123.00	134.10	56.90	22.50	80.64	42.85	49.56	16.24	570.80	63.75	96.21	21.18	66.67	121.60	115.50	21.81
22	124.00	157.40	66.15	25.83	82.10	40.96	45.20	16.26	404.10	51.68	84.64	20.58	59.52	114.30	89.62	21.81
23	145.30	145.70	64.79	20.77	127.00	39.07	43.07	15.91	408.60	69.98	67.43	21.10	74.70	114.40	74.00	21.66
24	158.40	110.30	60.99	26.29	125.50	38.30	47.77	16.53	391.60	167.30	56.39	18.69	164.40	107.60	71.49	21.66
25	125.70	111.60	60.09	26.29	110.30	37.68	43.96	16.64	234.10	129.20	53.03	17.85	70.15	110.60	63.46	21.67
26	127.80	112.60	59.13	25.48	124.20	40.06	40.04	16.53	153.50	128.60	46.30	16.54	71.91	88.75	59.85	21.33
27	124.00	113.20	58.61	25.60	129.00	37.40	34.45	16.39	162.80	141.60	45.34	15.71	61.88	84.72	53.51	20.55
28	125.50	103.70	58.26	22.55	127.70	36.26	33.76	16.36	292.10	141.60	44.32	15.00	200.00	83.81	43.49	20.73
29	183.00	100.40	58.11	20.77	125.00	38.05	37.69	15.88	186.40	141.60	42.31	15.54	72.59	86.43	38.55	20.73
30	142.70	92.57	56.02	22.48	126.40	42.22	33.10	15.36	239.20	144.80	40.67	15.54	122.20	126.80	32.93	20.73
31	144.90	90.15		23.57	126.30	44.65		16.53	265.10	148.90		15.10	89.14	168.00		20.37
Average Q(m3/s)	**96.10**	**129.56**	**92.99**	**32.93**	**103.02**	**57.18**	**70.30**	**22.06**	**158.30**	**152.76**	**119.51**	**24.87**	**67.64**	**145.60**	**200.27**	**24.33**
Min Q	**42.50**	**85.42**	**56.02**	**20.77**	**9.23**	**36.26**	**33.10**	**15.24**	**36.85**	**51.68**	**11.93**	**15.00**	**25.08**	**83.81**	**32.93**	**17.97**
Max Q	**183.00**	**186.10**	**225.50**	**55.11**	**205.00**	**126.70**	**172.80**	**34.21**	**570.80**	**269.40**	**301.40**	**39.92**	**200.00**	**205.50**	**684.50**	**32.57**
Volume (mcm)	**257.38**	**347.02**	**241.02**	**88.19**	**275.93**	**153.15**	**182.21**	**59.10**	**423.98**	**409.14**	**309.77**	**66.62**	**181.16**	**389.98**	**519.11**	**65.17**

Annexure 4.4b: Daily Dishcarge Data (in m3/s) for Pabar at Tiuni Gauge-Discharge Station

Station Name : Tiuni **River : Pabar**

Year	1996				1997				1998				1999			
Day	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**
1	59.53	63.41	48.52	37.32	30.92	79.04	62.73	30.80	30.01	29.96	34.98	58.31	29.28	41.56	32.99	29.80
2	60.99	60.95	48.18	34.93	31.02	76.20	62.85	31.46	30.97	29.81	34.11	57.47	30.90	58.03	32.29	28.55
3	58.04	72.49	48.75	35.43	35.52	78.92	69.77	31.02	29.48	28.78	42.38	55.58	32.50	52.73	31.63	26.99
4	56.35	55.20	50.74	32.50	30.98	95.07	69.86	33.69	28.51	27.92	39.03	41.60	33.47	59.46	29.98	25.74
5	60.09	76.20	78.70	38.43	30.58	80.38	20.50	33.53	31.23	25.60	35.66	38.31	32.72	51.94	30.87	27.03
6	59.01	68.86	64.21	34.11	30.00	67.29	65.01	33.53	34.50	27.31	35.66	41.46	30.73	50.59	31.31	26.07
7	57.77	64.21	66.32	33.57	25.83	76.89	73.92	34.86	31.50	41.61	37.92	42.35	30.81	53.58	30.33	25.26
8	58.21	61.81	165.80	28.14	32.15	72.60	68.75	34.48	33.08	41.41	38.33	41.50	29.93	63.31	29.75	24.65
9	59.74	67.30	225.50	24.42	33.57	71.55	62.67	33.64	30.05	31.51	31.67	39.99	26.54	59.76	28.90	23.57
10	59.41	66.55	207.40	22.79	35.35	63.37	57.72	30.54	32.61	66.04	31.29	39.28	53.14	139.40	31.21	23.98
11	54.83	66.94	112.10	22.22	37.17	63.37	62.65	29.98	28.70	61.05	36.02	38.89	39.01	134.00	36.00	25.62
12	62.07	66.32	100.20	20.53	38.22	80.04	57.11	29.44	27.56	37.14	37.27	31.15	19.88	102.10	42.74	25.96
13	66.40	98.42	74.68	20.18	38.08	77.65	50.95	28.56	32.13	29.30	39.36	27.98	20.60	75.67	43.96	26.35
14	60.79	225.90	66.05	20.63	39.28	74.51	45.57	28.30	28.98	28.94	42.04	25.91	16.96	57.14	44.64	25.18
15	61.17	203.60	75.90	23.09	37.62	52.07	40.64	27.91	24.33	27.96	41.94	24.91	18.82	45.82	43.00	24.82
16	67.38	108.50	60.48	25.12	35.34	73.16	39.22	29.43	31.40	47.54	38.54	23.62	19.44	38.50	41.10	24.04
17	67.26	87.94	56.49	30.02	34.58	70.96	37.50	30.05	30.76	41.42	37.04	160.20	19.67	36.48	37.06	25.32
18	67.06	102.30	50.32	32.51	27.86	80.54	35.27	29.93	30.48	31.70	35.55	205.60	21.09	46.52	33.79	24.68
19	62.16	81.14	48.01	34.15	33.33	82.06	34.36	29.98	66.49	38.63	36.56	149.20	26.00	53.22	32.84	25.36
20	60.36	77.98	46.13	35.56	37.72	70.51	37.63	31.74	75.63	39.95	35.80	62.75	43.45	55.52	32.37	25.36
21	59.24	79.68	45.81	40.03	35.64	65.40	40.33	31.34	71.86	36.04	31.06	59.77	120.50	57.90	34.94	29.29
22	66.11	108.70	38.08	38.83	36.91	60.42	39.09	32.25	65.76	92.02	145.30	56.92	89.10	56.87	34.65	26.17
23	57.94	106.80	42.95	40.35	36.48	56.67	39.96	31.86	55.16	92.02	160.10	55.98	55.68	47.61	43.40	24.61
24	54.42	131.70	42.70	39.56	38.51	54.00	38.47	30.86	35.11	84.95	147.00	43.86	51.74	44.71	40.33	24.61
25	54.25	119.10	40.22	38.32	75.29	53.71	36.13	29.16	29.05	74.41	125.80	43.10	46.44	42.75	37.23	23.06
26	83.73	55.23	45.77	37.41	78.78	60.47	35.12	29.35	29.05	59.61	56.25	41.07	38.12	41.23	37.23	22.37
27	62.22	45.26	41.91	37.91	60.82	54.48	35.99	29.54	27.55	42.55	53.20	37.03	32.69	44.24	37.70	21.77
28	58.72	42.28	36.84	35.85	76.50	85.02	40.49	29.15	25.20	44.11	63.91	32.05	30.50	41.41	33.98	22.69
29	54.22	39.24	34.66	39.36	62.56	77.94	33.99	28.56	24.51	36.96	62.23	29.98	25.11	41.60	34.51	23.87
30	61.88	47.99	47.63	36.16	49.37	72.98	31.97	28.87	26.85	35.39	60.57	28.05	26.73	40.83	31.83	22.20
31	61.64	51.24		37.50	70.32	65.81		29.17	33.06	36.73		25.69	33.04	33.99		22.57
Average Q(m3/s)	**61.06**	**83.98**	**70.37**	**32.48**	**41.82**	**70.74**	**47.54**	**30.74**	**35.86**	**44.14**	**54.89**	**53.53**	**36.28**	**57.05**	**35.42**	**25.08**
Min Q	**54.22**	**39.24**	**34.66**	**20.18**	**25.83**	**52.07**	**20.50**	**27.91**	**24.33**	**25.60**	**31.06**	**23.62**	**16.96**	**33.99**	**28.90**	**21.77**
Max Q	**83.73**	**225.90**	**225.50**	**40.35**	**78.78**	**95.07**	**73.92**	**34.86**	**75.63**	**92.02**	**160.10**	**205.60**	**120.50**	**139.40**	**44.64**	**29.80**
Volume (mcm)	**163.55**	**224.92**	**182.39**	**87.00**	**112.00**	**189.48**	**123.23**	**82.34**	**96.04**	**118.23**	**142.26**	**143.39**	**97.16**	**152.80**	**91.81**	**67.18**

Annexure 4.4b: Daily Dishcarge Data (in m3/s) for Pabar at Tiuni Gauge-Discharge Station

Station Name : Tiuni **River : Pabar**

Year	2000				2001				2002				2003			
Day	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**
1	51.29	79.14	51.96	27.70	34.92	31.11	45.99	21.11	37.42	23.64	108.30	44.69	37.90	47.53	42.80	34.52
2	44.64	67.67	45.48	26.39	32.16	28.41	53.96	21.67	39.46	23.51	96.27	43.50	36.63	66.87	43.32	34.92
3	37.97	60.72	43.22	24.44	33.88	29.04	39.91	21.46	40.75	24.36	95.82	41.91	38.30	76.97	93.25	35.32
4	36.84	46.05	38.00	23.29	33.19	31.54	37.87	21.20	39.09	25.10	92.25	40.21	37.31	85.03	66.94	34.92
5	36.45	39.77	34.58	21.30	33.48	33.77	39.05	20.94	37.37	42.14	85.56	39.52	37.31	93.10	51.53	34.52
6	33.37	32.96	34.27	21.70	35.57	33.14	36.78	20.68	35.15	36.95	80.20	38.33	35.00	93.67	69.96	34.92
7	29.91	31.39	34.99	21.10	37.05	35.03	34.89	20.42	34.40	38.06	78.19	37.53	35.99	79.18	68.26	33.73
8	27.57	30.00	34.19	19.50	38.24	42.66	32.89	19.90	31.40	45.10	91.35	36.32	34.61	83.67	45.84	33.36
9	28.24	27.00	35.14	19.20	36.46	48.03	33.21	19.35	29.80	42.37	89.65	35.11	33.38	81.62	42.78	32.62
10	29.24	30.29	34.22	18.70	39.86	43.77	31.30	18.61	28.29	50.01	82.31	33.91	31.86	80.38	46.85	32.27
11	31.81	34.09	40.83	18.35	57.56	71.87	29.92	18.14	30.30	47.12	79.23	33.14	29.22	65.58	51.90	31.92
12	55.23	29.66	35.92	17.90	85.02	68.27	33.42	17.72	29.34	48.77	84.04	33.14	26.95	68.88	47.56	31.56
13	44.29	29.66	34.30	17.70	64.09	78.47	31.63	17.50	31.26	66.60	209.20	32.51	28.97	59.43	46.96	30.84
14	66.86	36.82	32.59	17.70	69.41	59.75	29.63	17.29	32.20	121.10	88.73	32.20	42.71	68.88	43.12	30.56
15	58.53	34.74	31.42	17.45	68.27	67.65	25.04	17.08	28.90	117.30	81.63	32.20	49.68	65.54	43.40	30.00
16	119.10	34.22	30.51	17.45	68.65	69.88	23.35	16.65	27.57	102.40	77.03	31.80	47.14	53.27	51.53	29.43
17	105.90	35.25	30.78	17.45	69.98	59.38	22.50	16.00	26.54	86.36	78.78	30.63	38.74	50.87	48.77	29.19
18	99.22	37.51	30.78	17.25	64.63	69.22	25.66	15.57	29.25	79.34	79.70	29.58	43.02	46.86	46.87	28.71
19	91.11	44.73	33.30	17.00	50.04	51.83	22.83	15.17	29.97	68.60	77.43	28.55	39.02	72.47	43.99	28.41
20	86.26	54.41	32.44	16.75	46.38	51.13	20.71	14.82	31.90	76.84	75.29	28.15	40.24	70.66	43.02	28.10
21	133.30	36.02	32.38	16.50	49.66	48.40	19.37	14.82	31.15	72.05	72.64	26.97	56.14	56.17	12.65	27.83
22	186.80	34.01	30.81	15.70	53.57	54.89	18.85	14.66	29.26	67.78	71.53	25.78	49.39	51.18	43.03	27.27
23	159.80	39.65	30.00	15.21	71.17	56.30	18.16	14.47	28.60	67.25	68.58	24.56	43.84	47.16	53.93	27.27
24	100.70	45.19	29.44	13.75	72.90	58.29	16.55	14.20	27.35	72.35	65.80	23.53	47.99	45.82	54.48	26.81
25	78.88	43.98	30.31	13.40	69.39	53.55	18.65	14.28	25.60	70.85	61.29	22.75	44.05	45.48	50.39	26.36
26	103.20	37.03	29.50	13.20	67.92	55.48	20.19	14.10	25.00	71.75	57.11	21.69	44.04	52.89	43.69	25.91
27	99.50	35.44	29.01	12.70	70.04	59.90	21.39	13.94	24.00	75.84	54.66	21.21	56.60	80.59	43.04	25.45
28	146.40	33.04	28.00	12.40	63.12	54.83	19.91	13.45	23.64	66.14	51.41	19.75	61.31	68.51	42.15	24.80
29	149.20	35.75	28.37	12.40	50.81	53.06	19.15	13.29	24.53	70.74	50.03	18.35	46.81	78.71	34.11	24.22
30	116.90	40.89	29.00	13.51	37.65	57.19	18.59	13.12	24.54	72.41	46.72	17.56	41.05	58.97	35.32	24.20
31	89.73	45.40		14.92	32.94	51.88		12.95	24.66	93.15		16.88	38.36	50.50		24.49
Average Q(m3/s)	**79.94**	**40.08**	**33.86**	**17.81**	**52.84**	**51.86**	**28.05**	**16.92**	**30.28**	**63.42**	**81.02**	**30.39**	**41.08**	**66.01**	**48.38**	**29.82**
Min Q	**27.57**	**27.00**	**28.00**	**12.40**	**32.16**	**28.41**	**16.55**	**12.95**	**23.64**	**23.51**	**46.72**	**16.88**	**26.95**	**45.48**	**12.65**	**24.20**
Max Q	**186.80**	**79.14**	**51.96**	**27.70**	**85.02**	**78.47**	**53.96**	**21.67**	**40.75**	**121.10**	**209.20**	**44.69**	**61.31**	**93.67**	**93.25**	**35.32**
Volume (mcm)	**214.12**	**107.35**	**87.76**	**47.69**	**141.52**	**138.91**	**72.69**	**45.32**	**81.10**	**169.86**	**210.02**	**81.39**	**110.04**	**176.81**	**125.40**	**79.87**

Annexure 4.4b: Daily Dishcarge Data (in m3/s) for Pabar at Tiuni Gauge-Discharge Station

Station Name : Tiuni **River : Pabar**

Year	2004				2005				2006				2007			
Day	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**	**Jul**	**Aug**	**Sep**	**Oct**
1	34.25	51.15	37.07	16.71	49.78	65.26	27.31	41.80	33.40	45.71	41.35	16.00	29.99	21.48	31.04	22.05
2	36.78	41.44	35.79	16.42	46.10	66.53	26.57	40.60	33.40	52.44	43.08	15.67	31.36	21.07	57.77	22.05
3	35.04	38.10	35.79	17.00	46.10	67.38	25.47	39.76	37.31	48.07	43.48	14.96	43.44	77.65	62.56	21.65
4	36.63	31.30	33.66	17.59	45.66	59.72	24.26	39.10	38.02	48.46	39.49	14.72	43.44	85.17	42.94	20.63
5	33.45	31.30	31.95	17.88	52.25	52.48	25.47	38.32	35.53	66.25	37.68	14.42	36.73	69.88	40.08	19.95
6	30.98	30.00	29.82	17.59	118.10	46.95	25.10	37.60	30.20	63.85	37.67	13.82	29.67	44.81	35.40	19.95
7	33.41	29.10	29.42	17.30	66.76	43.84	23.26	36.52	25.76	65.85	34.56	13.52	25.32	49.10	33.06	19.02
8	30.53	44.40	30.62	16.12	48.19	38.41	25.10	35.86	26.60	73.02	32.24	13.22	24.20	41.28	33.57	16.69
9	31.21	35.42	29.62	15.56	62.53	38.01	25.11	35.50	25.38	70.62	30.21	13.22	49.11	35.81	32.50	16.69
10	28.52	36.31	28.33	15.36	61.48	36.45	25.43	34.84	30.26	62.55	28.43	12.92	31.00	36.88	32.50	16.32
11	27.52	74.19	27.10	14.96	66.30	36.07	24.83	34.84	37.66	64.19	25.76	12.65	30.67	36.32	30.64	15.95
12	24.52	50.63	26.70	15.60	61.37	36.07	26.94	34.48	33.00	52.55	23.64	12.25	31.72	41.69	29.51	15.60
13	21.73	65.56	25.51	16.42	75.65	36.07	28.04	34.48	34.31	55.56	25.31	12.08	33.07	75.99	29.52	15.26
14	19.69	59.73	24.70	16.97	84.29	32.97	26.68	34.14	35.11	42.67	27.39	11.94	29.22	50.86	29.16	14.91
15	18.51	51.33	27.08	15.87	99.88	31.42	25.78	33.88	30.31	47.87	25.31	11.82	26.76	46.48	28.25	14.91
16	20.93	37.17	29.15	15.39	104.50	44.99	26.96	33.22	29.04	49.47	28.90	11.71	24.66	40.51	26.00	14.56
17	18.21	33.16	30.22	15.39	97.57	77.71	29.62	32.68	29.29	46.67	27.30	11.49	25.03	38.40	24.13	14.21
18	17.73	43.79	28.77	14.79	104.00	60.86	50.69	32.32	39.49	46.27	24.51	11.49	24.30	35.39	25.90	13.94
19	13.38	36.30	27.95	14.64	74.01	53.04	52.20	31.72	82.37	42.27	21.88	11.38	23.94	39.66	23.60	13.67
20	12.47	32.77	25.81	14.32	63.31	45.39	45.44	31.48	110.30	44.68	24.52	11.29	21.09	42.44	24.43	13.42
21	13.64	30.96	24.73	14.17	51.05	41.51	41.07	31.48	55.91	58.33	27.99	11.29	25.06	53.80	25.58	13.16
22	13.20	58.38	24.68	14.17	47.36	38.01	39.05	31.12	58.40	45.45	25.75	11.20	34.88	40.09	29.53	12.91
23	12.94	69.43	24.30	13.86	45.40	36.51	37.30	30.76	64.64	57.09	24.51	11.12	31.37	40.09	25.05	12.41
24	12.20	60.97	23.18	13.72	46.98	35.44	53.95	30.63	62.56	47.47	24.15	11.12	40.10	36.34	23.33	12.16
25	11.86	50.20	22.40	13.57	45.69	33.94	51.46	30.28	59.51	52.29	22.68	11.03	29.51	34.61	22.99	11.91
26	12.03	51.05	22.02	14.04	42.35	32.90	47.31	30.28	62.99	46.26	21.46	10.96	27.60	29.92	25.21	11.66
27	12.43	44.19	20.01	13.73	73.37	31.93	45.84	29.89	59.39	44.64	19.62	10.96	26.48	31.00	24.42	11.41
28	17.48	40.00	19.31	13.41	55.20	31.16	46.90	29.89	55.43	44.24	18.42	10.88	24.67	29.81	22.45	11.41
29	29.11	38.65	18.28	13.30	134.50	29.61	45.04	29.49	61.80	42.26	17.68	10.88	24.12	31.84	22.06	11.28
30	31.87	35.89	17.29	13.01	76.86	28.78	43.25	29.06	57.15	40.77	16.65	10.85	23.84	33.54	21.66	11.41
31	57.63	39.06		13.01	71.70	28.41		29.06	56.31	37.68		10.86	23.49	31.79		11.28
Average Q(m3/s)	**24.19**	**44.26**	**27.04**	**15.22**	**68.33**	**43.16**	**34.71**	**33.71**	**46.16**	**51.79**	**28.05**	**12.31**	**29.87**	**42.70**	**30.49**	**15.24**
Min Q	**11.86**	**29.10**	**17.29**	**13.01**	**42.35**	**28.41**	**23.26**	**29.06**	**25.38**	**37.68**	**16.65**	**10.85**	**21.09**	**21.07**	**21.66**	**11.28**
Max Q	**57.63**	**74.19**	**37.07**	**17.88**	**134.50**	**77.71**	**53.95**	**41.80**	**110.30**	**73.02**	**43.48**	**16.00**	**49.11**	**85.17**	**62.56**	**22.05**
Volume (mcm)	**64.79**	**118.53**	**70.09**	**40.77**	**183.02**	**115.59**	**89.98**	**90.29**	**123.62**	**138.72**	**72.72**	**32.98**	**79.99**	**114.37**	**79.04**	**40.82**

Annexure 4.4b: Daily Dishcarge Data (in m3/s) for Pabar at Tiuni Gauge-Discharge Station

Station Name : Tiuni **River : Pabar**

Year	2008											
Day	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
1	9.60	9.96	12.74	15.58	26.19	22.44	43.86	51.86	51.07	35.33	21.11	12.10
2	9.68	9.96	14.47	15.58	29.12	23.24	39.46	51.84	49.52	34.13	20.34	11.80
3	9.60	9.96	14.90	16.34	26.51	22.84	36.13	55.04	56.79	35.03	18.40	12.44
4	9.69	9.87	16.67	16.72	27.81	25.23	33.31	51.45	39.07	33.82	19.12	13.40
5	9.68	10.64	16.30	15.66	22.13	26.82	34.90	73.51	56.15	28.60	19.12	14.04
6	9.84	10.73	15.94	19.90	29.97	24.83	53.17	57.65	39.48	27.75	18.77	13.71
7	9.76	10.82	16.67	18.13	25.29	27.71	54.76	59.82	35.39	26.60	18.42	13.71
8	10.01	10.73	15.50	15.62	23.28	29.96	47.28	75.30	32.53	26.30	18.42	14.03
9	13.10	10.83	16.32	15.26	23.78	33.17	92.16	69.37	30.90	25.90	18.08	13.07
10	13.50	10.73	17.08	13.12	21.28	30.92	56.94	60.33	32.50	25.20	18.08	13.43
11	11.30	10.63	16.70	14.90	21.88	30.92	50.54	55.16	30.93	24.85	17.77	11.79
12	11.40	10.53	16.70	24.27	21.28	42.78	58.85	62.99	31.70	24.50	17.15	11.79
13	11.01	10.53	16.33	23.52	20.98	42.05	69.07	77.94	29.70	25.60	16.34	11.47
14	10.62	10.35	20.23	23.16	21.44	40.23	51.45	99.22	28.43	24.85	15.93	11.37
15	10.30	10.35	18.11	21.27	20.98	45.33	45.45	122.68	57.80	24.20	15.93	11.27
16	10.22	10.11	17.40	22.83	23.29	52.96	39.88	75.76	59.72	25.20	15.63	11.17
17	10.22	10.27	17.76	22.06	25.70	44.95	35.39	89.26	28.44	24.20	15.23	11.17
18	10.72	10.19	16.70	21.27	27.32	49.85	58.03	76.66	37.50	24.50	15.73	11.36
19	10.72	10.19	16.34	20.49	26.51	57.85	55.83	68.91	98.79	24.50	15.08	11.56
20	10.72	10.11	15.25	22.10	29.51	66.75	56.28	60.74	186.85	24.20	15.08	11.76
21	10.63	11.11	15.25	22.58	26.51	64.71	64.77	62.54	129.51	23.85	14.70	11.79
22	10.36	10.30	15.25	22.06	28.61	60.67	50.55	79.66	93.67	23.20	14.70	11.99
23	10.20	10.40	15.25	23.23	30.02	39.87	45.47	76.23	77.16	24.85	14.41	11.99
24	10.20	10.50	15.26	24.40	30.02	32.90	48.79	78.05	63.45	25.20	14.41	11.78
25	10.36	10.20	15.25	23.85	28.30	36.18	39.89	62.09	55.43	22.60	14.41	11.57
26	10.36	10.30	15.26	24.40	29.44	37.82	38.25	55.83	51.06	21.35	14.06	11.36
27	10.28	10.10	14.90	23.85	27.72	45.18	38.25	41.50	49.52	20.80	13.00	11.36
28	10.12	10.92	15.24	23.85	24.33	40.68	51.45	43.54	46.21	21.10	12.70	11.26
29	10.20	11.00	15.57	23.85	23.20	54.99	51.84	54.25	42.48	21.10	12.40	11.17
30	10.04		15.57	23.85	24.01	45.05	42.81	45.87	38.19	20.80	12.10	11.17
31	10.12		14.91				59.80	52.93		21.50		11.07
Average Q(m3/s)	**10.47**	**10.42**	**15.99**	**20.46**	**25.55**	**39.96**	**49.83**	**66.06**	**55.33**	**25.54**	**16.22**	**12.03**
Min Q	**9.60**	**9.87**	**12.74**	**13.12**	**20.98**	**22.44**	**33.31**	**41.50**	**28.43**	**20.80**	**12.10**	**11.07**
Max Q	**13.50**	**11.11**	**20.23**	**24.40**	**30.02**	**66.75**	**92.16**	**122.68**	**186.85**	**35.33**	**21.11**	**14.04**
Volume (mcm)	**28.04**	**26.12**	**42.84**	**53.02**	**66.22**	**103.58**	**133.45**	**176.95**	**143.42**	**68.40**	**42.04**	**32.22**

Annexure 4.4b: Daily Dishcarge Data (in m3/s) for Pabar at Tiuni Gauge-Discharge Station

Station Name : Tiuni **River : Pabar**

Year	2009												2010					
Day	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
1	10.97	10.61	10.79	11.26	17.09	11.10	16.00	23.22	31.33	23.58	12.70	9.85	10.77	10.76	10.57	13.14	12.58	13.43
2	10.87	10.61	10.79	11.26	16.69	11.26	13.64	24.35	27.65	23.11	12.11	9.82	10.78	10.77	10.57	12.01	12.40	12.38
3	10.87	10.61	10.79	11.58	12.72	14.66	12.44	21.72	25.91	21.70	11.41	10.33	10.88	10.67	10.46	11.26	12.05	15.88
4	10.97	10.52	10.69	11.74	11.50	16.77	11.52	20.89	25.11	24.52	11.25	10.47	11.07	10.58	10.87	10.86	13.03	11.82
5	10.97	10.52	10.69	11.58	13.64	18.18	11.52	18.25	26.33	27.82	11.01	10.19	11.18	10.68	11.50	10.86	19.24	12.84
6	11.06	10.52	10.60	11.74	12.88	16.50	11.33	17.45	28.63	23.94	10.92	10.19	11.08	10.69	11.74	10.57	22.04	12.16
7	11.06	10.51	10.60	13.34	12.13	11.74	12.10	26.84	22.49	23.51	10.73	10.10	10.98	10.59	10.59	10.69	26.43	12.84
8	11.16	10.42	10.69	12.06	11.75	10.90	11.62	19.48	23.24	23.51	10.73	10.10	10.97	10.59	11.28	11.38	20.45	15.20
9	11.37	10.42	10.69	12.38	11.37	9.63	17.43	18.66	80.25	22.64	10.64	10.02	11.07	13.00	11.18	11.95	16.33	32.78
10	11.37	10.42	10.79	13.03	11.37	10.41	22.49	17.85	131.37	21.35	10.91	9.94	11.07	10.99	11.05	12.06	13.71	24.33
11	11.37	10.98	10.79	14.67	11.75	10.22	20.34	18.26	126.71	20.06	10.82	9.94	11.07	10.88	10.76	12.62	12.59	18.58
12	11.37	10.70	10.88	14.98	13.27	10.13	146.73	16.74	95.25	19.21	10.63	9.86	10.98	10.93	10.56	11.27	11.96	17.23
13	11.27	10.70	10.78	14.36	12.51	11.08	17.82	14.26	92.10	18.78	10.55	9.86	11.08	10.76	10.66	10.88	12.80	16.89
14	11.37	10.70	10.78	14.05	13.65	11.08	64.00	17.40	65.94	17.64	10.64	9.94	11.38	10.76	10.76	11.14	12.38	15.20
15	11.47	10.79	10.68	13.01	15.75	10.89	41.01	27.63	56.10	18.40	10.73	10.02	11.28	10.66	10.86	11.60	12.59	13.51
16	11.47	10.68	10.68	13.01	14.35	10.59	34.93	25.99	51.92	19.51	10.55	9.94	11.17	10.70	11.00	11.37	13.04	14.53
17	11.38	10.60	10.59	12.69	15.33	10.39	25.50	27.22	47.27	18.77	10.55	10.56	10.97	10.86	11.26	13.04	13.72	14.19
18	11.38	10.60	10.59	12.69	15.66	9.90	52.80	27.19	41.04	18.40	10.46	10.66	10.98	10.93	11.52	13.26	13.04	9.62
19	11.57	10.51	10.58	12.36	15.33	9.60	26.32	30.05	37.37	18.41	10.73	10.46	10.88	10.56	11.92	12.15	13.04	14.19
20	11.75	10.51	10.50	15.65	13.19	9.80	21.70	21.33	34.12	18.41	10.46	10.46	10.88	10.45	12.25	12.27	14.18	15.33
21	11.34	10.70	10.69	16.31	19.96	10.00	21.29	18.62	34.94	18.03	10.46	10.26	10.88	10.37	13.94	13.65	12.38	17.62
22	11.07	10.70	11.07	15.65	18.82	10.61	17.42	18.62	31.30	17.24	10.28	10.12	10.88	10.37	15.34	15.02	11.33	23.33
23	11.07	10.80	10.98	12.37	19.58	12.45	19.09	17.56	31.69	18.02	10.37	10.12	10.74	10.56	13.91	13.36	13.08	47.76
24	10.98	10.90	11.17	12.04	16.82	15.67	26.82	16.15	29.48	15.66	10.28	10.07	10.74	10.86	13.09	12.81	14.83	37.05
25	10.98	10.89	11.83	13.02	14.77	17.42	27.20	15.55	27.84	14.32	10.19	9.98	10.93	10.99	12.77	10.64	17.63	41.62
26	10.89	10.98	12.72	15.06	12.36	18.82	23.60	16.14	25.52	13.98	10.10	9.98	10.57	10.76	12.85	12.59	21.13	42.76
27	10.89	10.98	12.00	15.45	10.82	17.22	23.60	18.61	24.73	13.34	10.02	9.88	10.57	10.76	14.16	12.16	21.13	29.05
28	10.80	10.88	12.00	20.32	11.59	15.94	27.18	17.21	26.11	13.02	10.02	10.07	10.77	10.76	14.74	13.42	19.73	23.33
29	10.80		11.79	16.77	11.45	18.50	32.11	17.42	24.73	13.02	10.02	10.35	10.97		15.26	14.18	16.93	23.33
30	10.70		11.59	17.48	11.18	19.57	25.54	15.80	23.60	12.70	9.94	10.45	10.86		14.75	12.58	15.88	17.62
31	10.70		11.38		10.10		22.48	16.77		12.70		10.54	10.86		14.46		14.48	
Average Q(m3/s)	**11.14**	**10.67**	**11.01**	**13.73**	**13.85**	**13.03**	**27.66**	**20.10**	**45.00**	**18.88**	**10.67**	**10.15**	**10.94**	**10.79**	**12.15**	**12.16**	**15.36**	**20.55**
Min Q	**10.70**	**10.42**	**10.50**	**11.26**	**10.10**	**9.60**	**11.33**	**14.26**	**22.49**	**12.70**	**9.94**	**9.82**	**10.57**	**10.37**	**10.46**	**10.57**	**11.33**	**9.62**
Max Q	**11.75**	**10.98**	**12.72**	**20.32**	**19.96**	**19.57**	**146.73**	**30.05**	**131.37**	**27.82**	**12.70**	**10.66**	**11.38**	**13.00**	**15.34**	**15.02**	**26.43**	**47.76**
Volume (mcm)	**29.83**	**25.81**	**29.48**	**35.59**	**37.10**	**33.78**	**74.09**	**53.85**	**116.65**	**50.57**	**27.67**	**27.18**	**29.31**	**26.11**	**32.54**	**31.52**	**41.14**	**53.26**

Annexure 4.5a: Observed Discharge Data (cumecs) of Tons at Tiuni including Pabar

Catchment Area at Tiuni (including Pabar) = 3320 km2

Month	Period	Days	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Jan	I	10		49.63	52.26	34.24	42.76	40.21	37.45	58.21	33.71	37.38	31.22	24.78	65.83	75.51	118.93	106.02
	II	10		48.70	58.31	30.68	37.84	37.78	35.02	58.00	27.20	35.66	32.57	30.09	52.28	74.91	105.68	104.58
	III	11		49.20	53.11	29.95	37.27	43.60	36.19	57.49	27.78	35.10	30.03	22.72	43.53	81.21	117.43	113.51
Feb	I	10		46.12	55.53	30.15	37.14	45.59	35.39	57.17	24.86	33.30	30.31	22.44	43.62	100.86	129.79	117.11
	II	10		47.87	71.90	29.71	35.26	45.12	40.69	56.04	24.24	45.56	30.30	22.42	41.83	120.46	143.66	114.22
	III	8		50.97	80.31	29.82	36.24	45.38	39.38	61.71	31.25	35.75	31.26	29.93	42.11	102.11	147.23	111.05
Mar	I	10		56.47	90.89	35.91	52.89	90.00	60.35	65.99	37.42	35.54	45.74	32.92	44.31	108.03	181.45	121.07
	II	10		138.51	84.66	34.87	58.08	92.83	73.33	66.25	30.58	53.00	48.00	75.76	50.76	143.63	195.57	125.95
	III	11		71.81	99.36	41.71	128.64	124.07	79.66	67.36	37.32	54.69	56.33	80.30	76.60	210.17	221.06	143.88
Apr	I	10		68.82	132.84	54.33	92.64	144.91	86.13	63.88	41.46	68.26	68.77	68.89	84.85	155.34	239.17	151.94
	II	10		159.22	140.26	67.08	127.34	144.08	99.68	59.92	55.50	94.70	51.25	98.94	85.11	213.91	246.18	162.20
	III	10		100.85	157.45	89.18	124.95	153.13	143.77	60.88	64.18	108.48	82.29	88.14	78.90	226.04	248.04	203.58
May	I	10		169.92	135.56	92.91	132.25	165.10	176.61	67.73	77.31	98.86	132.19	88.87	111.07	204.93	299.65	210.06
	II	10		180.61	131.27	92.53	122.24	150.53	182.56	80.73	73.28	118.89	146.57	109.64	164.36	291.03	296.14	220.76
	III	11		163.28	122.16	103.28	131.28	149.12	171.01	94.78	127.87	115.45	124.33	110.04	167.97	247.18	263.87	206.68
Jun	I	10		173.85	116.93	157.04	137.91	173.95	194.37	96.31	92.75	108.94	176.61	95.50	197.17	237.67	262.96	211.41
	II	10		152.59	156.76	169.75	133.64	216.11	201.60	77.16	100.47	166.77	146.19	81.90	142.51	231.62	278.25	243.29
	III	10		210.32	200.93	224.01	164.94	172.83	194.43	77.10	109.07	225.62	149.14	136.15	150.52	302.69	285.38	285.10
Jul	I	10		351.62	200.68	265.90	168.60	204.23	216.86	125.57	125.32	214.43	162.10	163.78	146.55	344.63	287.24	233.30
	II	10		367.79	272.80	287.01	211.75	221.01	176.10	124.73	256.48	257.42	184.16	264.04	245.20	375.10	288.67	377.25
	III	11		373.39	260.26	281.12	356.71	249.29	260.99	172.82	245.05	295.73	189.90	313.42	374.12	350.29	306.96	604.15
Aug	I	10		436.45	287.03	278.87	452.13	253.29	254.38	150.23	253.26	272.88	169.10	317.86	260.49	380.98	301.57	519.23
	II	10		440.85	242.67	185.65	334.60	313.98	234.76	233.60	314.98	317.92	132.46	253.87	270.37	510.15	240.51	499.01
	III	11		331.54	185.39	192.94	197.20	268.24	316.71	201.27	220.45	209.38	153.87	279.15	394.28	399.82	335.98	416.46
Sep	I	10		584.12	156.60	182.53	146.48	211.24	347.66	189.94	182.23	153.93	124.34	153.00	358.94	382.35	315.24	379.26
	II	10		229.95	129.61	171.45	118.39	150.85	331.75	110.72	218.90	116.09	87.02	119.43	207.72	306.78	286.80	352.57
	III	10		195.74	108.79	151.99	122.25	108.21	181.34	69.41	156.95	92.65	77.51	250.75	197.23	251.97	221.72	186.05
Oct	I	10		152.09	104.58	133.76	108.99	84.52	189.36	72.41	101.48	90.42	67.04	196.94	165.13	244.82	190.81	137.54
	II	10		113.34	100.22	103.36	88.12	66.61	141.12	65.96	204.20	89.57	52.64	150.55	134.41	185.09	192.49	78.95
	III	11		108.28	67.82	89.42	79.42	60.14	84.18	58.78	91.09	60.79	44.51	97.86	119.71	149.21	150.70	74.07
Nov	I	10		100.54	59.31	77.52	90.00	53.01	74.91	50.75	69.53	55.44	34.44	70.15	107.31	138.58	120.75	51.38
	II	10		85.14	46.33	66.36	72.14	48.34	73.03	42.90	64.08	46.93	32.93	61.51	98.62	124.72	114.16	39.75
	III	10		74.15	39.20	60.58	60.76	44.21	66.60	38.50	47.80	42.39	32.78	53.64	92.13	119.41	115.74	42.80
Dec	I	10		71.54	35.41	56.65	51.91	41.11	62.08	36.38	43.35	42.66	27.63	56.17	77.03	110.91	110.31	39.34
	II	10		71.21	33.79	52.02	46.61	38.01	59.60	35.72	36.65	46.16	28.42	49.40	71.11	108.50	105.90	29.89
	III	11		57.33	33.14	47.78	43.37	36.43	58.48	34.78	40.91	35.66	28.47	65.95	82.76	116.82	111.20	25.00
Total	**m3/s**			**6083.81**	**4304.12**	**4032.06**	**4382.74**	**4487.06**	**5017.53**	**3041.18**	**3688.96**	**3912.40**	**3042.42**	**4136.90**	**5046.44**	**7727.43**	**7577.19**	**7038.41**
Runoff	**L/s/km2**			**51.07**	**36.06**	**33.87**	**36.91**	**37.72**	**42.17**	**25.56**	**31.04**	**32.89**	**25.57**	**34.89**	**42.61**	**64.88**	**63.53**	**59.21**
Average runoff	**cumec**			**169.56**	**119.73**	**112.46**	**122.54**	**125.23**	**140.01**	**84.86**	**103.06**	**109.20**	**84.90**	**115.83**	**141.48**	**215.41**	**210.92**	**196.56**

Annexure 4.5a: Observed Discharge Data (cumecs) of Tons at Tiuni including Pabar

Catchment Area at Tiuni (including Pabar) = 3320 km2

Month	Period	Days	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Jan	**I**	**10**	26.98	35.01	42.13	57.85	35.68	62.45	51.45	62.83	26.27	26.22	27.71	27.18	28.00	29.85	27.28	34.01	34.01
	II	**10**	31.18	34.76	35.29	59.72	35.44	59.05	55.30	66.63	27.21	25.99	28.45	29.75	26.09	31.08	25.86	36.81	30.80
	III	**11**	27.58	34.17	34.87	48.80	35.63	55.23	56.08	55.12	23.33	27.68	27.84	31.69	25.23	29.29	24.82	36.36	29.69
Feb	**I**	**10**	28.32	34.71	32.65	43.96	35.53	54.70	52.57	55.14	21.57	28.11	27.65	37.98	24.87	31.02	24.92	37.93	29.37
	II	**10**	31.25	34.46	35.66	45.05	35.68	48.50	52.46	58.92	25.48	35.85	27.79	34.05	30.54	32.59	27.72	37.95	29.62
	III	**8**	29.56	36.79	35.88	44.43	35.02	76.62	49.53	49.30	26.96	31.94	29.53	30.96	33.22	32.46	27.35	41.35	28.90
Mar	**I**	**10**	29.12	27.46	35.43	43.84	34.07	103.43	49.39	46.97	26.67	46.67	31.14	33.31	43.04	30.94	29.29	45.80	28.35
	II	**10**	29.35	40.14	34.68	47.29	33.15	110.67	48.68	48.39	27.69	46.05	32.12	36.72	51.97	33.37	35.48	50.40	28.37
	III	**11**	70.10	45.74	48.67	49.18	33.47	125.82	49.50	51.29	31.65	58.96	40.72	41.96	51.38	36.74	73.83	44.30	29.49
Apr	**I**	**10**	72.81	54.55	51.80	55.93	38.05	179.89	49.52	75.28	33.84	63.37	51.84	43.98	44.02	44.21	75.15	47.12	29.74
	II	**10**	69.96	42.51	50.45	59.90	45.01	145.29	53.52	76.49	34.27	60.52	54.14	42.72	45.43	47.57	80.35	50.59	33.39
	III	**10**	86.34	42.25	55.41	58.65	42.17	150.90	59.58	85.62	33.83	70.33	63.11	52.28	47.23	51.70	67.33	58.06	44.45
May	**I**	**10**	151.20	54.85	61.04	58.83	76.22	149.08	75.14	93.43	35.04	68.34	76.32	61.85	55.71	62.59	75.22	74.31	43.64
	II	**10**	127.43	74.64	83.72	73.68	53.38	129.44	90.90	113.52	53.88	79.44	95.00	89.53	70.52	68.77	79.87	71.47	63.01
	III	**11**	162.04	93.94	108.19	83.07	51.34	131.40	113.35	105.08	64.24	80.46	103.10	107.88	69.28	70.50	64.17	87.93	63.72
Jun	**I**	**10**	131.41	90.77	177.22	110.40	65.61	134.47	101.04	115.96	62.82	90.01	110.40	108.00	71.37	71.17	70.90	105.64	
	II	**10**	145.45	103.88	199.20	192.92	85.71	194.33	106.67	128.66	79.56	99.95	116.90	118.82	81.56	46.39	105.10	192.00	
	III	**10**	155.66	222.75	197.57	191.21	102.50	154.32	119.78	92.05	118.51	110.60	137.95	120.46	105.37	59.83	108.60	220.13	
Jul	**I**	**10**	178.68	282.36	182.57	204.06	133.32	168.32	152.07	131.35	149.31	144.89	136.35	112.73	225.46	92.56	166.30	305.76	
	II	**10**	469.54	421.05	260.26	212.12	171.43	175.95	126.07	220.50	203.06	141.39	168.90	91.88	232.78	169.59	116.20	295.48	
	III	**11**	304.16	708.17	442.46	292.48	351.33	178.29	187.54	291.45	186.79	134.86	184.84	113.75	225.77	214.66	139.20	316.31	
Aug	**I**	**10**	213.67	508.29	594.29	295.13	428.93	137.93	223.84	138.07	148.76	143.96	274.24	146.89	204.78	256.04	207.00	341.19	
	II	**10**	177.42	506.08	449.70	340.99	383.50	173.18	191.89	143.61	182.29	200.63	196.99	177.85	171.92	203.62	185.20	436.14	
	III	**11**	141.70	527.15	453.18	416.86	208.68	187.07	164.15	133.64	175.74	177.88	186.39	167.04	112.22	172.76	148.80	302.87	
Sep	**I**	**10**	236.51	574.66	708.97	367.93	193.86	143.53	135.43	126.61	127.90	316.38	180.32	110.79	85.13	117.35	154.10	166.05	
	II	**10**	259.16	339.30	360.23	336.48	214.03	149.10	156.61	117.32	86.19	189.76	160.24	108.40	109.90	83.62	103.60	203.59	
	III	**10**	153.50	185.15	176.97	256.35	178.27	255.70	144.65	106.32	55.76	112.76	147.74	99.34	132.75	77.20	96.56	301.99	
Oct	**I**	**10**	127.15	138.59	110.26	200.58	144.23	150.31	128.97	79.90	56.90	69.59	139.21	89.65	118.52	61.57	70.73	149.57	
	II	**10**	72.64	127.24	68.40	102.08	128.84	167.60	126.85	58.20	43.69	54.44	129.68	88.71	100.34	51.57	54.37	106.05	
	III	**11**	57.64	92.95	64.44	63.21	118.81	153.47	116.02	41.00	36.35	44.04	119.10	84.06	83.79	44.18	45.66	78.72	
Nov	**I**	**10**	56.04	83.13	61.53	54.25	118.44	126.41	100.00	37.40	31.71	37.95	98.21	77.57	73.26	39.22	42.78	51.05	
	II	**10**	55.79	71.49	60.66	49.55	117.48	114.05	98.38	32.79	28.58	33.74	77.08	64.25	63.93	35.18	39.56	35.05	
	III	**10**	56.16	61.93	60.26	39.27	113.30	109.88	94.78	27.23	28.58	30.15	59.17	54.98	49.35	30.82	36.92	33.17	
Dec	**I**	**10**	49.47	52.91	60.44	37.39	114.81	93.67	86.59	23.93	27.40	28.27	36.89	47.70	40.42	29.20	35.56	35.36	
	II	**10**	37.58	52.10	59.97	37.32	119.11	56.32	80.99	23.86	27.26	26.92	29.04	40.54	36.45	30.63	37.09	32.95	
	III	**11**	31.20	47.52	58.48	38.59	81.12	54.49	64.66	22.58	26.88	26.90	27.58	34.14	33.00	27.75	35.24	32.57	
Total	**m3/s**		**4083.75**	**5883.45**	**5552.93**	**4669.35**	**4193.15**	**4660.86**	**3613.95**	**3136.44**	**2375.97**	**2965.00**	**3433.68**	**2759.39**	**3004.60**	**2547.59**	**2738.11**	**4496.03**	**546.55**
Runoff	**l/s/km2**		**34.31**	**49.77**	**46.76**	**39.28**	**35.27**	**39.07**	**30.36**	**26.38**	**20.01**	**24.87**	**28.86**	**23.20**	**25.24**	**21.46**	**22.99**	**37.78**	**11.03**
Average runoff	**cumec**		**113.90**	**165.23**	**155.25**	**130.40**	**117.10**	**129.70**	**100.80**	**87.58**	**66.44**	**82.57**	**95.80**	**77.02**	**83.78**	**71.25**	**76.32**	**125.42**	**36.63**

Annexure 4.5b: Observed Discharge Data (cumecs) of Pabar at Tiuni
Catchment Area at Tiuni = 1406 km2

Month	Period	Days	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Jan	**I**	**10**		18.05	21.69	12.66	10.77	15.09	11.10	25.91	11.18	12.35	12.24	7.39	22.32	40.85	32.01
	II	**10**		17.37	24.86	13.29	10.35	13.98	10.82	25.89	9.03	11.46	12.74	8.44	18.59	38.99	31.48
	III	**11**		16.84	23.37	11.05	11.13	17.84	12.62	25.64	9.58	10.45	12.22	7.70	14.33	29.75	36.64
Feb	**I**	**10**		16.78	22.13	10.11	12.53	19.12	11.92	25.44	7.64	14.59	10.29	7.79	13.15	28.86	37.31
	II	**10**		17.52	25.57	13.20	11.70	21.04	15.96	22.85	7.73	22.33	12.32	8.16	12.75	34.75	43.44
	III	**8**		18.46	37.80	13.56	11.80	24.98	15.48	34.48	8.14	15.59	19.10	10.63	13.32	36.34	48.38
Mar	**I**	**10**		30.51	47.15	14.93	18.21	54.86	26.23	35.99	8.49	14.95	19.29	10.84	15.57	37.62	54.74
	II	**10**		48.44	43.82	14.15	14.59	54.86	39.43	37.65	8.41	28.28	15.31	23.03	15.27	47.64	50.07
	III	**11**		34.07	50.98	17.96	35.94	79.28	38.85	39.01	9.78	25.30	22.59	24.25	17.05	110.62	56.07
Apr	**I**	**10**		38.06	65.65	29.84	42.11	113.09	43.83	38.61	11.68	29.41	30.54	27.73	19.44	60.07	52.60
	II	**10**		60.85	62.49	30.19	65.10	96.67	64.60	32.92	18.87	38.67	27.75	29.60	23.53	99.36	52.34
	III	**10**		50.45	61.66	45.18	58.52	105.98	86.02	24.11	20.22	55.29	31.99	24.67	23.28	113.05	56.17
May	**I**	**10**		72.05	50.81	40.03	57.99	87.33	96.31	29.42	20.50	66.26	64.38	24.54	31.41	97.54	69.24
	II	**10**		59.21	47.31	36.77	50.30	83.77	91.43	34.14	20.48	38.68	54.80	29.11	45.85	116.85	70.41
	III	**11**		48.49	43.76	32.96	50.53	84.65	91.54	38.12	26.71	40.83	42.95	31.73	39.60	98.37	63.90
Jun	**I**	**10**		46.11	39.75	41.72	49.31	84.90	88.07	36.29	23.59	37.78	48.71	29.45	46.91	86.77	64.16
	II	**10**		37.96	48.14	50.29	40.68	110.62	98.00	32.89	21.66	46.27	34.02	27.15	32.90	63.48	68.52
	III	**10**		55.05	64.04	63.68	48.19	66.10	107.39	29.35	19.55	50.31	32.19	35.05	35.06	89.34	69.31
Jul	**I**	**10**		114.23	48.46	75.24	53.45	66.27	104.86	44.51	24.68	47.96	38.88	43.14	30.95	136.06	68.51
	II	**10**		124.37	101.23	127.34	66.77	67.49	84.57	41.90	73.98	47.31	43.62	81.72	46.72	189.29	66.52
	III	**11**		101.31	88.87	115.56	127.72	77.45	104.04	68.29	106.81	157.25	46.98	126.04	60.48	165.44	81.99
Aug	**I**	**10**		135.09	77.29	126.77	188.59	67.78	98.00	56.30	74.47	91.49	35.97	168.67	96.41	212.03	21.17
	II	**10**		174.48	72.04	75.97	133.78	116.02	79.47	105.35	47.70	92.73	33.59	123.80	67.26	251.49	54.08
	III	**11**		96.28	41.28	68.66	71.97	82.43	113.10	70.63	75.59	72.09	36.90	135.00	156.55	177.88	96.58
Sep	**I**	**10**		276.49	30.74	66.10	43.64	48.32	130.49	73.70	58.30	43.26	36.63	65.54	176.51	154.11	92.04
	II	**10**		123.20	30.77	59.17	38.23	34.80	121.31	48.36	74.75	32.86	19.93	49.09	85.81	124.46	86.12
	III	**10**		74.60	25.54	49.27	44.58	27.54	28.20	19.52	54.56	35.56	15.73	162.79	66.06	100.11	57.25
Oct	**I**	**10**		67.54	23.90	35.83	36.17	22.84	67.07	22.18	37.36	36.20	17.43	45.36	58.78	87.08	43.94
	II	**10**		58.99	22.79	30.77	27.48	20.54	75.65	18.90	51.44	33.55	16.23	46.09	52.00	49.26	40.29
	III	**11**		54.97	20.15	25.66	23.28	18.34	73.04	16.76	35.51	23.51	14.93	37.18	47.03	42.60	31.72
Nov	**I**	**10**		30.22	18.92	21.68	29.24	16.06	16.05	15.33	24.89	18.13	11.89	24.01	44.00	38.86	28.36
	II	**10**		48.70	18.43	17.69	21.49	14.70	14.66	14.53	20.15	14.57	8.16	19.07	41.44	37.23	26.38
	III	**10**		43.47	17.39	13.26	18.32	11.20	11.19	11.44	16.34	14.55	8.08	16.56	42.56	35.25	23.76
Dec	**I**	**10**		40.05	16.72	12.01	18.69	10.80	10.79	10.14	16.29	15.97	8.37	16.23	40.53	34.11	20.40
	II	**10**		38.35	14.46	11.18	16.83	10.33	10.34	10.28	17.96	17.68	8.15	15.95	34.67	31.58	18.27
	III	**11**		32.73	15.11	11.20	15.69	10.66	10.60	11.26	21.63	13.07	7.41	21.95	40.27	32.10	21.98
Total	**m3/s**			**2321.34**	**1465.07**	**1434.93**	**1575.67**	**1857.73**	**2103.03**	**1228.09**	**1095.65**	**1366.54**	**912.31**	**1565.45**	**1628.36**	**3129.19**	**1836.15**
Runoff	**l/s/km2**			**45.91**	**28.95**	**28.46**	**31.31**	**36.82**	**41.78**	**24.32**	**21.87**	**27.23**	**18.06**	**31.21**	**32.41**	**62.11**	**36.35**
Average runoff	**cumec**			**64.55**	**40.71**	**40.01**	**44.03**	**51.78**	**58.75**	**34.20**	**30.76**	**38.29**	**25.39**	**43.88**	**45.57**	**87.33**	**51.11**

Annexure 4.5b: Observed Discharge Data (cumecs) of Pabar at Tiuni
Catchment Area at Tiuni = 1406 km2

Month	Period	Days	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Jan	**I**	**10**	19.05	9.50	7.54	9.83	17.02	11.66	27.91	13.81	12.11	9.24	9.25	10.49	9.52	10.42	11.67	9.59	10.47	11.07
	II	**10**	18.81	10.67	7.57	7.42	17.84	11.45	23.26	13.37	12.88	10.75	8.77	11.26	10.44	10.29	11.82	9.11	10.72	11.44
	III	**11**	19.92	9.77	7.39	6.71	13.40	11.55	20.74	12.93	11.00	9.06	9.80	10.74	10.18	9.82	10.17	8.77	10.93	10.93
Feb	**I**	**10**	19.78	9.47	7.20	5.73	11.43	10.38	21.74	11.83	11.87	8.16	10.88	10.93	12.64	9.84	10.55	8.80	10.42	10.52
	II	**10**	19.06	11.12	6.94	7.51	11.46	9.78	19.45	11.65	11.75	10.27	12.22	10.57	10.71	12.66	12.49	10.13	10.33	10.68
	III	**8**	16.65	13.33	8.82	7.68	11.24	9.14	26.20	11.18	10.57	11.11	10.36	11.40	9.82	13.06	12.44	9.99	10.54	10.85
Mar	**I**	**10**	17.84	12.80	10.50	8.48	10.24	7.24	31.72	10.52	9.89	11.18	18.12	12.32	11.68	15.92	12.16	10.59	15.66	10.71
	II	**10**	19.29	13.62	16.10	8.07	11.28	7.50	22.78	10.05	11.76	11.56	15.69	12.35	13.17	24.78	12.86	15.27	17.15	10.69
	III	**11**	24.68	43.96	17.63	9.91	11.37	7.54	27.31	10.65	15.71	12.99	17.86	16.20	15.35	24.23	14.49	29.82	15.25	11.57
Apr	**I**	**10**	27.80	43.73	25.10	10.66	15.21	8.78	52.86	10.67	24.23	12.79	24.05	23.88	15.40	19.75	16.78	30.57	16.19	11.93
	II	**10**	31.42	37.57	19.26	11.06	18.00	11.09	38.23	10.60	27.51	11.96	29.81	26.13	14.17	19.18	19.22	28.42	21.59	13.75
	III	**10**	43.43	56.91	18.62	12.26	18.17	9.29	36.11	11.76	28.34	11.21	31.93	29.16	15.83	18.98	22.04	25.91	23.59	15.35
May	**I**	**10**	48.23	65.96	22.15	13.51	19.68	18.04	26.81	14.46	28.60	11.05	30.60	31.24	19.46	24.19	23.30	27.78	25.54	13.11
	II	**10**	74.41	47.01	35.62	18.00	20.45	17.70	22.76	16.19	31.69	16.59	34.20	34.50	26.26	33.47	25.24	25.29	23.89	14.08
	III	**11**	83.75	45.99	35.57	20.39	20.89	18.83	22.21	18.64	27.07	20.50	33.87	36.40	29.58	33.81	27.45	18.27	27.22	14.31
Jun	**I**	**10**	76.34	29.16	34.68	54.48	29.86	21.93	25.55	15.25	39.69	19.92	38.34	36.92	30.22	34.56	28.57	22.45	26.72	
	II	**10**	56.86	29.48	36.88	69.50	34.01	24.77	58.01	17.83	33.01	21.03	36.88	36.91	35.87	38.20	22.90	25.25	47.37	
	III	**10**	55.71	27.60	47.68	69.55	54.23	29.59	37.52	23.46	25.54	29.24	32.05	35.70	34.42	41.15	30.01	24.65	45.81	
Jul	**I**	**10**	58.11	31.43	54.19	61.43	58.91	31.78	31.19	33.00	35.55	35.47	35.31	35.83	33.08	59.69	31.59	34.43	49.20	
	II	**10**	84.69	159.52	105.72	42.91	62.65	34.92	37.66	24.52	75.83	62.10	29.72	38.57	19.47	83.09	46.08	27.05	51.08	
	III	**11**	138.55	116.74	300.76	96.66	61.31	56.47	38.65	49.96	124.02	58.11	26.21	48.14	20.40	62.90	59.46	28.28	47.81	
Aug	**I**	**10**	137.16	72.61	190.93	168.38	65.69	76.13	35.01	62.99	44.50	35.65	35.12	78.80	36.85	51.50	59.68	48.31	60.62	
	II	**10**	137.31	60.88	144.62	162.70	111.92	72.32	43.36	64.47	37.10	63.26	81.45	62.24	48.46	41.46	49.22	44.77	78.89	
	III	**11**	115.61	39.82	120.79	109.73	75.20	63.63	57.89	44.93	38.77	54.89	72.76	57.82	47.16	33.47	46.95	35.71	58.41	
Sep	**I**	**10**	99.52	73.88	174.83	360.81	100.42	66.38	36.10	30.93	38.60	37.59	89.99	57.15	32.21	25.31	36.82	40.14	39.34	
	II	**10**	119.51	93.07	136.03	175.72	69.02	43.88	38.00	38.76	33.29	26.47	93.11	46.71	27.30	33.72	25.45	27.11	52.69	
	III	**10**	59.92	40.86	58.25	64.12	41.64	37.21	90.54	36.29	29.67	19.06	59.98	41.28	21.62	45.12	21.89	24.23	64.67	
Oct	**I**	**10**	49.76	32.80	32.84	29.47	32.17	32.77	45.59	26.17	22.13	20.53	39.10	34.11	16.75	37.98	14.25	19.50	29.87	
	II	**10**	26.10	18.74	24.89	22.65	26.40	29.54	75.02	25.28	17.50	16.58	31.19	29.87	15.44	33.32	11.81	14.64	24.66	
	III	**11**	23.84	16.42	17.50	21.19	38.56	30.00	41.23	23.75	13.96	13.95	21.73	25.87	13.64	30.14	11.01	11.91	22.40	
Nov	**I**	**10**	19.04	16.65	14.97	19.99	34.61	29.36	27.57	22.78	14.74	11.81	15.68	23.22	12.55	27.98	10.57	10.80	18.99	
	II	**10**	14.13	16.42	11.49	19.05	31.10	27.22	22.80	22.95	12.59	10.18	14.01	19.47	11.19	25.36	10.43	10.27	15.98	
	III	**10**	16.64	13.50	9.41	18.46	14.33	25.72	22.42	21.42	10.79	10.88	12.51	15.40	9.92	21.37	10.22	9.94	13.69	
Dec	**I**	**10**	15.87	12.02	7.70	18.30	12.69	26.59	21.68	19.37	8.84	10.81	11.43	11.54	9.44	16.20	10.17	9.55	13.17	
	II	**10**	12.53	9.42	9.63	17.52	12.41	27.64	18.04	14.06	8.81	10.74	10.33	9.84	8.79	13.96	10.62	9.75	11.47	
	III	**11**	9.46	7.42	10.33	17.10	12.63	26.78	16.24	12.63	7.67	10.49	9.95	9.84	8.35	12.29	9.91	9.81	11.50	
Total	**m3/s**		**1810.78**	**1349.85**	**1790.13**	**1776.94**	**1207.44**	**984.60**	**1240.16**	**819.11**	**947.58**	**757.18**	**1094.26**	**1042.80**	**717.34**	**1049.17**	**800.29**	**756.86**	**1033.83**	**180.99**
Runoff	**l/s/km2**		**36.03**	**26.80**	**35.84**	**35.14**	**23.94**	**19.57**	**24.50**	**16.26**	**18.89**	**15.06**	**21.66**	**20.68**	**14.22**	**20.80**	**15.90**	**14.99**	**20.48**	**8.60**
Average runoff	**cumec**		**50.66**	**37.68**	**50.39**	**49.41**	**33.66**	**27.51**	**34.45**	**22.86**	**26.56**	**21.18**	**30.45**	**29.07**	**20.00**	**29.24**	**22.35**	**21.07**	**28.80**	**12.09**

Annexure 4.6: Derived Discharge Data (Cumecs) of Tons at Tiuni excluding Pabar (Subtracting discharge of Pabar from combind discharge of Tons & Pabar)

Catchment Area at Tiuni (excluding Pabar) = 1914.0 sqkm

Month	Period	Days	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Jan	I	10		31.58	30.57	21.58	31.99	25.12	26.35	32.30	22.53	25.03	18.98	17.39	43.51	34.66	86.92	86.97	17.48
	II	10		31.33	33.45	17.39	27.49	23.80	24.20	32.11	18.17	24.20	19.83	21.65	33.69	35.92	74.20	85.77	20.51
	III	11		32.36	29.74	18.90	26.14	25.76	23.57	31.85	18.20	24.65	17.81	15.02	29.20	51.46	80.79	93.59	17.81
Feb	I	10		29.34	33.40	20.04	24.61	26.47	23.47	31.73	17.22	18.71	20.02	14.65	30.47	72.00	92.48	97.33	18.85
	II	10		30.35	46.33	16.51	23.56	24.08	24.73	33.19	16.51	23.23	17.98	14.26	29.08	85.71	100.22	95.16	20.13
	III	8		32.51	42.51	16.26	24.44	20.40	23.90	27.23	23.11	20.16	12.16	19.30	28.79	65.77	98.85	94.40	16.23
Mar	I	10		25.96	43.74	20.98	34.68	35.14	34.12	30.00	28.93	20.59	26.45	22.08	28.74	70.41	126.71	103.23	16.32
	II	10		90.07	40.84	20.72	43.49	37.97	33.90	28.60	22.17	24.72	32.69	52.73	35.49	95.99	145.50	106.66	15.73
	III	11		37.74	48.38	23.75	92.70	44.79	40.81	28.35	27.54	29.39	33.74	56.05	59.55	99.55	164.99	119.20	26.14
Apr	I	10		30.76	67.19	24.49	50.53	31.82	42.30	25.27	29.78	38.85	38.23	41.16	65.41	95.27	186.57	124.14	29.08
	II	10		98.37	77.77	36.89	62.24	47.41	35.08	27.00	36.63	56.03	23.50	69.34	61.58	114.55	193.84	130.78	32.39
	III	10		50.40	95.79	44.00	66.43	47.15	57.75	36.77	43.96	53.19	50.30	63.47	55.62	112.99	191.87	160.15	29.43
May	I	10		97.87	84.75	52.88	74.26	77.77	80.30	38.31	56.81	32.60	67.81	64.33	79.66	107.39	230.41	161.83	85.24
	II	10		121.40	83.96	55.76	71.94	66.76	91.13	46.59	52.80	80.21	91.77	80.53	118.51	174.18	225.73	146.35	80.42
	III	11		114.79	78.40	70.32	80.75	64.47	79.47	56.66	101.16	74.62	81.38	78.31	128.37	148.81	199.97	122.93	116.05
Jun	I	10	69.46	127.74	77.18	115.32	88.60	89.05	106.30	60.02	69.16	71.16	127.90	66.05	150.26	150.90	198.80	135.07	102.25
	II	10	47.25	114.63	108.62	119.46	92.96	105.49	103.60	44.27	78.81	120.50	112.17	54.75	109.61	168.14	209.73	186.43	115.97
	III	10	142.14	155.27	136.89	160.33	116.75	106.73	87.04	47.75	89.52	175.31	116.95	101.10	115.46	213.35	216.07	229.39	128.06
Jul	I	10	326.26	237.39	152.22	190.66	115.15	137.96	112.00	81.06	100.64	166.47	123.22	120.64	115.60	208.57	218.73	175.19	147.25
	II	10	216.90	243.42	171.57	159.67	144.98	153.52	91.53	82.83	182.50	210.11	140.54	182.32	198.48	185.81	222.15	292.56	310.02
	III	11	273.54	272.08	171.39	165.56	228.99	171.84	156.95	104.53	138.24	138.48	142.92	187.38	313.64	184.85	224.97	465.60	187.42
Aug	I	10	214.07	301.36	209.74	152.10	263.54	185.51	156.38	93.93	178.79	181.39	133.13	149.19	164.08	168.95	280.40	382.07	141.06
	II	10	173.09	266.37	170.63	109.68	200.82	197.96	155.29	128.25	267.28	225.19	98.87	130.07	203.11	258.66	186.43	361.70	116.54
	III	11	135.76	235.26	144.11	124.28	125.23	185.81	203.61	130.64	144.86	137.29	116.97	144.15	237.73	221.94	239.40	300.85	101.88
Sep	I	10	198.92	307.63	125.86	116.43	102.84	162.92	217.17	116.24	123.93	110.67	87.71	87.46	182.43	228.24	223.20	279.74	162.63
	II	10	183.95	106.75	98.84	112.28	80.16	116.05	210.44	62.36	144.15	83.23	67.09	70.34	121.91	182.32	200.68	233.06	166.09
	III	10	142.35	121.14	83.25	102.72	77.67	80.67	153.14	49.89	102.39	57.09	61.78	87.96	131.17	151.86	164.47	126.13	112.64
Oct	I	10	97.03	84.55	80.68	97.93	72.82	61.68	122.29	50.23	64.12	54.22	49.61	151.58	106.35	157.74	146.87	87.78	94.35
	II	10	54.34	54.35	77.43	72.59	60.64	46.07	65.47	47.06	152.76	56.02	36.41	104.46	82.41	135.83	152.20	52.85	53.90
	III	11	54.79	53.31	47.67	63.76	56.14	41.80	11.14	42.02	55.58	37.28	29.58	60.68	72.68	106.61	118.98	50.23	41.22
Nov	I	10	52.40	70.32	40.39	55.84	60.76	36.95	58.86	35.42	44.64	37.31	22.55	46.14	63.31	99.72	92.39	32.34	39.39
	II	10	44.48	36.44	27.90	48.67	50.65	33.64	58.37	28.37	43.93	32.36	24.77	42.44	57.18	87.49	87.78	25.62	39.37
	III	10	43.29	30.68	21.81	47.32	42.44	33.01	55.41	27.06	31.46	27.84	24.70	37.08	49.57	84.16	91.98	26.16	42.66
Dec	I	10	32.51	31.49	18.69	44.64	33.22	30.31	51.29	26.24	27.06	26.69	19.26	39.94	36.50	76.80	89.91	23.47	37.45
	II	10	32.08	32.86	19.33	40.84	29.78	27.68	49.26	25.44	18.69	28.48	20.27	33.45	36.44	76.92	87.63	17.36	28.16
	III	11	31.92	24.60	18.03	36.58	27.68	25.77	47.88	23.52	19.28	22.59	21.06	44.00	42.49	84.72	89.22	15.54	23.78
Total	**m3/s**		**2566.53**	**3762.47**	**2839.05**	**2597.13**	**2807.07**	**2629.33**	**2914.50**	**1813.09**	**2593.31**	**2545.86**	**2130.11**	**2571.45**	**3418.08**	**4598.24**	**5741.04**	**5227.63**	**2733.90**
share	**%**			**62%**	**66%**	**64%**	**64%**	**59%**	**58%**	**60%**	**70%**	**65%**	**70%**	**62%**	**68%**	**60%**	**76%**	**74%**	**67%**
Runoff	**l/s/km 2**		**63.87**	**54.87**	**41.29**	**37.85**	**41.02**	**38.38**	**42.46**	**26.47**	**37.78**	**37.05**	**31.09**	**37.59**	**50.11**	**66.92**	**83.50**	**76.23**	**39.82**
Average ru	**cumec**		**122.25**	**105.01**	**79.02**	**72.44**	**78.52**	**73.46**	**81.26**	**50.67**	**72.31**	**70.91**	**59.51**	**71.95**	**95.91**	**128.08**	**159.81**	**145.91**	**76.22**

Annexure 4.6: Derived Discharge Data (Cumecs) of Tons at Tiuni excluding Pabar (Subtracting discharge of Pabar from combind discharge of Tons & Pabar)

Catchment Area at Tiuni (excluding Pabar) = 1914.0 sqkm

Month	Period	Days	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Jan	I	10	27.47	32.30	40.83	24.02	34.54	37.64	50.72	17.03	16.97	17.22	17.66	17.58	18.18	17.69	23.56	19.97	13.69
	II	10	27.19	27.87	41.88	23.99	35.79	41.93	53.75	16.46	17.22	17.19	19.31	15.80	19.26	16.75	26.09	19.36	14.34
	III	11	26.78	28.16	35.40	24.08	34.49	43.15	44.12	14.27	17.88	17.10	21.51	15.41	19.12	16.05	25.43	18.76	12.35
Feb	I	10	27.51	26.92	32.53	25.15	32.96	40.74	43.27	13.41	17.23	16.72	25.34	15.03	20.47	16.12	27.51	18.85	14.19
	II	10	27.52	28.15	33.59	25.90	29.05	40.81	47.17	15.21	23.63	17.22	23.34	17.88	20.10	17.59	27.62	18.94	13.67
	III	8	27.97	28.20	33.19	25.88	50.42	38.35	38.73	15.85	21.58	18.13	21.14	20.16	20.02	17.36	30.81	18.05	14.73
Mar	I	10	16.96	26.95	33.60	26.83	71.71	38.87	37.08	15.49	28.55	18.82	21.63	27.12	18.78	18.70	30.14	17.64	16.92
	II	10	24.04	26.61	36.01	25.65	87.89	38.63	36.63	16.13	30.36	19.77	23.55	27.19	20.51	20.21	33.25	17.68	19.05
	III	11	28.11	38.76	37.81	25.93	98.51	38.85	35.58	18.66	41.10	24.52	26.61	27.15	22.25	44.01	29.05	17.92	37.38
Apr	I	10	29.45	41.14	40.72	29.27	127.03	38.85	51.05	21.05	39.32	27.96	28.58	24.27	27.43	44.58	30.93	17.81	27.77
	II	10	23.25	39.39	41.90	33.92	107.06	42.92	48.98	22.31	30.71	28.01	28.55	26.25	28.35	51.93	29.00	19.64	50.43
	III	10	23.63	43.15	40.48	32.88	114.79	47.82	57.28	22.62	38.40	33.95	36.45	28.25	29.66	41.42	34.47	29.10	40.22
May	I	10	32.70	47.53	39.15	58.18	122.27	60.68	64.83	23.99	37.74	45.08	42.39	31.52	39.29	47.44	48.77	30.53	55.78
	II	10	39.02	65.72	53.23	35.68	106.68	74.71	81.83	37.29	45.24	60.50	63.27	37.05	43.53	54.58	47.58	48.93	44.66
	III	11	58.37	87.80	62.18	32.51	109.19	94.71	78.01	43.74	46.59	66.70	78.30	35.47	43.05	45.90	60.71	49.41	66.59
Jun	I	10	56.09	122.74	80.54	43.68	108.92	85.79	76.27	42.90	51.67	73.48	77.78	36.81	42.60	48.45	78.92	61.36	64.91
	II	10	67.00	129.70	158.91	60.94	136.32	88.84	95.65	58.53	63.07	79.99	82.95	43.36	23.49	79.85	144.63	41.60	67.15
	III	10	175.07	128.02	136.98	72.91	116.80	96.32	66.51	89.27	78.55	102.25	86.04	64.22	29.82	83.95	174.32	74.58	101.29
Jul	I	10	228.17	121.14	145.15	101.54	137.13	119.07	95.80	113.84	109.58	100.52	79.65	165.77	60.97	131.87	256.56	62.33	
	II	10	315.33	217.35	149.47	136.51	138.29	101.55	144.67	140.96	111.67	130.33	72.41	149.69	123.51	89.15	244.40	170.45	
	III	11	407.41	345.80	231.17	294.86	139.64	137.58	167.43	128.68	108.65	136.70	93.35	162.87	155.20	110.92	268.50	167.82	
Aug	I	10	317.36	425.91	229.44	352.80	102.92	160.85	93.57	113.11	108.84	195.44	110.04	153.28	196.36	158.69	280.57	102.35	
	II	10	361.46	287.00	229.07	311.18	129.82	127.42	106.51	119.03	119.18	134.75	129.39	130.46	154.40	140.43	357.25	122.85	
	III	11	406.36	343.45	341.66	145.05	129.18	119.22	94.87	120.85	105.12	128.57	119.88	78.75	125.81	113.09	244.46	94.12	
Sep	I	10	399.83	348.16	267.51	127.48	107.43	104.50	88.01	90.31	226.39	123.17	78.58	59.82	80.53	113.96	126.71	196.72	
	II	10	203.27	184.51	267.46	170.15	111.10	117.85	84.03	59.72	96.65	113.53	81.10	76.18	58.17	76.49	150.90	220.98	
	III	10	126.90	112.85	214.71	141.06	165.16	108.36	76.65	36.70	52.78	106.46	77.72	87.63	55.31	72.33	237.32	96.44	
Oct	I	10	105.75	80.79	168.41	111.46	104.72	102.80	57.77	36.37	30.49	105.10	72.90	80.54	47.32	51.23	119.70	79.42	
	II	10	102.35	45.75	75.68	99.30	92.58	101.57	40.70	27.11	23.25	99.81	73.27	67.02	39.76	39.73	81.39	58.31	
	III	11	75.45	43.25	24.65	88.81	112.24	92.27	27.04	22.40	22.31	93.23	70.42	53.65	33.17	33.75	56.32	43.34	
Nov	I	10	68.16	41.54	19.64	89.08	98.84	77.22	22.66	19.90	22.27	74.99	65.02	45.28	28.65	31.98	32.06	31.10	
	II	10	60.00	41.61	18.45	90.26	91.25	75.43	20.20	18.40	19.73	57.61	53.06	38.57	24.75	29.29	19.07	29.63	
	III	10	52.52	41.80	24.94	87.58	87.46	73.36	16.44	17.70	17.64	43.77	45.06	27.98	20.60	26.98	19.48	27.71	
Dec	I	10	45.21	42.14	24.70	88.22	71.99	67.22	15.09	16.59	16.84	25.35	38.26	24.22	19.03	26.01	22.19	24.26	
	II	10	42.47	42.45	24.91	91.47	38.28	66.93	15.05	16.52	16.59	19.20	31.75	22.49	20.01	27.34	21.48	21.29	
	III	11	37.19	41.38	25.96	54.34	38.25	52.03	14.91	16.39	16.95	17.74	25.79	20.71	17.84	25.43	21.07	14.85	
Total	**m3/s**		**4093.32**	**3775.99**	**3461.91**	**3208.55**	**3420.70**	**2794.84**	**2188.86**	**1618.79**	**1870.74**	**2390.88**	**2042.05**	**1955.43**	**1747.30**	**1981.25**	**3462.22**	**2104.10**	**675.12**
share	**%**		**70%**	**68%**	**74%**	**77%**	**73%**	**77%**	**70%**	**68%**	**63%**	**70%**	**74%**	**65%**	**69%**	**72%**	**77%**	**387%**	
Runoff	**l/s/km 2**		**60.00**	**55.30**	**50.55**	**46.81**	**49.77**	**40.72**	**31.88**	**23.65**	**27.23**	**34.87**	**29.79**	**28.50**	**25.55**	**28.87**	**50.48**	**30.65**	**19.74**
Average ru	**cumec**		**114.84**	**105.84**	**96.74**	**89.59**	**95.25**	**77.94**	**61.02**	**45.26**	**52.12**	**66.73**	**57.02**	**54.54**	**48.90**	**55.25**	**96.62**	**58.66**	**37.78**

Annexure 4.8a: Discharge at Jakhol Barrage (cumec) - Calendar Year (1977-1993)

Catchment Area at Jakhol Barrage Site = 268.2 sq. km
Catchment Area at Tiuni (excluding Pabar) = 1914 sq. km
Proportionality factor = 0.14

Month	Period	Days	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Jan	**I**	**10**		4.43	4.28	3.02	4.48	3.52	3.69	4.53	3.16	3.51	2.66	2.44	6.10	4.86	12.18	12.19	2.45
	II	**10**		4.39	4.69	2.44	3.85	3.33	3.39	4.50	2.55	3.39	2.78	3.03	4.72	5.03	10.40	12.02	2.87
	III	**11**		4.53	4.17	2.65	3.66	3.61	3.30	4.46	2.55	3.45	2.50	2.10	4.09	7.21	11.32	13.11	2.50
Feb	**I**	**10**		4.11	4.68	2.81	3.45	3.71	3.29	4.45	2.41	2.62	2.81	2.05	4.27	10.09	12.96	13.64	2.64
	II	**10**		4.25	6.49	2.31	3.30	3.37	3.47	4.65	2.31	3.26	2.52	2.00	4.07	12.01	14.04	13.33	2.82
	III	**8**		4.56	5.96	2.28	3.42	2.86	3.35	3.82	3.24	2.82	1.70	2.70	4.03	9.22	13.85	13.23	2.27
Mar	**I**	**10**		3.64	6.13	2.94	4.86	4.92	4.78	4.20	4.05	2.89	3.71	3.09	4.03	9.87	17.76	14.47	2.29
	II	**10**		12.62	5.72	2.90	6.09	5.32	4.75	4.01	3.11	3.46	4.58	7.39	4.97	13.45	20.39	14.95	2.20
	III	**11**		5.29	6.78	3.33	12.99	6.28	5.72	3.97	3.86	4.12	4.73	7.85	8.34	13.95	23.12	16.70	3.66
Apr	**I**	**10**		4.31	9.42	3.43	7.08	4.46	5.93	3.54	4.17	5.44	5.36	5.77	9.17	13.35	26.14	17.40	4.07
	II	**10**		13.78	10.90	5.17	8.72	6.64	4.92	3.78	5.13	7.85	3.29	9.72	8.63	16.05	27.16	18.33	4.54
	III	**10**		7.06	13.42	6.17	9.31	6.61	8.09	5.15	6.16	7.45	7.05	8.89	7.79	15.83	26.89	22.44	4.12
May	**I**	**10**		13.71	11.88	7.41	10.41	10.90	11.25	5.37	7.96	4.57	9.50	9.01	11.16	15.05	32.29	22.68	11.94
	II	**10**		17.01	11.76	7.81	10.08	9.35	12.77	6.53	7.40	11.24	12.86	11.28	16.61	24.41	31.63	20.51	11.27
	III	**11**		16.08	10.99	9.85	11.32	9.03	11.14	7.94	14.18	10.46	11.40	10.97	17.99	20.85	28.02	17.23	16.26
Jun	**I**	**10**	9.73	17.90	10.81	16.16	12.42	12.48	14.90	8.41	9.69	9.97	17.92	9.26	21.06	21.14	27.86	18.93	14.33
	II	**10**	6.62	16.06	15.22	16.74	13.03	14.78	14.52	6.20	11.04	16.89	15.72	7.67	15.36	23.56	29.39	26.12	16.25
	III	**10**	19.92	21.76	19.18	22.47	16.36	14.96	12.20	6.69	12.54	24.57	16.39	14.17	16.18	29.90	30.28	32.14	17.94
Jul	**I**	**10**	45.72	33.26	21.33	26.72	16.14	19.33	15.69	11.36	14.10	23.33	17.27	16.90	16.20	29.23	30.65	24.55	20.63
	II	**10**	30.39	34.11	24.04	22.37	20.32	21.51	12.83	11.61	25.57	29.44	19.69	25.55	27.81	26.04	31.13	41.00	43.44
	III	**11**	38.33	38.13	24.02	23.20	32.09	24.08	21.99	14.65	19.37	19.40	20.03	26.26	43.95	25.90	31.52	65.24	26.26
Aug	**I**	**10**	30.00	42.23	29.39	21.31	36.93	25.99	21.91	13.16	25.05	25.42	18.65	20.91	22.99	23.67	39.29	53.54	19.77
	II	**10**	24.25	37.33	23.91	15.37	28.14	27.74	21.76	17.97	37.45	31.55	13.85	18.23	28.46	36.24	26.12	50.68	16.33
	III	**11**	19.02	32.97	20.19	17.41	17.55	26.04	28.53	18.31	20.30	19.24	16.39	20.20	33.31	31.10	33.55	42.16	14.28
Sep	**I**	**10**	27.87	43.11	17.64	16.31	14.41	22.83	30.43	16.29	17.37	15.51	12.29	12.26	25.56	31.98	31.28	39.20	22.79
	II	**10**	25.78	14.96	13.85	15.73	11.23	16.26	29.49	8.74	20.20	11.66	9.40	9.86	17.08	25.55	28.12	32.66	23.27
	III	**10**	19.95	16.97	11.67	14.39	10.88	11.30	21.46	6.99	14.35	8.00	8.66	12.33	18.38	21.28	23.05	17.67	15.78
Oct	**I**	**10**	13.60	11.85	11.31	13.72	10.20	8.64	17.14	7.04	8.98	7.60	6.95	21.24	14.90	22.10	20.58	12.30	13.22
	II	**10**	7.61	7.62	10.85	10.17	8.50	6.46	9.17	6.59	21.41	7.85	5.10	14.64	11.55	19.03	21.33	7.41	7.55
	III	**11**	7.68	7.47	6.68	8.93	7.87	5.86	1.56	5.89	7.79	5.22	4.14	8.50	10.18	14.94	16.67	7.04	5.78
Nov	**I**	**10**	7.34	9.85	5.66	7.82	8.51	5.18	8.25	4.96	6.26	5.23	3.16	6.47	8.87	13.97	12.95	4.53	5.52
	II	**10**	6.23	5.11	3.91	6.82	7.10	4.71	8.18	3.98	6.16	4.53	3.47	5.95	8.01	12.26	12.30	3.59	5.52
	III	**10**	6.07	4.30	3.06	6.63	5.95	4.63	7.76	3.79	4.41	3.90	3.46	5.20	6.95	11.79	12.89	3.67	5.98
Dec	**I**	**10**	4.56	4.41	2.62	6.26	4.65	4.25	7.19	3.68	3.79	3.74	2.70	5.60	5.11	10.76	12.60	3.29	5.25
	II	**10**	4.50	4.60	2.71	5.72	4.17	3.88	6.90	3.56	2.62	3.99	2.84	4.69	5.11	10.78	12.28	2.43	3.95
	III	**11**	4.47	3.45	2.53	5.13	3.88	3.61	6.71	3.30	2.70	3.17	2.95	6.17	5.95	11.87	12.50	2.18	3.33
Max			**45.72**	**43.11**	**29.39**	**26.72**	**36.93**	**27.74**	**30.43**	**18.31**	**37.45**	**31.55**	**20.03**	**26.26**	**43.95**	**36.24**	**39.29**	**65.24**	**43.44**
Min			**4.47**	**3.45**	**2.53**	**2.28**	**3.30**	**2.86**	**1.56**	**3.30**	**2.31**	**2.62**	**1.70**	**2.00**	**4.03**	**4.86**	**10.40**	**2.18**	**2.20**

Annexure 4.8a: Discharge at Jakhol Barrage (cumec) - Calendar Year (1994-2010)

Catchment Area at Jakhol Barrage Site = 268.2 sq. km
Catchment Area at Tiuni (excluding Pabar) = 1914 sq. km
Proportionality factor = 0.14

Month	Period	Days	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Jan	**I**	**10**	3.85	4.53	5.72	3.37	4.84	5.27	7.11	2.39	2.38	2.41	2.47	2.46	2.55	2.48	3.30	2.80	1.92
	II	**10**	3.81	3.91	5.87	3.36	5.02	5.88	7.53	2.31	2.41	2.41	2.71	2.21	2.70	2.35	3.66	2.71	2.01
	III	**11**	3.75	3.95	4.96	3.37	4.83	6.05	6.18	2.00	2.51	2.40	3.01	2.16	2.68	2.25	3.56	2.63	1.73
Feb	**I**	**10**	3.85	3.77	4.56	3.52	4.62	5.71	6.06	1.88	2.41	2.34	3.55	2.11	2.87	2.26	3.85	2.64	1.99
	II	**10**	3.86	3.94	4.71	3.63	4.07	5.72	6.61	2.13	3.31	2.41	3.27	2.51	2.82	2.46	3.87	2.65	1.92
	III	**8**	3.92	3.95	4.65	3.63	7.07	5.37	5.43	2.22	3.02	2.54	2.96	2.82	2.81	2.43	4.32	2.53	2.06
Mar	**I**	**10**	2.38	3.78	4.71	3.76	10.05	5.45	5.20	2.17	4.00	2.64	3.03	3.80	2.63	2.62	4.22	2.47	2.37
	II	**10**	3.37	3.73	5.05	3.59	12.32	5.41	5.13	2.26	4.25	2.77	3.30	3.81	2.87	2.83	4.66	2.48	2.67
	III	**11**	3.94	5.43	5.30	3.63	13.80	5.44	4.99	2.61	5.76	3.44	3.73	3.80	3.12	6.17	4.07	2.51	5.24
Apr	**I**	**10**	4.13	5.76	5.71	4.10	17.80	5.44	7.15	2.95	5.51	3.92	4.00	3.40	3.84	6.25	4.33	2.50	3.89
	II	**10**	3.26	5.52	5.87	4.75	15.00	6.01	6.86	3.13	4.30	3.92	4.00	3.68	3.97	7.28	4.06	2.75	7.07
	III	**10**	3.31	6.05	5.67	4.61	16.08	6.70	8.03	3.17	5.38	4.76	5.11	3.96	4.16	5.80	4.83	4.08	5.64
May	**I**	**10**	4.58	6.66	5.49	8.15	17.13	8.50	9.08	3.36	5.29	6.32	5.94	4.42	5.51	6.65	6.83	4.28	7.82
	II	**10**	5.47	9.21	7.46	5.00	14.95	10.47	11.47	5.23	6.34	8.48	8.87	5.19	6.10	7.65	6.67	6.86	6.26
	III	**11**	8.18	12.30	8.71	4.56	15.30	13.27	10.93	6.13	6.53	9.35	10.97	4.97	6.03	6.43	8.51	6.92	9.33
Jun	**I**	**10**	7.86	17.20	11.29	6.12	15.26	12.02	10.69	6.01	7.24	10.30	10.90	5.16	5.97	6.79	11.06	8.60	9.10
	II	**10**	9.39	18.17	22.27	8.54	19.10	12.45	13.40	8.20	8.84	11.21	11.62	6.08	3.29	11.19	20.27	5.83	9.41
	III	**10**	24.53	17.94	19.19	10.22	16.37	13.50	9.32	12.51	11.01	14.33	12.06	9.00	4.18	11.76	24.43	10.45	14.19
Jul	**I**	**10**	31.97	16.97	20.34	14.23	19.22	16.68	13.42	15.95	15.35	14.09	11.16	23.23	8.54	18.48	35.95	8.73	
	II	**10**	44.19	30.46	20.94	19.13	19.38	14.23	20.27	19.75	15.65	18.26	10.15	20.98	17.31	12.49	34.25	23.88	
	III	**11**	57.09	48.46	32.39	41.32	19.57	19.28	23.46	18.03	15.22	19.16	13.08	22.82	21.75	15.54	37.62	23.52	
Aug	**I**	**10**	44.47	59.68	32.15	49.44	14.42	22.54	13.11	15.85	15.25	27.39	15.42	21.48	27.52	22.24	39.31	14.34	
	II	**10**	50.65	40.22	32.10	43.60	18.19	17.85	14.92	16.68	16.70	18.88	18.13	18.28	21.64	19.68	50.06	17.21	
	III	**11**	56.94	48.13	47.88	20.33	18.10	16.71	13.29	16.93	14.73	18.02	16.80	11.03	17.63	15.85	34.26	13.19	
Sep	**I**	**10**	56.03	48.79	37.48	17.86	15.05	14.64	12.33	12.65	31.72	17.26	11.01	8.38	11.28	15.97	17.76	27.57	
	II	**10**	28.48	25.85	37.48	23.84	15.57	16.51	11.77	8.37	13.54	15.91	11.36	10.67	8.15	10.72	21.14	30.96	
	III	**10**	17.78	15.81	30.09	19.77	23.14	15.18	10.74	5.14	7.40	14.92	10.89	12.28	7.75	10.14	33.25	13.51	
Oct	**I**	**10**	14.82	11.32	23.60	15.62	14.67	14.40	8.10	5.10	4.27	14.73	10.22	11.29	6.63	7.18	16.77	11.13	
	II	**10**	14.34	6.41	10.60	13.91	12.97	14.23	5.70	3.80	3.26	13.99	10.27	9.39	5.57	5.57	11.40	8.17	
	III	**11**	10.57	6.06	3.45	12.44	15.73	12.93	3.79	3.14	3.13	13.06	9.87	7.52	4.65	4.73	7.89	6.07	
Nov	**I**	**10**	9.55	5.82	2.75	12.48	13.85	10.82	3.18	2.79	3.12	10.51	9.11	6.34	4.01	4.48	4.49	4.36	
	II	**10**	8.41	5.83	2.59	12.65	12.79	10.57	2.83	2.58	2.76	8.07	7.44	5.40	3.47	4.10	2.67	4.15	
	III	**10**	7.36	5.86	3.49	12.27	12.26	10.28	2.30	2.48	2.47	6.13	6.31	3.92	2.89	3.78	2.73	3.88	
Dec	**I**	**10**	6.34	5.90	3.46	12.36	10.09	9.42	2.11	2.32	2.36	3.55	5.36	3.39	2.67	3.64	3.11	3.40	
	II	**10**	5.95	5.95	3.49	12.82	5.36	9.38	2.11	2.31	2.32	2.69	4.45	3.15	2.80	3.83	3.01	2.98	
	III	**11**	5.21	5.80	3.64	7.61	5.36	7.29	2.09	2.30	2.38	2.49	3.61	2.90	2.50	3.56	2.95	2.08	
Max			**57.09**	**59.68**	**47.88**	**49.44**	**23.14**	**22.54**	**23.46**	**19.75**	**31.72**	**27.39**	**18.13**	**23.23**	**27.52**	**22.24**	**50.06**	**30.96**	**14.19**
Min			**2.38**	**3.73**	**2.59**	**3.36**	**4.07**	**5.27**	**2.09**	**1.88**	**2.32**	**2.34**	**2.47**	**2.11**	**2.50**	**2.25**	**2.67**	**2.08**	**1.73**

Annexure 4.8b: Discharge at Jakhol Barrage (cumec) - Hydrological Year (1977-1994)

Catchment Area at Jakhol Barrage Site = 268.2 sq. km
Catchment Area at Tiuni (excluding Pabar) = 1914 sq. km
Proportionality factor = 0.14

Month	Period	Days	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94
Jun	I	10	9.73	17.90	10.81	16.16	12.42	12.48	14.90	8.41	9.69	9.97	17.92	9.26	21.06	21.14	27.86	18.93	14.33
	II	10	6.62	16.06	15.22	16.74	13.03	14.78	14.52	6.20	11.04	16.89	15.72	7.67	15.36	23.56	29.39	26.12	16.25
	III	10	19.92	21.76	19.18	22.47	16.36	14.96	12.20	6.69	12.54	24.57	16.39	14.17	16.18	29.90	30.28	32.14	17.94
Jul	I	10	45.72	33.26	21.33	26.72	16.14	19.33	15.69	11.36	14.10	23.33	17.27	16.90	16.20	29.23	30.65	24.55	20.63
	II	10	30.39	34.11	24.04	22.37	20.32	21.51	12.83	11.61	25.57	29.44	19.69	25.55	27.81	26.04	31.13	41.00	43.44
	III	11	38.33	38.13	24.02	23.20	32.09	24.08	21.99	14.65	19.37	19.40	20.03	26.26	43.95	25.90	31.52	65.24	26.26
Aug	I	10	30.00	42.23	29.39	21.31	36.93	25.99	21.91	13.16	25.05	25.42	18.65	20.91	22.99	23.67	39.29	53.54	19.77
	II	10	24.25	37.33	23.91	15.37	28.14	27.74	21.76	17.97	37.45	31.55	13.85	18.23	28.46	36.24	26.12	50.68	16.33
	III	11	19.02	32.97	20.19	17.41	17.55	26.04	28.53	18.31	20.30	19.24	16.39	20.20	33.31	31.10	33.55	42.16	14.28
Sep	I	10	27.87	43.11	17.64	16.31	14.41	22.83	30.43	16.29	17.37	15.51	12.29	12.26	25.56	31.98	31.28	39.20	22.79
	II	10	25.78	14.96	13.85	15.73	11.23	16.26	29.49	8.74	20.20	11.66	9.40	9.86	17.08	25.55	28.12	32.66	23.27
	III	10	19.95	16.97	11.67	14.39	10.88	11.30	21.46	6.99	14.35	8.00	8.66	12.33	18.38	21.28	23.05	17.67	15.78
Oct	I	10	13.60	11.85	11.31	13.72	10.20	8.64	17.14	7.04	8.98	7.60	6.95	21.24	14.90	22.10	20.58	12.30	13.22
	II	10	7.61	7.62	10.85	10.17	8.50	6.46	9.17	6.59	21.41	7.85	5.10	14.64	11.55	19.03	21.33	7.41	7.55
	III	11	7.68	7.47	6.68	8.93	7.87	5.86	1.56	5.89	7.79	5.22	4.14	8.50	10.18	14.94	16.67	7.04	5.78
Nov	I	10	7.34	9.85	5.66	7.82	8.51	5.18	8.25	4.96	6.26	5.23	3.16	6.47	8.87	13.97	12.95	4.53	5.52
	II	10	6.23	5.11	3.91	6.82	7.10	4.71	8.18	3.98	6.16	4.53	3.47	5.95	8.01	12.26	12.30	3.59	5.52
	III	10	6.07	4.30	3.06	6.63	5.95	4.63	7.76	3.79	4.41	3.90	3.46	5.20	6.95	11.79	12.89	3.67	5.98
Dec	I	10	4.56	4.41	2.62	6.26	4.65	4.25	7.19	3.68	3.79	3.74	2.70	5.60	5.11	10.76	12.60	3.29	5.25
	II	10	4.50	4.60	2.71	5.72	4.17	3.88	6.90	3.56	2.62	3.99	2.84	4.69	5.11	10.78	12.28	2.43	3.95
	III	11	4.47	3.45	2.53	5.13	3.88	3.61	6.71	3.30	2.70	3.17	2.95	6.17	5.95	11.87	12.50	2.18	3.33
Jan	I	10	4.43	4.28	3.02	4.48	3.52	3.69	4.53	3.16	3.51	2.66	2.44	6.10	4.86	12.18	12.19	2.45	3.85
	II	10	4.39	4.69	2.44	3.85	3.33	3.39	4.50	2.55	3.39	2.78	3.03	4.72	5.03	10.40	12.02	2.87	3.81
	III	11	4.53	4.17	2.65	3.66	3.61	3.30	4.46	2.55	3.45	2.50	2.10	4.09	7.21	11.32	13.11	2.50	3.75
Feb	I	10	4.11	4.68	2.81	3.45	3.71	3.29	4.45	2.41	2.62	2.81	2.05	4.27	10.09	12.96	13.64	2.64	3.85
	II	10	4.25	6.49	2.31	3.30	3.37	3.47	4.65	2.31	3.26	2.52	2.00	4.07	12.01	14.04	13.33	2.82	3.86
	III	8	4.56	5.96	2.28	3.42	2.86	3.35	3.82	3.24	2.82	1.70	2.70	4.03	9.22	13.85	13.23	2.27	3.92
Mar	I	10	3.64	6.13	2.94	4.86	4.92	4.78	4.20	4.05	2.89	3.71	3.09	4.03	9.87	17.76	14.47	2.29	2.38
	II	10	12.62	5.72	2.90	6.09	5.32	4.75	4.01	3.11	3.46	4.58	7.39	4.97	13.45	20.39	14.95	2.20	3.37
	III	11	5.29	6.78	3.33	12.99	6.28	5.72	3.97	3.86	4.12	4.73	7.85	8.34	13.95	23.12	16.70	3.66	3.94
Apr	I	10	4.31	9.42	3.43	7.08	4.46	5.93	3.54	4.17	5.44	5.36	5.77	9.17	13.35	26.14	17.40	4.07	4.13
	II	10	13.78	10.90	5.17	8.72	6.64	4.92	3.78	5.13	7.85	3.29	9.72	8.63	16.05	27.16	18.33	4.54	3.26
	III	10	7.06	13.42	6.17	9.31	6.61	8.09	5.15	6.16	7.45	7.05	8.89	7.79	15.83	26.89	22.44	4.12	3.31
May	I	10	13.71	11.88	7.41	10.41	10.90	11.25	5.37	7.96	4.57	9.50	9.01	11.16	15.05	32.29	22.68	11.94	4.58
	II	10	17.01	11.76	7.81	10.08	9.35	12.77	6.53	7.40	11.24	12.86	11.28	16.61	24.41	31.63	20.51	11.27	5.47
	III	11	16.08	10.99	9.85	11.32	9.03	11.14	7.94	14.18	10.46	11.40	10.97	17.99	20.85	28.02	17.23	16.26	8.18

Annexure 4.8b: Discharge at Jakhol Barrage (cumec) - Hydrological Year (1994-2010)

Catchment Area at Jakhol Barrage Site = 268.2 sq. km
Catchment Area at Tiuni (excluding Pabar) = 1914 sq. km
Proportionality factor = 0.14

Month	Period	Days	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10
Jun	I	10	7.86	17.20	11.29	6.12	15.26	12.02	10.69	6.01	7.24	10.30	10.90	5.16	5.97	6.79	11.06	8.60
	II	10	9.39	18.17	22.27	8.54	19.10	12.45	13.40	8.20	8.84	11.21	11.62	6.08	3.29	11.19	20.27	5.83
	III	10	24.53	17.94	19.19	10.22	16.37	13.50	9.32	12.51	11.01	14.33	12.06	9.00	4.18	11.76	24.43	10.45
Jul	I	10	31.97	16.97	20.34	14.23	19.22	16.68	13.42	15.95	15.35	14.09	11.16	23.23	8.54	18.48	35.95	8.73
	II	10	44.19	30.46	20.94	19.13	19.38	14.23	20.27	19.75	15.65	18.26	10.15	20.98	17.31	12.49	34.25	23.88
	III	11	57.09	48.46	32.39	41.32	19.57	19.28	23.46	18.03	15.22	19.16	13.08	22.82	21.75	15.54	37.62	23.52
Aug	I	10	44.47	59.68	32.15	49.44	14.42	22.54	13.11	15.85	15.25	27.39	15.42	21.48	27.52	22.24	39.31	14.34
	II	10	50.65	40.22	32.10	43.60	18.19	17.85	14.92	16.68	16.70	18.88	18.13	18.28	21.64	19.68	50.06	17.21
	III	11	56.94	48.13	47.88	20.33	18.10	16.71	13.29	16.93	14.73	18.02	16.80	11.03	17.63	15.85	34.26	13.19
Sep	I	10	56.03	48.79	37.48	17.86	15.05	14.64	12.33	12.65	31.72	17.26	11.01	8.38	11.28	15.97	17.76	27.57
	II	10	28.48	25.85	37.48	23.84	15.57	16.51	11.77	8.37	13.54	15.91	11.36	10.67	8.15	10.72	21.14	30.96
	III	10	17.78	15.81	30.09	19.77	23.14	15.18	10.74	5.14	7.40	14.92	10.89	12.28	7.75	10.14	33.25	13.51
Oct	I	10	14.82	11.32	23.60	15.62	14.67	14.40	8.10	5.10	4.27	14.73	10.22	11.29	6.63	7.18	16.77	11.13
	II	10	14.34	6.41	10.60	13.91	12.97	14.23	5.70	3.80	3.26	13.99	10.27	9.39	5.57	5.57	11.40	8.17
	III	11	10.57	6.06	3.45	12.44	15.73	12.93	3.79	3.14	3.13	13.06	9.87	7.52	4.65	4.73	7.89	6.07
Nov	I	10	9.55	5.82	2.75	12.48	13.85	10.82	3.18	2.79	3.12	10.51	9.11	6.34	4.01	4.48	4.49	4.36
	II	10	8.41	5.83	2.59	12.65	12.79	10.57	2.83	2.58	2.76	8.07	7.44	5.40	3.47	4.10	2.67	4.15
	III	10	7.36	5.86	3.49	12.27	12.26	10.28	2.30	2.48	2.47	6.13	6.31	3.92	2.89	3.78	2.73	3.88
Dec	I	10	6.34	5.90	3.46	12.36	10.09	9.42	2.11	2.32	2.36	3.55	5.36	3.39	2.67	3.64	3.11	3.40
	II	10	5.95	5.95	3.49	12.82	5.36	9.38	2.11	2.31	2.32	2.69	4.45	3.15	2.80	3.83	3.01	2.98
	III	11	5.21	5.80	3.64	7.61	5.36	7.29	2.09	2.30	2.38	2.49	3.61	2.90	2.50	3.56	2.95	2.08
Jan	I	10	4.53	5.72	3.37	4.84	5.27	7.11	2.39	2.38	2.41	2.47	2.46	2.55	2.48	3.30	2.80	1.92
	II	10	3.91	5.87	3.36	5.02	5.88	7.53	2.31	2.41	2.41	2.71	2.21	2.70	2.35	3.66	2.71	2.01
	III	11	3.95	4.96	3.37	4.83	6.05	6.18	2.00	2.51	2.40	3.01	2.16	2.68	2.25	3.56	2.63	1.73
Feb	I	10	3.77	4.56	3.52	4.62	5.71	6.06	1.88	2.41	2.34	3.55	2.11	2.87	2.26	3.85	2.64	1.99
	II	10	3.94	4.71	3.63	4.07	5.72	6.61	2.13	3.31	2.41	3.27	2.51	2.82	2.46	3.87	2.65	1.92
	III	8	3.95	4.65	3.63	7.07	5.37	5.43	2.22	3.02	2.54	2.96	2.82	2.81	2.43	4.32	2.53	2.06
Mar	I	10	3.78	4.71	3.76	10.05	5.45	5.20	2.17	4.00	2.64	3.03	3.80	2.63	2.62	4.22	2.47	2.37
	II	10	3.73	5.05	3.59	12.32	5.41	5.13	2.26	4.25	2.77	3.30	3.81	2.87	2.83	4.66	2.48	2.67
	III	11	5.43	5.30	3.63	13.80	5.44	4.99	2.61	5.76	3.44	3.73	3.80	3.12	6.17	4.07	2.51	5.24
Apr	I	10	5.76	5.71	4.10	17.80	5.44	7.15	2.95	5.51	3.92	4.00	3.40	3.84	6.25	4.33	2.50	3.89
	II	10	5.52	5.87	4.75	15.00	6.01	6.86	3.13	4.30	3.92	4.00	3.68	3.97	7.28	4.06	2.75	7.07
	III	10	6.05	5.67	4.61	16.08	6.70	8.03	3.17	5.38	4.76	5.11	3.96	4.16	5.80	4.83	4.08	5.64
May	I	10	6.66	5.49	8.15	17.13	8.50	9.08	3.36	5.29	6.32	5.94	4.42	5.51	6.65	6.83	4.28	7.82
	II	10	9.21	7.46	5.00	14.95	10.47	11.47	5.23	6.34	8.48	8.87	5.19	6.10	7.65	6.67	6.86	6.26
	III	11	12.30	8.71	4.56	15.30	13.27	10.93	6.13	6.53	9.35	10.97	4.97	6.03	6.43	8.51	6.92	9.33

Annexure 4.8c: Dependable Year Calculation

Year	Annual Volume (MCM)	Sorted Annual Volume (MCM)	Rank	Exceedance Probability (%)	Year
1977-78	421.67	667.96	1	2.94	
1978-79	461.29	648.01	2	5.88	
1979-80	303.74	525.98	3	8.82	
1980-81	354.25	500.85	4	11.76	
1981-82	329.78	488.94	5	14.71	
1982-83	329.74	483.49	6	17.65	
1983-84	342.33	469.03	7	20.59	
1984-85	225.52	461.29	8	23.53	
1985-86	323.08	421.67	9	26.47	
1986-87	314.38	409.69	10	29.41	
1987-88	272.39	408.57	11	32.35	
1988-89	342.43	366.71	12	35.29	
1989-90	488.94	354.25	13	38.24	
1990-91	667.96	350.29	14	41.18	
1991-92	648.01	342.43	15	44.12	
1992-93	500.85	342.33	16	47.06	
1993-94	323.64	329.78	17	**50.00**	**1981-82**
1994-95	525.98	329.74	18	52.94	
1995-96	469.03	323.64	19	55.88	
1996-97	408.57	323.08	20	58.82	
1997-98	483.49	314.38	21	61.76	
1998-99	366.71	303.74	22	64.71	
1999-2000	350.29	300.93	23	67.65	
2000-01	214.08	272.39	24	70.59	
2001-02	217.06	269.25	25	73.53	
2002-03	227.56	248.13	26	76.47	
2003-04	300.93	243.99	27	79.41	
2004-05	237.93	237.93	28	82.35	
2005-06	243.99	227.56	29	85.29	
2006-07	226.15	226.15	30	88.24	
2007-08	248.13	225.52	31	**91.18**	**1984-85**
2008-09	409.69	217.06	32	94.12	
2009-10	269.25	214.08	33	97.06	

Annexure 4.9: Annual Flow Series in 90% & 50% Dependable Years

		Dependable Years	
Month	**Period**	**90%**	**50%**
		1981-82	**1984-85**
Jun	**I**	12.42	8.41
	II	13.03	6.20
	III	16.36	6.69
Jul	**I**	16.14	11.36
	II	20.32	11.61
	III	32.09	14.65
Aug	**I**	36.93	13.16
	II	28.14	17.97
	III	17.55	18.31
Sep	**I**	14.41	16.29
	II	11.23	8.74
	III	10.88	6.99
Oct	**I**	10.20	7.04
	II	8.50	6.59
	III	7.87	5.89
Nov	**I**	8.51	4.96
	II	7.10	3.98
	III	5.95	3.79
Dec	**I**	4.65	3.68
	II	4.17	3.56
	III	3.88	3.30
Jan	**I**	3.52	3.16
	II	3.33	2.55
	III	3.61	2.55
Feb	**I**	3.71	2.41
	II	3.37	2.31
	III	2.86	3.24
Mar	**I**	4.92	4.05
	II	5.32	3.11
	III	6.28	3.86
Apr	**I**	4.46	4.17
	II	6.64	5.13
	III	6.61	6.16
May	**I**	10.90	7.96
	II	9.35	7.40
	III	9.03	14.18

Annexure 4.10a: Flood Frequency Analysis by Gumbel's Method

Application of Gumbel's Law, y = A + Bx to Annual Discharges of Jakhol Sankri HEP

Year	Sorted Annual Peak Discharge y (m3/s)	M	T = (N+1)/M	x = log10 log10(T/(T-1))	x*y	x2
1997	1410.93	1	31.00	-1.85	-2605.25	3.41
2002	1353.80	2	15.50	-1.54	-2082.34	2.37
1999	1309.60	3	10.33	-1.35	-1773.91	1.83
1994	1130.20	4	7.75	-1.22	-1380.95	1.49
1995	807.50	5	6.20	-1.12	-901.96	1.25
1992	694.30	6	5.17	-1.03	-714.82	1.06
2009	623.46	7	4.43	-0.95	-594.84	0.91
1985	618.10	8	3.88	-0.89	-548.43	0.79
1982	577.50	9	3.44	-0.83	-477.59	0.68
2008	547.45	10	3.10	-0.77	-422.49	0.60
1996	535.40	11	2.82	-0.72	-385.75	0.52
1993	526.10	12	2.58	-0.67	-353.76	0.45
1989	478.40	13	2.38	-0.63	-299.92	0.39
1981	404.30	14	2.21	-0.58	-235.91	0.34
1990	386.10	15	2.07	-0.54	-209.17	0.29
2005	335.80	16	1.94	-0.50	-168.34	0.25
2003	321.53	17	1.82	-0.46	-148.51	0.21
1980	314.50	18	1.72	-0.42	-133.09	0.18
1991	262.10	19	1.63	-0.38	-100.89	0.15
1998	259.50	20	1.55	-0.35	-90.00	0.12
2007	245.23	21	1.48	-0.31	-75.68	0.10
2000	233.60	22	1.41	-0.27	-63.06	0.07
1983	223.40	23	1.35	-0.23	-51.48	0.05
2001	222.98	24	1.29	-0.19	-42.27	0.04
1984	192.80	25	1.24	-0.15	-28.30	0.02
1986	186.50	26	1.19	-0.10	-18.85	0.01
2006	171.10	27	1.15	-0.05	-8.72	0.00
2004	160.81	28	1.11	0.01	0.99	0.00
1987	130.41	29	1.07	0.08	9.87	0.01
1988	77.60	30	1.03	0.17	13.47	0.03
	14741.00	465.00	123.84	-17.85	-13891.93	17.63

N= 30

$\bar{y} = (\sum y)/N$ 491.37 $\bar{x} = (\sum x)/N$

$B = \frac{\sum(xy) - (N\ \bar{x}\ \bar{y})}{\sum(x)2 - (N\ (\bar{x})2)}$ -731.22 $A = \bar{y} - B\ \bar{x}$ 56.22

Line of Best Fit, y = 56.22 - 731.22 log10 log10(T/(T-1))

Annexure 4.10b: Estimated Floods for Different Return Periods

Catchment Area at Tuini= 1914 km2

at JSHEP Weir= 268.2 km2

Retrun Period (T) Years	x = log10 log10 (T/(T-1))	Estimated Flood Flow (y) m3/s	Applying CA Proportionality at Jakhol Sankhri Project m3/s	Increased by 15% m3/s
5	-1.01	-28833.87	111.74	128.50
10	-1.34	-33638.06	145.13	166.90
20	-1.65	-38246.35	177.16	203.74
25	-1.75	-39708.16	187.32	215.42
50	-2.06	-44211.31	218.62	**251.42**
100	-2.36	-48681.21	249.69	**287.15**
500	-3.06	-59010.46	321.49	**369.71**
1000	-3.36	-63451.15	352.36	405.21

Annexure 5.1: 33 years 10-daily discharge data of river Supin at Jakhol Sankri Barrage location

Month	Period	Days	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	Avg
Jun	I	10	9.73	17.9	10.82	16.16	12.41	12.48	14.9	8.41	9.69	9.97	17.92	9.25	21.06	21.15	27.86	18.93	14.33	7.86	17.2	11.29	6.12	15.26	12.02	10.69	6.01	7.24	10.3	10.9	5.16	5.97	6.79	11.06	8.6	**12.29**
	II	10	6.62	16.06	15.22	16.74	13.03	14.78	14.52	6.2	11.04	16.89	15.72	7.67	15.36	23.56	29.39	26.12	16.25	9.39	18.17	22.27	8.54	19.1	12.45	13.4	8.2	8.84	11.21	11.62	6.08	3.29	11.19	20.27	5.83	**13.79**
	III	10	19.92	21.76	19.18	22.47	16.36	14.96	12.2	6.69	12.54	24.57	16.39	14.17	16.18	29.9	30.28	32.14	17.94	24.53	17.94	19.19	10.22	16.37	13.5	9.32	12.51	11.01	14.33	12.06	9	4.18	11.76	24.43	10.45	**16.62**
July	I	10	45.72	33.26	21.33	26.72	16.14	19.33	15.69	11.36	14.1	23.33	17.27	16.91	16.2	29.23	30.65	24.55	20.63	31.97	16.98	20.34	14.23	19.22	16.68	13.42	15.95	15.35	14.09	11.16	23.23	8.54	18.48	35.95	8.73	**20.20**
	II	10	30.39	34.11	24.04	22.37	20.32	21.51	12.83	11.61	25.57	29.44	19.69	25.55	27.81	26.04	31.13	40.99	43.44	44.19	30.46	20.94	19.13	19.38	14.23	20.27	19.75	15.65	18.26	10.15	20.98	17.31	12.49	34.25	23.88	**23.88**
	III	11	38.33	38.13	24.02	23.2	32.09	24.08	21.99	14.65	19.37	19.41	20.03	26.26	43.95	25.9	31.52	65.24	26.26	57.09	48.46	32.39	41.32	19.57	19.28	23.46	18.03	15.22	19.16	13.08	22.82	21.75	15.54	37.62	23.52	**27.96**
Aug	I	10	30	42.23	29.39	21.31	36.93	25.99	21.91	13.16	25.05	25.42	18.66	20.91	22.99	23.67	39.29	53.54	19.77	44.47	59.68	32.15	49.44	14.42	22.54	13.11	15.85	15.25	27.39	15.42	21.48	27.52	22.24	39.31	14.34	**27.42**
	II	10	24.25	37.32	23.91	15.37	28.14	27.74	21.76	17.97	37.45	31.56	13.85	18.23	28.46	36.24	26.12	50.68	16.33	50.65	40.22	32.1	43.6	18.19	17.85	14.92	16.68	16.7	18.88	18.13	18.28	21.64	19.68	50.06	17.21	**26.37**
	III	11	19.02	32.97	20.19	17.41	17.55	26.04	28.53	18.31	20.3	19.24	16.39	20.2	33.31	31.1	33.55	42.16	14.28	56.94	48.13	47.88	20.32	18.1	16.71	13.29	16.93	14.73	18.02	16.8	11.03	17.63	15.85	34.26	13.19	**23.95**
Sep	I	10	27.87	43.11	17.64	16.32	14.41	22.83	30.43	16.29	17.37	15.51	12.29	12.25	25.56	31.98	31.28	39.2	22.79	56.03	48.79	37.48	17.86	15.05	14.64	12.33	12.66	31.72	17.26	11.01	8.38	11.28	15.97	17.76	27.57	**22.82**
	II	10	25.78	14.96	13.85	15.73	11.23	16.26	29.49	8.74	20.2	11.66	9.4	9.86	17.08	25.55	28.12	32.66	23.27	28.48	25.85	37.48	23.84	15.57	16.51	11.77	8.37	13.54	15.91	11.36	10.67	8.15	10.72	21.14	30.96	**18.31**
	III	10	19.95	16.98	11.66	14.39	10.88	11.3	21.46	6.99	14.35	8	8.66	12.33	18.38	21.28	23.05	17.67	15.78	17.78	15.81	30.09	19.77	23.14	15.18	10.74	5.14	7.4	14.92	10.89	12.28	7.75	10.14	33.25	13.51	**15.18**
Oct	I	10	13.6	11.85	11.31	13.72	10.2	8.64	17.14	7.04	8.99	7.6	6.95	21.24	14.9	22.1	20.58	12.3	13.22	14.82	11.32	23.6	15.62	14.67	14.41	8.09	5.1	4.27	14.73	10.22	11.29	6.63	7.18	16.77	11.13	**12.46**
	II	10	7.61	7.62	10.85	10.17	8.5	6.46	9.17	6.59	21.41	7.85	5.1	14.64	11.55	19.03	21.33	7.41	7.55	14.34	6.41	10.6	13.91	12.97	14.23	5.7	3.8	3.26	13.99	10.27	9.39	5.57	5.57	11.4	8.17	**10.07**
	III	11	7.68	7.47	6.68	8.93	7.87	5.86	1.56	5.89	7.79	5.22	4.15	8.5	10.18	14.94	16.67	7.04	5.78	10.57	6.06	3.45	12.44	15.73	12.93	3.79	3.14	3.13	13.06	9.87	7.52	4.65	4.73	7.89	6.07	**7.80**
Nov	I	10	7.34	9.85	5.66	7.83	8.51	5.18	8.25	4.96	6.25	5.23	3.16	6.47	8.87	13.97	12.95	4.53	5.52	9.55	5.82	2.75	12.48	13.85	10.82	3.17	2.79	3.12	10.51	9.11	6.34	4.01	4.48	4.49	4.36	**7.04**
	II	10	6.23	5.11	3.91	6.82	7.1	4.71	8.18	3.98	6.16	4.53	3.47	5.95	8.01	12.26	12.3	3.59	5.52	8.41	5.83	2.58	12.65	12.79	10.57	2.83	2.58	2.76	8.07	7.44	5.4	3.47	4.1	2.67	4.15	**6.19**
	III	10	6.07	4.3	3.06	6.63	5.95	4.63	7.76	3.79	4.41	3.9	3.46	5.2	6.95	11.79	12.89	3.66	5.98	7.36	5.86	3.5	12.27	12.25	10.28	2.3	2.48	2.47	6.13	6.31	3.92	2.89	3.78	2.73	3.88	**5.72**
Dec	I	10	4.56	4.41	2.62	6.25	4.66	4.25	7.19	3.68	3.79	3.74	2.7	5.6	5.11	10.76	12.6	3.29	5.25	6.33	5.91	3.46	12.36	10.09	9.42	2.11	2.33	2.36	3.55	5.36	3.39	2.67	3.64	3.11	3.4	**5.15**
	II	10	4.5	4.6	2.71	5.72	4.17	3.88	6.9	3.57	2.62	3.99	2.84	4.69	5.11	10.78	12.28	2.43	3.95	5.95	5.95	3.49	12.82	5.36	9.38	2.11	2.32	2.32	2.69	4.45	3.15	2.8	3.83	3.01	2.98	**4.77**
	III	11	4.47	3.45	2.53	5.13	3.88	3.61	6.71	3.3	2.7	3.17	2.95	6.16	5.95	11.87	12.5	2.18	3.33	5.21	5.8	3.64	7.61	5.36	7.29	2.09	2.3	2.38	2.49	3.61	2.9	2.5	3.56	2.95	2.08	**4.41**
Jan	I	10	4.42	4.28	3.02	4.48	3.52	3.69	4.53	3.16	3.51	2.66	2.44	6.1	4.86	12.18	12.19	2.45	3.85	4.53	5.72	3.37	4.84	5.27	7.11	2.39	2.38	2.41	2.47	2.46	2.55	2.48	3.3	2.8	1.92	**4.16**
	II	10	4.39	4.69	2.44	3.85	3.33	3.39	4.5	2.55	3.39	2.78	3.03	4.72	5.03	10.4	12.02	2.87	3.81	3.91	5.87	3.36	5.01	5.88	7.53	2.31	2.41	2.41	2.71	2.21	2.7	2.35	3.66	2.71	2.01	**4.07**
	III	11	4.53	4.17	2.65	3.66	3.61	3.3	4.46	2.55	3.45	2.5	2.1	4.09	7.21	11.32	13.11	2.5	3.75	3.95	4.96	3.37	4.83	6.05	6.18	2	2.5	2.4	3.01	2.16	2.68	2.25	3.56	2.63	1.73	**4.04**
Feb	I	10	4.11	4.68	2.81	3.45	3.71	3.29	4.45	2.41	2.62	2.81	2.05	4.27	10.09	12.96	13.64	2.64	3.85	3.77	4.56	3.52	4.62	5.71	6.06	1.88	2.4	2.34	3.55	2.11	2.87	2.26	3.85	2.64	1.99	**4.18**
	II	10	4.25	6.49	2.31	3.3	3.37	3.47	4.65	2.31	3.25	2.52	2	4.08	12.01	14.04	13.33	2.82	3.86	3.94	4.71	3.63	4.07	5.72	6.61	2.13	3.4	2.41	3.27	2.51	2.82	2.46	3.87	2.65	1.92	**4.37**
	III	8	4.56	5.96	2.28	3.42	2.86	3.35	3.82	3.24	2.83	1.7	2.7	4.03	9.22	13.85	13.23	2.27	3.92	3.95	4.65	3.63	7.07	5.37	5.43	2.22	3.02	2.54	2.96	2.82	2.81	2.43	4.32	2.53	2.06	**4.27**
Mar	I	10	3.64	6.13	2.94	4.86	4.92	4.78	4.2	4.05	2.89	3.71	3.09	4.03	9.87	17.75	14.47	2.29	2.38	3.78	4.71	3.76	10.05	5.45	5.2	2.17	4	2.64	3.03	3.8	2.63	2.62	4.22	2.47	2.37	**4.82**
	II	10	12.62	5.72	2.9	6.09	5.32	4.75	4.01	3.11	3.46	4.58	7.39	4.97	13.45	20.39	14.95	2.2	3.37	3.73	5.05	3.59	12.32	5.41	5.13	2.26	4.25	2.77	3.3	3.81	2.87	2.83	4.66	2.48	2.67	**5.65**
	III	11	5.29	6.78	3.33	12.99	6.28	5.72	3.97	3.86	4.12	4.73	7.85	8.34	13.95	23.12	16.7	3.66	3.94	5.43	5.3	3.63	13.8	5.44	4.99	2.61	5.76	3.44	3.73	3.8	3.12	6.17	4.07	2.51	5.24	**6.47**
Apr	I	10	4.31	9.41	3.43	7.08	4.46	5.93	3.54	4.17	5.44	5.36	5.77	9.16	13.35	26.14	17.4	4.08	4.13	5.76	5.71	4.1	17.8	5.44	7.15	2.95	5.51	3.92	4	3.4	3.84	6.25	4.33	2.5	3.89	**6.66**
	II	10	13.78	10.9	5.17	8.72	6.64	4.91	3.78	5.13	7.85	3.29	9.72	8.63	16.05	27.16	18.32	4.54	3.26	5.52	5.87	4.75	15	6.01	6.86	3.13	4.31	3.92	4	3.68	3.97	7.28	4.06	2.75	7.07	**7.46**
	III	10	7.06	13.42	6.16	9.31	6.61	8.09	5.15	6.16	7.45	7.05	8.89	7.79	15.83	26.89	22.44	4.12	3.31	6.05	5.67	4.61	16.08	6.7	8.03	3.17	5.37	4.76	5.11	3.96	4.16	5.8	4.83	4.08	5.64	**7.87**
May	I	10	13.71	11.88	7.41	10.41	10.9	11.25	5.37	7.96	4.57	9.5	9.01	11.16	15.05	32.29	22.68	11.94	4.58	6.66	5.49	8.15	17.13	8.5	9.08	3.36	5.29	6.32	5.94	4.42	5.51	6.65	6.83	4.28	7.82	**9.43**
	II	10	17.01	11.76	7.81	10.08	9.35	12.77	6.53	7.4	11.24	12.86	11.28	16.61	24.41	31.63	20.51	11.27	5.47	9.21	7.46	5	14.95	10.47	11.47	5.23	6.33	8.48	8.87	5.19	6.1	7.65	6.67	6.86	6.26	**10.73**
	III	11	16.08	10.99	9.85	11.32	9.03	11.14	7.94	14.17	10.46	11.4	10.97	17.99	20.85	28.02	17.23	16.26	8.18	12.3	8.71	4.56	15.3	13.27	10.93	6.13	6.53	9.35	10.97	4.97	6.03	6.43	8.51	6.92	9.33	**11.28**
Average Q			**13.32**	**14.58**	**9.59**	**11.18**	**10.40**	**10.40**	**10.82**	**7.09**	**10.21**	**9.94**	**8.59**	**10.78**	**15.39**	**21.15**	**20.52**	**15.73**	**10.25**	**16.51**	**14.75**	**12.88**	**15.26**	**11.59**	**11.07**	**6.75**	**6.84**	**7.19**	**9.50**	**7.51**	**7.70**	**7.11**	**7.85**	**12.92**	**8.50**	**11.33**
Dec-Feb Avg. Q			**4.42**	**4.75**	**2.60**	**4.36**	**3.68**	**3.58**	**5.25**	**2.97**	**3.13**	**2.87**	**2.53**	**4.86**	**7.18**	**12.02**	**12.77**	**2.61**	**3.95**	**4.62**	**5.35**	**3.50**	**7.03**	**6.09**	**7.22**	**2.14**	**2.56**	**2.40**	**2.97**	**3.08**	**2.87**	**2.47**	**3.73**	**2.78**	**2.23**	**4.38**
Mar-Nov Avg. Q			**16.28**	**17.85**	**11.92**	**13.45**	**12.63**	**12.67**	**12.68**	**8.47**	**12.57**	**12.29**	**10.61**	**12.75**	**18.13**	**24.19**	**23.10**	**20.10**	**12.34**	**20.48**	**17.89**	**16.01**	**18.01**	**13.42**	**12.36**	**8.28**	**8.27**	**8.79**	**11.67**	**8.99**	**9.31**	**8.66**	**9.22**	**16.30**	**10.59**	**13.65**
Volume (mcm)			**421.66**	**461.30**	**303.75**	**354.23**	**329.79**	**329.75**	**342.34**	**225.53**	**323.08**	**314.42**	**272.37**	**342.45**	**488.93**	**667.96**	**648.04**	**500.83**	**323.65**	**525.98**	**469.07**	**408.56**	**483.47**	**366.69**	**350.29**	**214.05**	**217.12**	**227.57**	**300.95**	**237.93**	**243.99**	**226.16**	**248.12**	**409.68**	**269.25**	**359.06**
Total Discharge			**479.4**	**524.71**	**345.09**	**402.41**	**374.24**	**374.35**	**389.47**	**255.41**	**367.68**	**357.68**	**309.34**	**388.01**	**554.2**	**761.24**	**738.56**	**566.22**	**368.83**	**594.41**	**531.09**	**463.7**	**549.42**	**417.13**	**398.68**	**242.85**	**246.38**	**258.83**	**341.87**	**270.52**	**277.35**	**256.11**	**282.46**	**465.19**	**305.93**	**407.8412**

Annexure 5.2: 33 years 10-daily discharge data of river Supin at Jakhol Sankri Barrage location excluding the Environmental Release

Month	Period	Days	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10
Jun	I	10	9.50	17.67	10.59	15.93	12.18	12.25	14.67	8.18	9.46	9.74	17.69	9.02	20.83	20.92	27.63	18.70	14.10	7.63	16.97	11.06	5.89	15.03	11.79	10.46	5.78	7.01	10.07	10.67	4.93	5.74	6.56	10.83	8.37
	II	10	6.39	15.83	14.99	16.51	12.80	14.55	14.29	5.97	10.81	16.66	15.49	7.44	15.13	23.33	29.16	25.89	16.02	9.16	17.94	22.04	8.31	18.87	12.22	13.17	7.97	8.61	10.98	11.39	5.85	3.06	10.96	20.04	5.60
	III	10	19.69	21.53	18.95	22.24	16.13	14.73	11.97	6.46	12.31	24.34	16.16	13.94	15.95	29.67	30.05	31.91	17.71	24.30	17.71	18.96	9.99	16.14	13.27	9.09	12.28	10.78	14.10	11.83	8.77	3.95	11.53	24.20	10.22
July	I	10	45.49	33.03	21.10	26.49	15.91	19.10	15.46	11.13	13.87	23.10	17.04	16.68	15.97	29.00	30.42	24.32	20.40	31.74	16.75	20.11	14.00	18.99	16.45	13.19	15.72	15.12	13.86	10.93	23.00	8.31	18.25	35.72	8.50
	II	10	30.16	33.88	23.81	22.14	20.09	21.28	12.60	11.38	25.34	29.21	19.46	25.32	27.58	25.81	30.90	40.76	43.21	43.96	30.23	20.71	18.90	19.15	14.00	20.04	19.52	15.42	18.03	9.92	20.75	17.08	12.26	34.02	23.65
	III	11	38.10	37.90	23.79	22.97	31.86	23.85	21.76	14.42	19.14	19.18	19.80	26.03	43.72	25.67	31.29	65.01	26.03	56.86	48.23	32.16	41.09	19.34	19.05	23.23	17.80	14.99	18.93	12.85	22.59	21.52	15.31	37.39	23.29
Aug	I	10	29.77	42.00	29.16	21.08	36.70	25.76	21.68	12.93	24.82	25.19	18.43	20.68	22.76	23.44	39.06	53.31	19.54	44.24	59.45	31.92	49.21	14.19	22.31	12.88	15.62	15.02	27.16	15.19	21.25	27.29	22.01	39.08	14.11
	II	10	24.02	37.09	23.68	15.14	27.91	27.51	21.53	17.74	37.22	31.33	13.62	18.00	28.23	36.01	25.89	50.45	16.10	50.42	39.99	31.87	43.37	17.96	17.62	14.69	16.45	16.47	18.65	17.90	18.05	21.41	19.45	49.83	16.98
	III	11	18.79	32.74	19.96	17.18	17.32	25.81	28.30	18.08	20.07	19.01	16.16	19.97	33.08	30.87	33.32	41.93	14.05	56.71	47.90	47.65	20.09	17.87	16.48	13.06	16.70	14.50	17.79	16.57	10.80	17.40	15.62	34.03	12.96
Sep	I	10	27.64	42.88	17.41	16.09	14.18	22.60	30.20	16.06	17.14	15.28	12.06	12.02	25.33	31.75	31.05	38.97	22.56	55.80	48.56	37.25	17.63	14.82	14.41	12.10	12.43	31.49	17.03	10.78	8.15	11.05	15.74	17.53	27.34
	II	10	25.55	14.73	13.62	15.50	11.00	16.03	29.26	8.51	19.97	11.43	9.17	9.63	16.85	25.32	27.89	32.43	23.04	28.25	25.62	37.25	23.61	15.34	16.28	11.54	8.14	13.31	15.68	11.13	10.44	7.92	10.49	20.91	30.73
	III	10	19.72	16.75	11.43	14.16	10.65	11.07	21.23	6.76	14.12	7.77	8.43	12.10	18.15	21.05	22.82	17.44	15.55	17.55	15.58	29.86	19.54	22.91	14.95	10.51	4.91	7.17	14.69	10.66	12.05	7.52	9.91	33.02	13.28
Oct	I	10	13.37	11.62	11.08	13.49	9.97	8.41	16.91	6.81	8.76	7.37	6.72	21.01	14.67	21.87	20.35	12.07	12.99	14.59	11.09	23.37	15.39	14.44	14.18	7.86	4.87	4.04	14.50	9.99	11.06	6.40	6.95	16.54	10.90
	II	10	7.38	7.39	10.62	9.94	8.27	6.23	8.94	6.36	21.18	7.62	4.87	14.41	11.32	18.80	21.10	7.18	7.32	14.11	6.18	10.37	13.68	12.74	14.00	5.47	3.57	3.03	13.76	10.04	9.16	5.34	5.34	11.17	7.94
	III	11	7.45	7.24	6.45	8.70	7.64	5.63	1.33	5.66	7.56	4.99	3.92	8.27	9.95	14.71	16.44	6.81	5.55	10.34	5.83	3.22	12.21	15.50	12.70	3.56	2.91	2.90	12.83	9.64	7.29	4.42	4.50	7.66	5.84
Nov	I	10	7.11	9.62	5.43	7.60	8.28	4.95	8.02	4.73	6.02	5.00	2.93	6.24	8.64	13.74	12.72	4.30	5.29	9.32	5.59	2.52	12.25	13.62	10.59	2.94	2.56	2.89	10.28	8.88	6.11	3.78	4.25	4.26	4.13
	II	10	6.00	4.88	3.68	6.59	6.87	4.48	7.95	3.75	5.93	4.30	3.24	5.72	7.78	12.03	12.07	3.36	5.29	8.18	5.60	2.35	12.42	12.56	10.34	2.60	2.35	2.53	7.84	7.21	5.17	3.24	3.87	2.44	3.92
	III	10	5.84	4.07	2.83	6.40	5.72	4.40	7.53	3.56	4.18	3.67	3.23	4.97	6.72	11.56	12.66	3.43	5.75	7.13	5.63	3.27	12.04	12.02	10.05	2.07	2.25	2.24	5.90	6.08	3.69	2.66	3.55	2.50	3.65
Dec	I	10	4.33	4.18	2.39	6.02	4.43	4.02	6.96	3.45	3.56	3.51	2.47	5.37	4.88	10.53	12.37	3.06	5.02	6.10	5.68	3.23	12.13	9.86	9.19	1.88	2.10	2.13	3.32	5.13	3.16	2.44	3.41	2.88	3.17
	II	10	4.27	4.37	2.48	5.49	3.94	3.65	6.67	3.34	2.39	3.76	2.61	4.46	4.88	10.55	12.05	2.20	3.72	5.72	5.72	3.26	12.59	5.13	9.15	1.88	2.09	2.09	2.46	4.22	2.92	2.57	3.60	2.78	2.75
	III	11	4.24	3.22	2.30	4.90	3.65	3.38	6.48	3.07	2.47	2.94	2.72	5.93	5.72	11.64	12.27	1.95	3.10	4.98	5.57	3.41	7.38	5.13	7.06	1.86	2.07	2.15	2.26	3.38	2.67	2.27	3.33	2.72	1.85
Jan	I	10	4.19	4.05	2.79	4.25	3.29	3.46	4.30	2.93	3.28	2.43	2.21	5.87	4.63	11.95	11.96	2.22	3.62	4.30	5.49	3.14	4.61	5.04	6.88	2.16	2.15	2.18	2.24	2.23	2.32	2.25	3.07	2.57	1.69
	II	10	4.16	4.46	2.21	3.62	3.10	3.16	4.27	2.32	3.16	2.55	2.80	4.49	4.80	10.17	11.79	2.64	3.58	3.68	5.64	3.13	4.78	5.65	7.30	2.08	2.18	2.18	2.48	1.98	2.47	2.12	3.43	2.48	1.78
	III	11	4.30	3.94	2.42	3.43	3.38	3.07	4.23	2.32	3.22	2.27	1.87	3.86	6.98	11.09	12.88	2.27	3.52	3.72	4.73	3.14	4.60	5.82	5.95	1.77	2.27	2.17	2.78	1.93	2.45	2.02	3.33	2.40	1.50
Feb	I	10	3.88	4.45	2.58	3.22	3.48	3.06	4.22	2.18	2.39	2.58	1.82	4.04	9.86	12.73	13.41	2.41	3.62	3.54	4.33	3.29	4.39	5.48	5.83	1.65	2.17	2.11	3.32	1.88	2.64	2.03	3.62	2.41	1.76
	II	10	4.02	6.26	2.08	3.07	3.14	3.24	4.42	2.08	3.02	2.29	1.77	3.85	11.78	13.81	13.10	2.59	3.63	3.71	4.48	3.40	3.84	5.49	6.38	1.90	3.17	2.18	3.04	2.28	2.59	2.23	3.64	2.42	1.69
	III	8	4.33	5.73	2.05	3.19	2.63	3.12	3.59	3.01	2.60	1.47	2.47	3.80	8.99	13.62	13.00	2.04	3.69	3.72	4.42	3.40	6.84	5.14	5.20	1.99	2.79	2.31	2.73	2.59	2.58	2.20	4.09	2.30	1.83
Mar	I	10	3.41	5.90	2.71	4.63	4.69	4.55	3.97	3.82	2.66	3.48	2.86	3.80	9.64	17.52	14.24	2.06	2.15	3.55	4.48	3.53	9.82	5.22	4.97	1.94	3.77	2.41	2.80	3.57	2.40	2.39	3.99	2.24	2.14
	II	10	12.39	5.49	2.67	5.86	5.09	4.52	3.78	2.88	3.23	4.35	7.16	4.74	13.22	20.16	14.72	1.97	3.14	3.50	4.82	3.36	12.09	5.18	4.90	2.03	4.02	2.54	3.07	3.58	2.64	2.60	4.43	2.25	2.44
	III	11	5.06	6.55	3.10	12.76	6.05	5.49	3.74	3.63	3.89	4.50	7.62	8.11	13.72	22.89	16.47	3.43	3.71	5.20	5.07	3.40	13.57	5.21	4.76	2.38	5.53	3.21	3.50	3.57	2.89	5.94	3.84	2.28	5.01
Apr	I	10	4.08	9.18	3.20	6.85	4.23	5.70	3.31	3.94	5.21	5.13	5.54	8.93	13.12	25.91	17.17	3.85	3.90	5.53	5.48	3.87	17.57	5.21	6.92	2.72	5.28	3.69	3.77	3.17	3.61	6.02	4.10	2.27	3.66
	II	10	13.55	10.67	4.94	8.49	6.41	4.68	3.55	4.90	7.62	3.06	9.49	8.40	15.82	26.93	18.09	4.31	3.03	5.29	5.64	4.52	14.77	5.78	6.63	2.90	4.08	3.69	3.77	3.45	3.74	7.05	3.83	2.52	6.84
	III	10	6.83	13.19	5.93	9.08	6.38	7.86	4.92	5.93	7.22	6.82	8.66	7.56	15.60	26.66	22.21	3.89	3.08	5.82	5.44	4.38	15.85	6.47	7.80	2.94	5.14	4.53	4.88	3.73	3.93	5.57	4.60	3.85	5.41
May	I	10	13.48	11.65	7.18	10.18	10.67	11.02	5.14	7.73	4.34	9.27	8.78	10.93	14.82	32.06	22.45	11.71	4.35	6.43	5.26	7.92	16.90	8.27	8.85	3.13	5.06	6.09	5.71	4.19	5.28	6.42	6.60	4.05	7.59
	II	10	16.78	11.53	7.58	9.85	9.12	12.54	6.30	7.17	11.01	12.63	11.05	16.38	24.18	31.40	20.28	11.04	5.24	8.98	7.23	4.77	14.72	10.24	11.24	5.00	6.10	8.25	8.64	4.96	5.87	7.42	6.44	6.63	6.03
	III	11	15.85	10.76	9.62	11.09	8.80	10.91	7.71	13.94	10.23	11.17	10.74	17.76	20.62	27.79	17.00	16.03	7.95	12.07	8.48	4.33	15.07	13.04	10.70	5.90	6.30	9.12	10.74	4.74	5.80	6.20	8.28	6.69	9.10
Average Q			**13.09**	**14.34**	**9.35**	**10.95**	**10.16**	**10.17**	**10.59**	**6.86**	**9.98**	**9.70**	**8.36**	**10.55**	**15.16**	**20.91**	**20.28**	**15.50**	**10.01**	**16.28**	**14.52**	**12.65**	**15.03**	**11.36**	**10.84**	**6.51**	**6.61**	**6.96**	**9.27**	**7.28**	**7.47**	**6.88**	**7.62**	**12.69**	**8.27**
Dec-Feb Avg. Q			**4.19**	**4.52**	**2.37**	**4.13**	**3.45**	**3.35**	**5.01**	**2.74**	**2.90**	**2.64**	**2.30**	**4.63**	**6.95**	**11.79**	**12.54**	**2.37**	**3.72**	**4.38**	**5.12**	**3.27**	**6.79**	**5.86**	**6.99**	**1.91**	**2.33**	**2.17**	**2.74**	**2.85**	**2.64**	**2.24**	**3.50**	**2.55**	**2.00**
Mar-Nov Avg. Q			**16.05**	**17.62**	**11.68**	**13.22**	**12.40**	**12.44**	**12.45**	**8.24**	**12.34**	**12.06**	**10.38**	**12.52**	**17.90**	**23.96**	**22.87**	**19.87**	**12.11**	**20.25**	**17.66**	**15.78**	**17.78**	**13.19**	**12.13**	**8.05**	**8.04**	**8.56**	**11.44**	**8.76**	**9.08**	**8.43**	**8.99**	**16.07**	**10.36**
Volume (mcm)			**414.37**	**454.02**	**296.46**	**346.95**	**322.50**	**322.47**	**335.05**	**218.25**	**315.79**	**307.13**	**265.09**	**335.17**	**481.65**	**660.67**	**640.75**	**493.55**	**316.37**	**518.69**	**461.78**	**401.27**	**476.18**	**359.40**	**343.00**	**206.77**	**209.83**	**220.28**	**293.67**	**230.65**	**236.71**	**218.88**	**240.84**	**402.39**	**261.97**
Total Discharge			**471.08**	**516.39**	**336.77**	**394.09**	**365.92**	**366.03**	**381.15**	**247.09**	**359.36**	**349.36**	**301.02**	**379.69**	**545.88**	**752.92**	**730.24**	**557.90**	**360.51**	**586.09**	**522.77**	**455.38**	**541.10**	**408.81**	**390.36**	**234.53**	**238.06**	**250.51**	**333.55**	**262.20**	**269.03**	**247.79**	**274.14**	**456.87**	**297.61**

Annexure 5.3: Head Losses In the Water Conductor System

Full Reservoir Level		=	1959.400	m
Tailwater Level corresponding to rated discharge		=	1510.360	m
Turbine Centreline Level		=	1513.600	m
Maximum gross head		=	445.800	m
Design Discharge of 2 units		=	13.340	cumec

General Notations:

Velocity of water	V			
Acceleration due to gravity	g	=	9.810	m/s2
loss co-efficient due to trash racks	K_{tr}			
loss co-efficient at bellmouth entrance	K_e			
Manning friction co-efficient	n			
Diameter	D			
Velocity before transition	V_1			
velocity after transition	V_2			
Transition angle	a			
Transition loss co-efficient	K_t			
loss co-efficient at gates	K_g			
Loss co-eff due to butterfly valve	K_{bv}			
Loss co-eff due to bends	K_b			
Loss co-eff due to wye piece	K_p			
Loss co-eff due to spherical valve	K_s			
Loss co-eff due contraction	K_c			
Hydraulic Radius	R			
Hydraulic Area	A			
Hydraulic Perimeter	P			

1 Head Losses in the System when 2 units are in operation:

1.1	Head loss from reservoir intake upto tunnel intake	=	**0.430**	**m**

1.2 HRT

1.2.1 Head loss due to HRT Intake Gate:

Ref: IS: 4880 (Part III) - 1976

At the start of HRT, the water has to pass through the HRT Intake Gate

The size of the opening is 3.0 m width x 3.0 m height.

Discharge through gate	=	13.340	m3/s
Head loss at gate	=	$K_e*V^2/2g$	
Area of entrance	=	3.0 x 3.0	
	=	9.000	m2
Velocity of flow	=	13.34/9	
	=	1.482	m/s
K_e	=	0.100	
Head loss	=	0.1*(1.48^2)/(2*9.81)	
	=	**0.011**	m

1.2.2 Head loss due to horizontal bends in tunnel:

Ref: IS 2951 (part-2& 1)

The tunnel consists of 3 horizontal bends.

No of bends in the Tunnel	=	4	
Design Discharge	=	13.340	m3/sec
Head loss due to bend	=	$K_b*V^2/2g$	
Diameter of Modified Horse Shoe tunnel	=	3.000	m
Area of Tunnel	=	7.069	m2
Perimeter of Tunnel	=	9.425	m
Velocity in HRT	=	13.34/7.14	
	=	1.887	m/sec
From Fig. 1, IS 2951 (part I), Relative Roughness	=	Ks/Deq	
	=	0.001	
From Fig 2, IS 2951 (part II), resistance coefficient K for 11 ^{0} bend and r/D 4	=	0.030	
From Fig 2, IS 2951 (part II), resistance coefficient K for 44 ^{0} bend and r/D 4	=	0.060	
From Fig 2, IS 2951 (part II), resistance coefficient K for 20 ^{0} bend and r/D 4	=	0.040	
Average resistance coefficient	=	0.043	
Hence bend loss	=	**0.0315**	**m**

1.2.3 Head loss due to friction in Head Race Tunnel (HRT):

Ref: IS 4880 (Part-3)

An HRT is provided to pass the discharge from Desander to Surge Shaft.

The tunnel is modified horse shoe shaped with radius of hydraulic equivalent circle as 1.45 m and length 6624.48 m approx.

Discharge through HRT		=	13.340	m3/s
Area of the Tunnel	A	=	7.139	m2
Perimeter of the Tunnel	P	=	9.520	m
Friction loss per m(Manning formula)		=	$n^2.V^2.R^{\frac{4}{3}}$	
Where,				
Manning Coefficient (with steel formwork)	n	=	0.012	
Velocity of flow	V	=	1.870	m/s
Hydraulic Radius	R	=	0.750	m/s
Head loss per metre length		=	0.012^2*(1.87^2)/(0.75^1.333)	
		=	0.00074	m
Length of the tunnel		=	6624.480	m (approx.)
Total friction loss for 6624.48 m length		=	0.00074*6624.48	
		=	**4.895**	
Losses up to the HRT		=	**5.368**	

1.3 Surge Shaft & Pressure Shaft

1.3.1 Head loss due to friction in pressure shaft Ref: USBR EM 03

Water from surge shaft enters into high pressure shaft of length 874.18 m.

The diameter of pressure shaft is 2 m circular.

Design Discharge		=	13.340	m3/sec
Diameter of Penstock Shaft		=	2.0	m
Area of Penstock/ Pressure Shaft		=	3.14	m^2
Perimeter of the Tunnel	P	=	6.28	m
Head Loss due to friction loss per 1000 ft of pipe (Scobey formula)		=	$\frac{Ks.V^{1.9}}{D^{1.1}}$	
Where,				
Loss co-efficient determined experimentally	Ks	=	0.2995	
Velocity of flow in ft/s	V	=	13.930	m/s
Dia of pipe in ft	D	=	6.560	
Head Loss due to friction loss per 1000 ft of pipe		=	0.2995*(13.93^1.9)/(6.56^1.1)	
		=	5.640	ft
Total Length of the (Pressure Shaft +Pen Stock + Vertical PS+Horizontal PS)		=	874.181	m
		=	2866.167	ft
Total friction loss for 2868.01 ft length		=	5.64*2868.01/1000	
		=	16.166	ft
		=	**4.931**	**m**

1.3.2 Loss due to gate after surge shaft:

Ref: IS 4880 (Part-3)

One service gate of size 2.5m x 3.2 m is provided in the surge shaft to regulate flow into preesure shaft

Discharge through gates		=	13.340	m3/sec
Loss co-eff due to gates	K_g	=	0.100	
Area of gate entrance		=	2.5 x 3.2	
		=	8.000	m2
Velocity through gates		=	13.34/8	
		=	1.668	m/sec
Head loss due to one gate slot		=	$K_gV^2/2g$	
		=	0.1*(1.67^2)/2*9.81	
		=	0.014	m
Head loss in gate groove		**=**	**0.014**	**m**

1.3.3 Head loss due to bends in Pressure Shaft

Ref: IS 11625 - 1986

The pressure shaft consists of 2 vertical bends.

No of bends in the Penstock/Pressure Shaft		=	9.000	
Design Discharge		=	13.340	m3/sec
Head loss due to bend		=	$K_b*V^2/2g$	
Diameter of Penstock Shaft		=	2.000	m
Area of penstock		=	3.142	m2
Velocity in penstock		=	13.34/3.14	
		=	4.246	m/s
K_b value		=	0.090	
Hence bend loss		**=**	**0.083**	**m**

1.3.4 Loss due to Bifurcation piece:

Ref: IS 11625 -1986

The 2.0 m diameter Pressure Shaft bifurcated into 2 nos 1.30 m dia unit pressure Shaft.

		=	$K_p*V^2/2*g$	
Design Discharge before bifurcatrion (wye)		=	13.340	m3/s
Diameter before wye	D	=	2.000	m
Area of penstock before wye	A	=	3.142	m2
Velocity before wye	V	=	4.246	m/s
Design Discharge after bifurcatrion (wye)		=	6.670	m3/s
Diameter after first bifurcation piece	D_{b1}	=	1.300	m
Area after first bifurcation piece	A_{b1}	=	1.327	m2
Velocity after first bifurcation piece	V_{b1}	=	5.025	m
Velocity Ratio	V_{b1}/V	=	1.183	
Loss coefficient	K_p	=	0.350	
Head loss due to wye		=	0.35*(4.64^2)/2*9.81	
		=	**0.322**	**m**

1.3.5 Friction loss in Unit penstock after wye piece:

Ref: IS 4880(part-3)

Length of unit penstock		=	50.550	m
Design Discharge		=	6.670	m3/sec
Diameter of unit penstock		=	1.300	m
Area of shaft		=	1.330	m2
Perimeter of the Tunnel	P	=	4.084	m
Friction loss per m(Manning formula)		=	$n^2.V^2.R^{4/3}$	
Where,				
Manning Coefficient	n	=	0.012	
Velocity of flow	V	=	5.015	m/s
Hydraulic Radius	R	=	0.326	m
Head loss per metre length		=	0.012^2.0*(5.03^2.0)/(0.33^1.333)	
		=	0.0160	
Total friction loss for 50.55 m length		=	0.0160*50.55	
		=	**0.807**	**m**

1.3.6 Loss in PPV (Butterfly Valve):

Ref: USBR EM No. 3

Design Discharge in Penstock		=	13.340	m3/s
Diameter of Butterfly valve		=	2.000	m
Area of valve		=	3.142	m2
Loss co-eff due to Butterfly valve K_s		=	0.260	
Velocity through the valve		=	13.34/3.14	
		=	4.246	m/s
Head loss		=	0.26*(4.25^2)/2*9.81	
		=	**0.239**	**m**

1.3.7 Loss in MIV (Spherical Valve):

Ref: USBR EM No. 3

Design Discharge in Unit Penstock		=	6.670	m3/s
Diameter of Spherical Valve		=	1.000	m
Area of valve		=	0.785	m2
Loss co-eff due to Spherical Valve K_s		=	0.240	
Velocity through the valve		=	6.67/0.79	
		=	8.493	m/s
Head loss		=	0.24*(8.49^2)/2*9.81	
		=	**0.882**	**m**

Note: Loss in spherical valve is negligible as they have the same opening as the pipe.
The k value considered for the reducer before the valve

Total Loss		**=**	**12.645**	**m**

Annexure 5.4: 33 years 10-daily Power data of river Supin at Jakhol Sankri Barrage location

Month	Period	Days	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10
Jun	I	10	36.32	67.56	40.49	60.91	46.57	46.84	56.09	31.28	36.17	37.24	67.64	34.49	79.65	79.99	105.65	71.50	53.91	29.17	64.89	42.29	22.52	57.47	45.08	39.99	22.10	26.80	38.50	40.80	18.85	21.95	25.08	41.41	32.00
	II	10	24.43	60.53	57.32	63.13	48.94	55.63	54.64	22.82	41.33	63.70	59.23	28.45	57.85	89.21	111.50	99.00	61.26	35.02	68.60	84.28	31.77	72.15	46.72	50.36	30.47	32.92	41.98	43.55	22.37	11.70	41.91	76.63	21.41
	III	10	75.29	82.33	72.46	85.04	61.68	56.32	45.77	24.70	47.07	93.07	61.79	53.30	60.99	113.45	114.90	122.02	67.72	92.92	67.72	72.50	38.20	61.71	50.74	34.76	46.95	41.22	53.91	45.23	33.53	15.10	44.09	92.53	39.08
July	I	10	173.95	126.30	80.68	101.29	60.83	73.03	59.11	42.56	53.03	88.33	65.16	63.78	61.06	110.89	116.32	92.99	78.00	121.37	64.05	76.90	53.53	72.61	62.90	50.43	60.11	57.81	53.00	41.79	87.95	31.77	69.78	136.59	32.50
	II	10	115.33	129.55	91.04	84.66	76.82	81.37	48.18	43.51	96.89	111.69	74.41	96.82	105.46	98.69	118.16	155.86	165.23	168.10	115.59	79.19	72.27	73.22	53.53	76.63	74.64	58.96	68.94	37.93	79.34	65.31	46.88	130.09	90.43
	III	11	145.69	144.92	90.97	87.83	121.83	91.20	83.20	55.14	73.19	73.34	75.71	99.53	167.18	98.16	119.65	248.59	99.53	217.42	184.42	122.97	157.12	73.95	72.84	88.83	68.06	57.32	72.38	49.13	86.38	82.29	58.54	142.97	89.06
Aug	I	10	113.83	160.60	111.50	80.60	140.33	98.50	82.90	49.44	94.91	96.32	70.47	79.07	87.03	89.63	149.36	203.85	74.72	169.17	227.33	122.06	188.17	54.26	85.31	49.25	59.73	57.43	103.85	58.08	81.25	104.35	84.16	149.43	53.95
	II	10	91.85	141.83	90.55	57.89	106.72	105.19	82.33	67.83	142.32	119.80	52.08	68.83	107.95	137.70	99.00	192.91	61.56	192.80	152.91	121.86	165.84	68.67	67.37	56.17	62.90	62.98	71.31	68.44	69.02	81.87	74.37	190.54	64.93
	III	11	71.85	125.19	76.32	65.69	66.23	98.69	108.21	69.13	76.74	72.69	61.79	76.36	126.49	118.04	127.41	160.33	53.72	216.85	183.16	182.21	76.82	68.33	63.01	49.94	63.86	55.44	68.02	63.36	41.29	66.53	59.73	130.12	49.55
Sep	I	10	105.69	163.97	66.57	61.52	54.22	86.42	115.48	61.41	65.54	58.43	46.11	45.96	96.86	121.41	118.73	149.01	86.26	213.37	185.69	142.44	67.41	56.67	55.10	46.27	47.53	120.41	65.12	41.22	31.16	42.25	60.18	67.03	104.54
	II	10	97.70	56.32	52.08	59.27	42.06	61.29	111.88	32.54	76.36	43.70	35.06	36.82	64.43	96.82	106.65	124.01	88.10	108.02	97.96	142.44	90.28	58.66	62.25	44.12	31.12	50.89	59.96	42.56	39.92	30.28	40.11	79.95	117.51
	III	10	75.40	64.05	43.70	54.14	40.72	42.33	81.18	25.85	53.99	29.71	32.23	46.27	69.40	80.49	87.26	66.69	59.46	67.11	59.57	114.18	74.72	87.60	57.16	40.19	18.77	27.41	56.17	40.76	46.07	28.75	37.89	126.26	50.78
Oct	I	10	51.12	44.43	42.37	51.58	38.12	32.16	64.66	26.04	33.49	28.18	25.69	80.34	56.09	83.63	77.81	46.15	49.67	55.79	42.40	89.36	58.85	55.21	54.22	30.05	18.62	15.44	55.44	38.20	42.29	24.47	26.57	63.24	41.68
	II	10	28.22	28.25	40.61	38.01	31.62	23.82	34.18	24.32	80.99	29.13	18.62	55.10	43.28	71.89	80.68	27.45	27.99	53.95	23.63	39.65	52.31	48.71	53.53	20.91	13.65	11.58	52.61	38.39	35.02	20.42	20.42	42.71	30.36
	III	11	28.48	27.68	24.66	33.26	29.21	21.52	5.08	21.64	28.90	19.08	14.99	31.62	38.04	56.25	62.86	26.04	21.22	39.54	22.29	12.31	46.69	59.27	48.56	13.61	11.12	11.09	49.06	36.86	27.87	16.90	17.20	29.29	22.33
Nov	I	10	27.18	36.78	20.76	29.06	31.66	18.92	30.66	18.08	23.02	19.12	11.20	23.86	33.03	52.54	48.64	16.44	20.22	35.64	21.37	9.63	46.84	52.08	40.49	11.24	9.79	11.05	39.31	33.95	23.36	14.45	16.25	16.29	15.79
	II	10	22.94	18.66	14.07	25.20	26.27	17.13	30.40	14.34	22.67	16.44	12.39	21.87	29.75	46.00	46.15	12.84	20.22	31.28	21.41	8.98	47.49	48.02	39.54	9.94	8.98	9.67	29.98	27.57	19.77	12.39	14.79	9.33	14.99
	III	10	22.33	15.56	10.82	24.47	21.87	16.82	28.79	13.61	15.98	14.03	12.35	19.00	25.69	44.20	48.41	13.11	21.98	27.26	21.52	12.50	46.04	45.96	38.43	7.91	8.60	8.56	22.56	23.25	14.11	10.17	13.57	9.56	13.95
Dec	I	10	16.55	15.98	9.14	23.02	16.94	15.37	26.61	13.19	13.61	13.42	9.44	20.53	18.66	40.26	47.30	11.70	19.19	23.32	21.72	12.35	46.38	37.70	35.14	7.19	8.03	8.14	12.69	19.61	12.08	9.33	13.04	11.01	12.12
	II	10	16.32	16.71	9.48	20.99	15.06	13.95	25.50	12.77	9.14	14.37	9.98	17.05	18.66	40.34	46.07	8.41	14.22	21.87	21.87	12.46	48.14	19.61	34.99	7.19	7.99	7.99	9.40	16.13	11.16	9.82	13.76	10.63	10.51
	III	11	16.21	12.31	8.79	18.73	13.95	12.92	24.78	11.74	9.44	11.24	10.40	22.67	21.87	44.51	46.92	7.45	11.85	19.04	21.30	13.04	28.22	19.61	26.99	7.11	7.91	8.22	8.64	12.92	10.21	8.68	12.73	10.40	7.07
Jan	I	10	16.02	15.48	10.66	16.25	12.58	13.23	16.44	11.20	12.54	9.29	8.45	22.44	17.70	45.69	45.73	8.49	13.84	16.44	20.99	12.00	17.62	19.27	26.30	8.26	8.22	8.33	8.56	8.52	8.87	8.60	11.74	9.82	6.46
	II	10	15.90	17.05	8.45	13.84	11.85	12.08	16.32	8.87	12.08	9.75	10.70	17.17	18.35	38.89	45.08	10.09	13.69	14.07	21.56	11.97	18.27	21.60	27.91	7.95	8.33	8.33	9.48	7.57	9.44	8.10	13.11	9.48	6.80
	III	11	16.44	15.06	9.25	13.11	12.92	11.74	16.17	8.87	12.31	8.68	7.15	14.76	26.69	42.40	49.25	8.68	13.46	14.22	18.08	12.00	17.59	22.25	22.75	6.76	8.68	8.29	10.63	7.38	9.36	7.72	12.73	9.17	5.73
Feb	I	10	14.83	17.01	9.86	12.31	13.30	11.70	16.13	8.33	9.14	9.86	6.96	15.44	37.70	48.67	51.27	9.21	13.84	13.53	16.55	12.58	16.78	20.95	22.29	6.31	8.29	8.06	12.69	7.19	10.09	7.76	13.84	9.21	6.73
	II	10	15.37	23.93	7.95	11.74	12.00	12.39	16.90	7.95	11.54	8.75	6.76	14.72	45.04	52.80	50.09	9.90	13.88	14.18	17.13	13.00	14.68	20.99	24.39	7.26	12.12	8.33	11.62	8.71	9.90	8.52	13.92	9.25	6.46
	III	8	16.55	21.91	7.84	12.19	10.05	11.93	13.72	11.51	9.94	5.62	9.44	14.53	34.37	52.08	49.71	7.80	14.11	14.22	16.90	13.00	26.15	19.65	19.88	7.61	10.66	8.83	10.44	9.90	9.86	8.41	15.64	8.79	6.99
Mar	I	10	13.04	22.56	10.36	17.70	17.93	17.39	15.18	14.60	10.17	13.30	10.93	14.53	36.86	66.99	54.45	7.87	8.22	13.57	17.13	13.49	37.55	19.96	19.00	7.41	14.41	9.21	10.70	13.65	9.17	9.14	15.25	8.56	8.18
	II	10	47.37	20.99	10.21	22.40	19.46	17.28	14.45	11.01	12.35	16.63	27.38	18.12	50.55	77.09	56.28	7.53	12.00	13.38	18.43	12.84	46.23	19.80	18.73	7.76	15.37	9.71	11.74	13.69	10.09	9.94	16.94	8.60	9.33
	III	11	19.35	25.04	11.85	48.79	23.13	20.99	14.30	13.88	14.87	17.20	29.13	31.01	52.46	87.53	62.98	13.11	14.18	19.88	19.38	13.00	51.89	19.92	18.20	9.10	21.14	12.27	13.38	13.65	11.05	22.71	14.68	8.71	19.15
Apr	I	10	15.60	35.10	12.23	26.19	16.17	21.79	12.65	15.06	19.92	19.61	21.18	34.14	50.17	99.07	65.65	14.72	14.91	21.14	20.95	14.79	67.18	19.92	26.46	10.40	20.19	14.11	14.41	12.12	13.80	23.02	15.67	8.68	13.99
	II	10	51.81	40.80	18.89	32.46	24.51	17.89	13.57	18.73	29.13	11.70	36.29	32.12	60.49	102.97	69.17	16.48	11.58	20.22	21.56	17.28	56.48	22.10	25.35	11.09	15.60	14.11	14.41	13.19	14.30	26.95	14.64	9.63	26.15
	III	10	26.11	50.43	22.67	34.72	24.39	30.05	18.81	22.67	27.60	26.08	33.11	28.90	59.65	101.94	84.93	14.87	11.77	22.25	20.80	16.74	60.61	24.74	29.82	11.24	19.65	17.32	18.66	14.26	15.02	21.30	17.59	14.72	20.68
May	I	10	51.54	44.54	27.45	38.92	40.80	42.14	19.65	29.56	16.59	35.44	33.57	41.79	56.67	122.59	85.84	44.77	16.63	24.58	20.11	30.28	64.62	31.62	33.84	11.97	19.35	23.28	21.83	16.02	20.19	24.55	25.23	15.48	29.02
	II	10	64.16	44.09	28.98	37.66	34.87	47.95	24.09	27.41	42.10	48.29	42.25	62.63	92.46	120.07	77.55	42.21	20.03	34.33	27.64	18.24	56.28	39.15	42.98	19.12	23.32	31.54	33.03	18.96	22.44	28.37	24.62	25.35	23.05
	III	11	60.61	41.14	36.78	42.40	33.65	41.72	29.48	53.30	39.11	42.71	41.07	67.91	78.85	106.26	65.00	61.29	30.40	46.15	32.42	16.55	57.62	49.86	40.91	22.56	24.09	34.87	41.07	18.12	22.17	23.70	31.66	25.58	34.79
Total	**MW**		**1801**	**1975**	**1288**	**1507**	**1399**	**1400**	**1458**	**945**	**1374**	**1336**	**1151**	**1452**	**2087**	**2879**	**2792**	**2133**	**1379**	**2241**	**1999**	**1741**	**2069**	**1563**	**1493**	**897**	**910**	**958**	**1275**	**1003**	**1029**	**948**	**1048**	**1747**	**1138**

Annexure 5.4: 33 years 10-daily Energy data of river Supin at Jakhol Sankri Barrage location

Month	Period	Days	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10
Jun	I	10	8.72	16.22	9.72	14.62	11.18	11.24	13.46	7.51	8.68	8.94	16.23	8.28	19.12	19.20	25.36	17.16	12.94	7.00	15.57	10.15	5.40	13.79	10.82	9.60	5.30	6.43	9.24	9.79	4.52	5.27	6.02	9.94	7.68
	II	10	5.86	14.53	13.76	15.15	11.75	13.35	13.11	5.48	9.92	15.29	14.21	6.83	13.88	21.41	26.76	23.76	14.70	8.41	16.46	20.23	7.63	17.32	11.21	12.09	7.31	7.90	10.08	10.45	5.37	2.81	10.06	18.39	5.14
	III	10	18.07	19.76	17.39	20.41	14.80	13.52	10.98	5.93	11.30	22.34	14.83	12.79	14.64	27.23	27.58	29.28	16.25	22.30	16.25	17.40	9.17	14.81	12.18	8.34	11.27	9.89	12.94	10.86	8.05	3.62	10.58	22.21	9.38
July	I	10	41.75	30.31	19.36	24.31	14.60	17.53	14.19	10.21	12.73	21.20	15.64	15.31	14.66	26.61	27.92	22.32	18.72	29.13	15.37	18.45	12.85	17.43	15.10	12.10	14.43	13.88	12.72	10.03	21.11	7.63	16.75	32.78	7.80
	II	10	27.68	31.09	21.85	20.32	18.44	19.53	11.56	10.44	23.25	26.81	17.86	23.24	25.31	23.69	28.36	37.41	39.65	40.34	27.74	19.01	17.34	17.57	12.85	18.39	17.91	14.15	16.55	9.10	19.04	15.67	11.25	31.22	21.70
	III	11	38.46	38.26	24.02	23.19	32.16	24.08	21.97	14.56	19.32	19.36	19.99	26.28	44.13	25.91	31.59	65.63	26.28	57.40	48.69	32.46	41.48	19.52	19.23	23.45	17.97	15.13	19.11	12.97	22.80	21.72	15.45	37.74	23.51
Aug	I	10	27.32	38.54	26.76	19.35	33.68	23.64	19.90	11.87	22.78	23.12	16.91	18.98	20.89	21.51	35.85	48.92	17.93	40.60	54.56	29.29	45.16	13.02	20.47	11.82	14.33	13.78	24.92	13.94	19.50	25.04	20.20	35.86	12.95
	II	10	22.04	34.04	21.73	13.89	25.61	25.25	19.76	16.28	34.16	28.75	12.50	16.52	25.91	33.05	23.76	46.30	14.77	46.27	36.70	29.25	39.80	16.48	16.17	13.48	15.10	15.11	17.11	16.43	16.56	19.65	17.85	45.73	15.58
	III	11	18.97	33.05	20.15	17.34	17.48	26.05	28.57	18.25	20.26	19.19	16.31	20.16	33.39	31.16	33.64	42.33	14.18	57.25	48.35	48.10	20.28	18.04	16.64	13.18	16.86	14.64	17.96	16.73	10.90	17.56	15.77	34.35	13.08
Sep	I	10	25.37	39.35	15.98	14.77	13.01	20.74	27.71	14.74	15.73	14.02	11.07	11.03	23.25	29.14	28.49	35.76	20.70	51.21	44.56	34.18	16.18	13.60	13.22	11.10	11.41	28.90	15.63	9.89	7.48	10.14	14.44	16.09	25.09
	II	10	23.45	13.52	12.50	14.22	10.09	14.71	26.85	7.81	18.33	10.49	8.41	8.84	15.46	23.24	25.59	29.76	21.14	25.93	23.51	34.18	21.67	14.08	14.94	10.59	7.47	12.21	14.39	10.21	9.58	7.27	9.63	19.19	28.20
	III	10	18.10	15.37	10.49	12.99	9.77	10.16	19.48	6.20	12.96	7.13	7.74	11.10	16.66	19.32	20.94	16.00	14.27	16.11	14.30	27.40	17.93	21.02	13.72	9.64	4.51	6.58	13.48	9.78	11.06	6.90	9.09	30.30	12.19
Oct	I	10	12.27	10.66	10.17	12.38	9.15	7.72	15.52	6.25	8.04	6.76	6.17	19.28	13.46	20.07	18.68	11.08	11.92	13.39	10.18	21.45	14.12	13.25	13.01	7.21	4.47	3.71	13.31	9.17	10.15	5.87	6.38	15.18	10.00
	II	10	6.77	6.78	9.75	9.12	7.59	5.72	8.20	5.84	19.44	6.99	4.47	13.22	10.39	17.25	19.36	6.59	6.72	12.95	5.67	9.52	12.55	11.69	12.85	5.02	3.28	2.78	12.63	9.21	8.41	4.90	4.90	10.25	7.29
	III	11	7.52	7.31	6.51	8.78	7.71	5.68	1.34	5.71	7.63	5.04	3.96	8.35	10.04	14.85	16.60	6.87	5.60	10.44	5.88	3.25	12.33	15.65	12.82	3.59	2.94	2.93	12.95	9.73	7.36	4.46	4.54	7.73	5.89
Nov	I	10	6.52	8.83	4.98	6.97	7.60	4.54	7.36	4.34	5.52	4.59	2.69	5.73	7.93	12.61	11.67	3.95	4.85	8.55	5.13	2.31	11.24	12.50	9.72	2.70	2.35	2.65	9.43	8.15	5.61	3.47	3.90	3.91	3.79
	II	10	5.51	4.48	3.38	6.05	6.30	4.11	7.30	3.44	5.44	3.95	2.97	5.25	7.14	11.04	11.08	3.08	4.85	7.51	5.14	2.16	11.40	11.53	9.49	2.39	2.16	2.32	7.19	6.62	4.74	2.97	3.55	2.24	3.60
	III	10	5.36	3.73	2.60	5.87	5.25	4.04	6.91	3.27	3.84	3.37	2.96	4.56	6.17	10.61	11.62	3.15	5.28	6.54	5.17	3.00	11.05	11.03	9.22	1.90	2.06	2.05	5.41	5.58	3.39	2.44	3.26	2.29	3.35
Dec	I	10	3.97	3.84	2.19	5.52	4.06	3.69	6.39	3.17	3.27	3.22	2.27	4.93	4.48	9.66	11.35	2.81	4.61	5.60	5.21	2.96	11.13	9.05	8.43	1.72	1.93	1.95	3.05	4.71	2.90	2.24	3.13	2.64	2.91
	II	10	3.92	4.01	2.28	5.04	3.61	3.35	6.12	3.06	2.19	3.45	2.39	4.09	4.48	9.68	11.06	2.02	3.41	5.25	5.25	2.99	11.55	4.71	8.40	1.72	1.92	1.92	2.26	3.87	2.68	2.36	3.30	2.55	2.52
	III	11	4.28	3.25	2.32	4.95	3.68	3.41	6.54	3.10	2.49	2.97	2.74	5.99	5.77	11.75	12.39	1.97	3.13	5.03	5.62	3.44	7.45	5.18	7.13	1.88	2.09	2.17	2.28	3.41	2.69	2.29	3.36	2.74	1.87
Jan	I	10	3.84	3.72	2.56	3.90	3.02	3.17	3.95	2.69	3.01	2.23	2.03	5.39	4.25	10.97	10.98	2.04	3.32	3.95	5.04	2.88	4.23	4.62	6.31	1.98	1.97	2.00	2.05	2.05	2.13	2.06	2.82	2.36	1.55
	II	10	3.82	4.09	2.03	3.32	2.84	2.90	3.92	2.13	2.90	2.34	2.57	4.12	4.40	9.33	10.82	2.42	3.28	3.38	5.18	2.87	4.39	5.18	6.70	1.91	2.00	2.00	2.28	1.82	2.27	1.94	3.15	2.28	1.63
	III	11	4.34	3.98	2.44	3.46	3.41	3.10	4.27	2.34	3.25	2.29	1.89	3.90	7.05	11.19	13.00	2.29	3.55	3.75	4.77	3.17	4.64	5.87	6.01	1.79	2.29	2.19	2.81	1.95	2.47	2.04	3.36	2.42	1.51
Feb	I	10	3.56	4.08	2.37	2.95	3.19	2.81	3.87	2.00	2.19	2.37	1.67	3.71	9.05	11.68	12.31	2.21	3.32	3.25	3.97	3.02	4.03	5.03	5.35	1.51	1.99	1.94	3.05	1.72	2.42	1.86	3.32	2.21	1.61
	II	10	3.69	5.74	1.91	2.82	2.88	2.97	4.06	1.91	2.77	2.10	1.62	3.53	10.81	12.67	12.02	2.38	3.33	3.40	4.11	3.12	3.52	5.04	5.85	1.74	2.91	2.00	2.79	2.09	2.38	2.05	3.34	2.22	1.55
	III	8	3.18	4.21	1.50	2.34	1.93	2.29	2.64	2.21	1.91	1.08	1.81	2.79	6.60	10.00	9.54	1.50	2.71	2.73	3.24	2.50	5.02	3.77	3.82	1.46	2.05	1.70	2.00	1.90	1.89	1.61	3.00	1.69	1.34
Mar	I	10	3.13	5.41	2.49	4.25	4.30	4.17	3.64	3.50	2.44	3.19	2.62	3.49	8.85	16.08	13.07	1.89	1.97	3.26	4.11	3.24	9.01	4.79	4.56	1.78	3.46	2.21	2.57	3.28	2.20	2.19	3.66	2.05	1.96
	II	10	11.37	5.04	2.45	5.38	4.67	4.15	3.47	2.64	2.96	3.99	6.57	4.35	12.13	18.50	13.51	1.81	2.88	3.21	4.42	3.08	11.09	4.75	4.50	1.86	3.69	2.33	2.82	3.28	2.42	2.39	4.06	2.06	2.24
	III	11	5.11	6.61	3.13	12.88	6.11	5.54	3.77	3.66	3.93	4.54	7.69	8.19	13.85	23.11	16.63	3.46	3.74	5.25	5.12	3.43	13.70	5.26	4.80	2.40	5.58	3.24	3.53	3.60	2.92	6.00	3.88	2.30	5.06
Apr	I	10	3.74	8.42	2.94	6.29	3.88	5.23	3.04	3.61	4.78	4.71	5.08	8.19	12.04	23.78	15.76	3.53	3.58	5.07	5.03	3.55	16.12	4.78	6.35	2.50	4.84	3.39	3.46	2.91	3.31	5.52	3.76	2.08	3.36
	II	10	12.43	9.79	4.53	7.79	5.88	4.29	3.26	4.50	6.99	2.81	8.71	7.71	14.52	24.71	16.60	3.95	2.78	4.85	5.18	4.15	13.55	5.30	6.08	2.66	3.74	3.39	3.46	3.17	3.43	6.47	3.51	2.31	6.28
	III	10	6.27	12.10	5.44	8.33	5.85	7.21	4.51	5.44	6.63	6.26	7.95	6.94	14.32	24.47	20.38	3.57	2.83	5.34	4.99	4.02	14.55	5.94	7.16	2.70	4.72	4.16	4.48	3.42	3.61	5.11	4.22	3.53	4.96
May	I	10	12.37	10.69	6.59	9.34	9.79	10.11	4.72	7.09	3.98	8.51	8.06	10.03	13.60	29.42	20.60	10.75	3.99	5.90	4.83	7.27	15.51	7.59	8.12	2.87	4.64	5.59	5.24	3.84	4.84	5.89	6.06	3.72	6.96
	II	10	15.40	10.58	6.96	9.04	8.37	11.51	5.78	6.58	10.10	11.59	10.14	15.03	22.19	28.82	18.61	10.13	4.81	8.24	6.63	4.38	13.51	9.40	10.31	4.59	5.60	7.57	7.93	4.55	5.39	6.81	5.91	6.08	5.53
	III	11	16.00	10.86	9.71	11.19	8.88	11.01	7.78	14.07	10.33	11.28	10.84	17.93	20.82	28.05	17.16	16.18	8.02	12.18	8.56	4.37	15.21	13.16	10.80	5.96	6.36	9.21	10.84	4.78	5.85	6.26	8.36	6.75	9.19
Total	**MU**		**440**	**482**	**315**	**369**	**343**	**343**	**356**	**231.82**	**335**	**326**	**282**	**356**	**512**	**702**	**681**	**524**	**336**	**551**	**491**	**426**	**506**	**382**	**364**	**220**	**223**	**234**	**312**	**245**	**251**	**232**	**256**	**427**	**278**

Annexure 5.4: Energy at different Plant Capacities

Month	Period	Days	Unrestricted Power	33.5		36		38.5		41	
			For Year 1984-85	MW	MU	MW	MU	MW	MU	MW	MU
Jun	**I**	**10**	*31.28*	*31.28*	7.51	*31.28*	7.51	*31.28*	7.51	*31.28*	7.51
	II	**10**	*22.82*	*22.82*	5.48	*22.82*	5.48	*22.82*	5.48	*22.82*	5.48
	III	**10**	*24.70*	*24.70*	5.93	*24.70*	5.93	*24.70*	5.93	*24.70*	5.93
July	**I**	**10**	*42.56*	*33.50*	8.04	*36.00*	8.64	*38.50*	9.24	*41.00*	9.84
	II	**10**	*43.51*	*33.50*	8.04	*36.00*	8.64	*38.50*	9.24	*41.00*	9.84
	III	**11**	*55.14*	*33.50*	8.84	*36.00*	9.50	*38.50*	10.16	*41.00*	10.82
Aug	**I**	**10**	*49.44*	*33.50*	8.04	*36.00*	8.64	*38.50*	9.24	*41.00*	9.84
	II	**10**	*67.83*	*33.50*	8.04	*36.00*	8.64	*38.50*	9.24	*41.00*	9.84
	III	**11**	*69.13*	*33.50*	8.84	*36.00*	9.50	*38.50*	10.16	*41.00*	10.82
Sep	**I**	**10**	*61.41*	*33.50*	8.04	*36.00*	8.64	*38.50*	9.24	*41.00*	9.84
	II	**10**	*32.54*	*32.54*	7.81	*32.54*	7.81	*32.54*	7.81	*32.54*	7.81
	III	**10**	*25.85*	*25.85*	6.20	*25.85*	6.20	*25.85*	6.20	*25.85*	6.20
Oct	**I**	**10**	*26.04*	*26.04*	6.25	*26.04*	6.25	*26.04*	6.25	*26.04*	6.25
	II	**10**	*24.32*	*24.32*	5.84	*24.32*	5.84	*24.32*	5.84	*24.32*	5.84
	III	**11**	*21.64*	*21.64*	5.71	*21.64*	5.71	*21.64*	5.71	*21.64*	5.71
Nov	**I**	**10**	*18.08*	*18.08*	4.34	*18.08*	4.34	*18.08*	4.34	*18.08*	4.34
	II	**10**	*14.34*	*14.34*	3.44	*14.34*	3.44	*14.34*	3.44	*14.34*	3.44
	III	**10**	*13.61*	*13.61*	3.27	*13.61*	3.27	*13.61*	3.27	*13.61*	3.27
Dec	**I**	**10**	*13.19*	*13.19*	3.17	*13.19*	3.17	*13.19*	3.17	*13.19*	3.17
	II	**10**	*12.77*	*12.77*	3.06	*12.77*	3.06	*12.77*	3.06	*12.77*	3.06
	III	**11**	*11.74*	*11.74*	3.10	*11.74*	3.10	*11.74*	3.10	*11.74*	3.10
Jan	**I**	**10**	*11.20*	*11.20*	2.69	*11.20*	2.69	*11.20*	2.69	*11.20*	2.69
	II	**10**	*8.87*	*8.87*	2.13	*8.87*	2.13	*8.87*	2.13	*8.87*	2.13
	III	**11**	*8.87*	*8.87*	2.34	*8.87*	2.34	*8.87*	2.34	*8.87*	2.34
Feb	**I**	**10**	*8.33*	*8.33*	2.00	*8.33*	2.00	*8.33*	2.00	*8.33*	2.00
	II	**10**	*7.95*	*7.95*	1.91	*7.95*	1.91	*7.95*	1.91	*7.95*	1.91
	III	**8**	*11.51*	*11.51*	2.21	*11.51*	2.21	*11.51*	2.21	*11.51*	2.21
Mar	**I**	**10**	*14.60*	*14.60*	3.50	*14.60*	3.50	*14.60*	3.50	*14.60*	3.50
	II	**10**	*11.01*	*11.01*	2.64	*11.01*	2.64	*11.01*	2.64	*11.01*	2.64
	III	**11**	*13.88*	*13.88*	3.66	*13.88*	3.66	*13.88*	3.66	*13.88*	3.66
Apr	**I**	**10**	*15.06*	*15.06*	3.61	*15.06*	3.61	*15.06*	3.61	*15.06*	3.61
	II	**10**	*18.73*	*18.73*	4.50	*18.73*	4.50	*18.73*	4.50	*18.73*	4.50
	III	**10**	*22.67*	*22.67*	5.44	*22.67*	5.44	*22.67*	5.44	*22.67*	5.44
May	**I**	**10**	*29.56*	*29.56*	7.09	*29.56*	7.09	*29.56*	7.09	*29.56*	7.09
	II	**10**	*27.41*	*27.41*	6.58	*27.41*	6.58	*27.41*	6.58	*27.41*	6.58
	III	**11**	*53.30*	*33.50*	8.84	*36.00*	9.50	*38.50*	10.16	*41.00*	10.82
Total					**188.14**		**193.12**		**198.10**		**203.08**

Annexure 5.4: Energy at different Plant Capacities

Month	Period	Days	Unrestricted Power	43.5		46		48.5		51	
			For Year 1984-85	MW	MU	MW	MU	MW	MU	MW	MU
Jun	I	10	*31.28*	*31.28*	7.51	*31.28*	7.51	*31.28*	7.51	*31.28*	7.51
	II	10	*22.82*	*22.82*	5.48	*22.82*	5.48	*22.82*	5.48	*22.82*	5.48
	III	10	*24.70*	*24.70*	5.93	*24.70*	5.93	*24.70*	5.93	*24.70*	5.93
July	I	10	*42.56*	*42.56*	10.21	*42.56*	10.21	*42.56*	10.21	*42.56*	10.21
	II	10	*43.51*	*43.50*	10.44	*43.51*	10.44	*43.51*	10.44	*43.51*	10.44
	III	11	*55.14*	*43.50*	11.48	*46.00*	12.14	*48.50*	12.80	*51.00*	13.46
Aug	I	10	*49.44*	*43.50*	10.44	*46.00*	11.04	*48.50*	11.64	*49.44*	11.87
	II	10	*67.83*	*43.50*	10.44	*46.00*	11.04	*48.50*	11.64	*51.00*	12.24
	III	11	*69.13*	*43.50*	11.48	*46.00*	12.14	*48.50*	12.80	*51.00*	13.46
Sep	I	10	*61.41*	*43.50*	10.44	*46.00*	11.04	*48.50*	11.64	*51.00*	12.24
	II	10	*32.54*	*32.54*	7.81	*32.54*	7.81	*32.54*	7.81	*32.54*	7.81
	III	10	*25.85*	*25.85*	6.20	*25.85*	6.20	*25.85*	6.20	*25.85*	6.20
Oct	I	10	*26.04*	*26.04*	6.25	*26.04*	6.25	*26.04*	6.25	*26.04*	6.25
	II	10	*24.32*	*24.32*	5.84	*24.32*	5.84	*24.32*	5.84	*24.32*	5.84
	III	11	*21.64*	*21.64*	5.71	*21.64*	5.71	*21.64*	5.71	*21.64*	5.71
Nov	I	10	*18.08*	*18.08*	4.34	*18.08*	4.34	*18.08*	4.34	*18.08*	4.34
	II	10	*14.34*	*14.34*	3.44	*14.34*	3.44	*14.34*	3.44	*14.34*	3.44
	III	10	*13.61*	*13.61*	3.27	*13.61*	3.27	*13.61*	3.27	*13.61*	3.27
Dec	I	10	*13.19*	*13.19*	3.17	*13.19*	3.17	*13.19*	3.17	*13.19*	3.17
	II	10	*12.77*	*12.77*	3.06	*12.77*	3.06	*12.77*	3.06	*12.77*	3.06
	III	11	*11.74*	*11.74*	3.10	*11.74*	3.10	*11.74*	3.10	*11.74*	3.10
Jan	I	10	*11.20*	*11.20*	2.69	*11.20*	2.69	*11.20*	2.69	*11.20*	2.69
	II	10	*8.87*	*8.87*	2.13	*8.87*	2.13	*8.87*	2.13	*8.87*	2.13
	III	11	*8.87*	*8.87*	2.34	*8.87*	2.34	*8.87*	2.34	*8.87*	2.34
Feb	I	10	*8.33*	*8.33*	2.00	*8.33*	2.00	*8.33*	2.00	*8.33*	2.00
	II	10	*7.95*	*7.95*	1.91	*7.95*	1.91	*7.95*	1.91	*7.95*	1.91
	III	8	*11.51*	*11.51*	2.21	*11.51*	2.21	*11.51*	2.21	*11.51*	2.21
Mar	I	10	*14.60*	*14.60*	3.50	*14.60*	3.50	*14.60*	3.50	*14.60*	3.50
	II	10	*11.01*	*11.01*	2.64	*11.01*	2.64	*11.01*	2.64	*11.01*	2.64
	III	11	*13.88*	*13.88*	3.66	*13.88*	3.66	*13.88*	3.66	*13.88*	3.66
Apr	I	10	*15.06*	*15.06*	3.61	*15.06*	3.61	*15.06*	3.61	*15.06*	3.61
	II	10	*18.73*	*18.73*	4.50	*18.73*	4.50	*18.73*	4.50	*18.73*	4.50
	III	10	*22.67*	*22.67*	5.44	*22.67*	5.44	*22.67*	5.44	*22.67*	5.44
May	I	10	*29.56*	*29.56*	7.09	*29.56*	7.09	*29.56*	7.09	*29.56*	7.09
	II	10	*27.41*	*27.41*	6.58	*27.41*	6.58	*27.41*	6.58	*27.41*	6.58
	III	11	*53.30*	*43.50*	11.48	*46.00*	12.14	*48.50*	12.80	*51.00*	13.46
Total					**207.83**		**211.61**		**215.39**		**218.80**

Annexure 5.4: Energy at different Plant Capacities

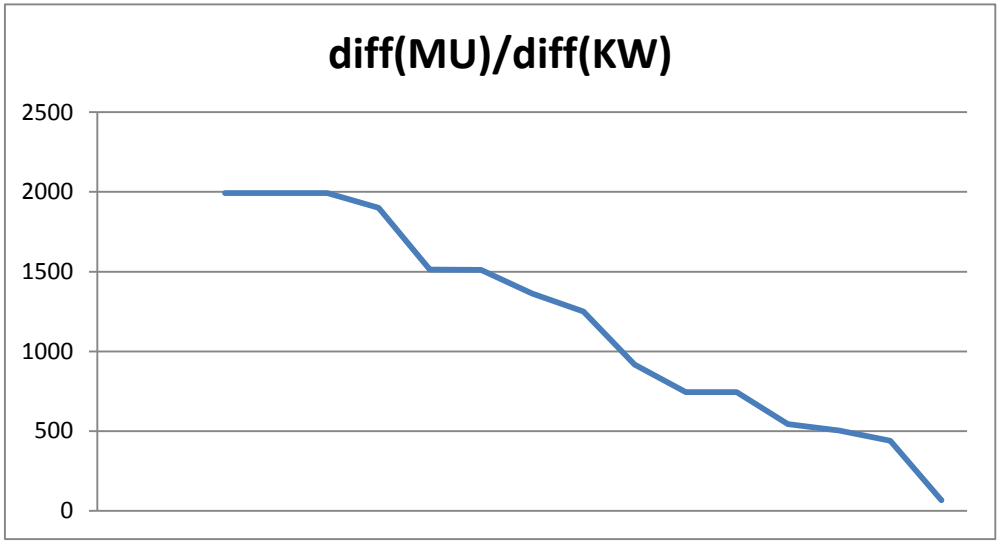
Month	Period	Days	Unrestricted Power	53.5		56		58.5		61	
			For Year 1984-85	MW	MU	MW	MU	MW	MU	MW	MU
Jun	I	10	*31.28*	*31.28*	7.51	*31.28*	7.51	*31.28*	7.51	*31.28*	7.51
	II	10	*22.82*	*22.82*	5.48	*22.82*	5.48	*22.82*	5.48	*22.82*	5.48
	III	10	*24.70*	*24.70*	5.93	*24.70*	5.93	*24.70*	5.93	*24.70*	5.93
July	I	10	*42.56*	*42.56*	10.21	*42.56*	10.21	*42.56*	10.21	*42.56*	10.21
	II	10	*43.51*	*43.51*	10.44	*43.51*	10.44	*43.51*	10.44	*43.51*	10.44
	III	11	*55.14*	*53.50*	14.12	*55.14*	14.56	*55.14*	14.56	*55.14*	14.56
Aug	I	10	*49.44*	*49.44*	11.87	*49.44*	11.87	*49.44*	11.87	*49.44*	11.87
	II	10	*67.83*	*53.50*	12.84	*56.00*	13.44	*58.50*	14.04	*61.00*	14.64
	III	11	*69.13*	*53.50*	14.12	*56.00*	14.78	*58.50*	15.44	*61.00*	16.10
Sep	I	10	*61.41*	*53.50*	12.84	*56.00*	13.44	*58.50*	14.04	*61.00*	14.64
	II	10	*32.54*	*32.54*	7.81	*32.54*	7.81	*32.54*	7.81	*32.54*	7.81
	III	10	*25.85*	*25.85*	6.20	*25.85*	6.20	*25.85*	6.20	*25.85*	6.20
Oct	I	10	*26.04*	*26.04*	6.25	*26.04*	6.25	*26.04*	6.25	*26.04*	6.25
	II	10	*24.32*	*24.32*	5.84	*24.32*	5.84	*24.32*	5.84	*24.32*	5.84
	III	11	*21.64*	*21.64*	5.71	*21.64*	5.71	*21.64*	5.71	*21.64*	5.71
Nov	I	10	*18.08*	*18.08*	4.34	*18.08*	4.34	*18.08*	4.34	*18.08*	4.34
	II	10	*14.34*	*14.34*	3.44	*14.34*	3.44	*14.34*	3.44	*14.34*	3.44
	III	10	*13.61*	*13.61*	3.27	*13.61*	3.27	*13.61*	3.27	*13.61*	3.27
Dec	I	10	*13.19*	*13.19*	3.17	*13.19*	3.17	*13.19*	3.17	*13.19*	3.17
	II	10	*12.77*	*12.77*	3.06	*12.77*	3.06	*12.77*	3.06	*12.77*	3.06
	III	11	*11.74*	*11.74*	3.10	*11.74*	3.10	*11.74*	3.10	*11.74*	3.10
Jan	I	10	*11.20*	*11.20*	2.69	*11.20*	2.69	*11.20*	2.69	*11.20*	2.69
	II	10	*8.87*	*8.87*	2.13	*8.87*	2.13	*8.87*	2.13	*8.87*	2.13
	III	11	*8.87*	*8.87*	2.34	*8.87*	2.34	*8.87*	2.34	*8.87*	2.34
Feb	I	10	*8.33*	*8.33*	2.00	*8.33*	2.00	*8.33*	2.00	*8.33*	2.00
	II	10	*7.95*	*7.95*	1.91	*7.95*	1.91	*7.95*	1.91	*7.95*	1.91
	III	8	*11.51*	*11.51*	2.21	*11.51*	2.21	*11.51*	2.21	*11.51*	2.21
Mar	I	10	*14.60*	*14.60*	3.50	*14.60*	3.50	*14.60*	3.50	*14.60*	3.50
	II	10	*11.01*	*11.01*	2.64	*11.01*	2.64	*11.01*	2.64	*11.01*	2.64
	III	11	*13.88*	*13.88*	3.66	*13.88*	3.66	*13.88*	3.66	*13.88*	3.66
Apr	I	10	*15.06*	*15.06*	3.61	*15.06*	3.61	*15.06*	3.61	*15.06*	3.61
	II	10	*18.73*	*18.73*	4.50	*18.73*	4.50	*18.73*	4.50	*18.73*	4.50
	III	10	*22.67*	*22.67*	5.44	*22.67*	5.44	*22.67*	5.44	*22.67*	5.44
May	I	10	*29.56*	*29.56*	7.09	*29.56*	7.09	*29.56*	7.09	*29.56*	7.09
	II	10	*27.41*	*27.41*	6.58	*27.41*	6.58	*27.41*	6.58	*27.41*	6.58
	III	11	*53.30*	*53.30*	14.07	*53.30*	14.07	*53.30*	14.07	*53.30*	14.07
Total					**221.93**		**224.22**		**226.08**		**227.94**

Annexure 5.4: Energy at different Plant Capacities

Month	Period	Days	Unrestricted Power	63.5		66		68.5		71	
			For Year 1984-85	MW	MU	MW	MU	MW	MU	MW	MU
Jun	I	10	*31.28*	*31.28*	7.51	*31.28*	7.51	*31.28*	7.51	*31.28*	7.51
	II	10	*22.82*	*22.82*	5.48	*22.82*	5.48	*22.82*	5.48	*22.82*	5.48
	III	10	*24.70*	*24.70*	5.93	*24.70*	5.93	*24.70*	5.93	*24.70*	5.93
July	I	10	*42.56*	*42.56*	10.21	*42.56*	10.21	*42.56*	10.21	*42.56*	10.21
	II	10	*43.51*	*43.51*	10.44	*43.51*	10.44	*43.51*	10.44	*43.51*	10.44
	III	11	*55.14*	*55.14*	14.56	*55.14*	14.56	*55.14*	14.56	*55.14*	14.56
Aug	I	10	*49.44*	*49.44*	11.87	*49.44*	11.87	*49.44*	11.87	*49.44*	11.87
	II	10	*67.83*	*63.50*	15.24	*66.00*	15.84	*67.83*	16.28	*67.83*	16.28
	III	11	*69.13*	*63.50*	16.76	*66.00*	17.42	*68.50*	18.08	*69.13*	18.25
Sep	I	10	*61.41*	*61.41*	14.74	*61.41*	14.74	*61.41*	14.74	*61.41*	14.74
	II	10	*32.54*	*32.54*	7.81	*32.54*	7.81	*32.54*	7.81	*32.54*	7.81
	III	10	*25.85*	*25.85*	6.20	*25.85*	6.20	*25.85*	6.20	*25.85*	6.20
Oct	I	10	*26.04*	*26.04*	6.25	*26.04*	6.25	*26.04*	6.25	*26.04*	6.25
	II	10	*24.32*	*24.32*	5.84	*24.32*	5.84	*24.32*	5.84	*24.32*	5.84
	III	11	*21.64*	*21.64*	5.71	*21.64*	5.71	*21.64*	5.71	*21.64*	5.71
Nov	I	10	*18.08*	*18.08*	4.34	*18.08*	4.34	*18.08*	4.34	*18.08*	4.34
	II	10	*14.34*	*14.34*	3.44	*14.34*	3.44	*14.34*	3.44	*14.34*	3.44
	III	10	*13.61*	*13.61*	3.27	*13.61*	3.27	*13.61*	3.27	*13.61*	3.27
Dec	I	10	*13.19*	*13.19*	3.17	*13.19*	3.17	*13.19*	3.17	*13.19*	3.17
	II	10	*12.77*	*12.77*	3.06	*12.77*	3.06	*12.77*	3.06	*12.77*	3.06
	III	11	*11.74*	*11.74*	3.10	*11.74*	3.10	*11.74*	3.10	*11.74*	3.10
Jan	I	10	*11.20*	*11.20*	2.69	*11.20*	2.69	*11.20*	2.69	*11.20*	2.69
	II	10	*8.87*	*8.87*	2.13	*8.87*	2.13	*8.87*	2.13	*8.87*	2.13
	III	11	*8.87*	*8.87*	2.34	*8.87*	2.34	*8.87*	2.34	*8.87*	2.34
Feb	I	10	*8.33*	*8.33*	2.00	*8.33*	2.00	*8.33*	2.00	*8.33*	2.00
	II	10	*7.95*	*7.95*	1.91	*7.95*	1.91	*7.95*	1.91	*7.95*	1.91
	III	8	*11.51*	*11.51*	2.21	*11.51*	2.21	*11.51*	2.21	*11.51*	2.21
Mar	I	10	*14.60*	*14.60*	3.50	*14.60*	3.50	*14.60*	3.50	*14.60*	3.50
	II	10	*11.01*	*11.01*	2.64	*11.01*	2.64	*11.01*	2.64	*11.01*	2.64
	III	11	*13.88*	*13.88*	3.66	*13.88*	3.66	*13.88*	3.66	*13.88*	3.66
Apr	I	10	*15.06*	*15.06*	3.61	*15.06*	3.61	*15.06*	3.61	*15.06*	3.61
	II	10	*18.73*	*18.73*	4.50	*18.73*	4.50	*18.73*	4.50	*18.73*	4.50
	III	10	*22.67*	*22.67*	5.44	*22.67*	5.44	*22.67*	5.44	*22.67*	5.44
May	I	10	*29.56*	*29.56*	7.09	*29.56*	7.09	*29.56*	7.09	*29.56*	7.09
	II	10	*27.41*	*27.41*	6.58	*27.41*	6.58	*27.41*	6.58	*27.41*	6.58
	III	11	*53.30*	*53.30*	14.07	*53.30*	14.07	*53.30*	14.07	*53.30*	14.07
Total					**229.30**		**230.56**		**231.66**		**231.82**

Annexure 5.4: Data for Determining Plant Capacity

Pl Capacity	Annual MU	Max. Energy	Load Factor %	MU/KW	Diff Energy	diff(MU)/diff(KW)	Harnessing energy%
33.50	188.14	293.46	64.11%	5616.05			81.16%
36.00	193.12	315.36	61.24%	5364.38	4.98	1992.00	83.30%
38.50	198.10	337.26	58.74%	5145.40	4.98	1992.00	85.45%
41.00	203.08	359.16	56.54%	4953.12	4.98	1992.00	87.60%
43.50	207.83	381.06	54.54%	4777.73	4.75	1901.41	89.65%
46.00	211.61	402.96	52.51%	4600.31	3.78	1513.18	91.28%
48.50	215.39	424.86	50.70%	4441.12	3.78	1512.00	92.91%
51.00	218.80	446.76	48.97%	4290.19	3.41	1362.18	94.38%
53.50	221.93	468.66	47.35%	4148.17	3.13	1251.05	95.73%
56.00	224.22	490.56	45.71%	4003.92	2.29	916.87	96.72%
58.50	226.08	512.46	44.12%	3864.61	1.86	744.00	97.52%
61.00	227.94	534.36	42.66%	3736.71	1.86	744.00	98.32%
63.50	229.30	556.26	41.22%	3610.98	1.36	543.19	98.91%
66.00	230.56	578.16	39.88%	3493.30	1.26	504.00	99.45%
68.50	231.66	600.06	38.61%	3381.86	1.10	439.91	99.93%
71.00	231.82	621.96	37.27%	3265.13	0.17	66.80	100.00%



Annexure 5.4: Data for 51 MW Plant Capacity at 95% Plant availability

Month	Period	Days	Discharge		Unrestricted Power	Plant Capacity		
			Initial	Excluding Environmental Release	For Year 1984-85	51		95% Plant Availability
			m3/s	m3/s	MW	MW	MU	MU
Jun	**I**	**10**	8.41	8.179	31.28	31.28	7.51	7.51
	II	**10**	6.20	5.969	22.82	22.82	5.48	5.48
	III	**10**	6.69	6.459	24.70	24.70	5.93	5.93
July	**I**	**10**	11.36	11.129	42.56	42.56	10.21	10.21
	II	**10**	11.61	11.379	43.51	43.51	10.44	10.44
	III	**11**	14.65	14.419	55.14	51.00	13.46	12.79
Aug	**I**	**10**	13.16	12.929	49.44	49.44	11.87	11.87
	II	**10**	17.97	17.739	67.83	51.00	12.24	11.63
	III	**11**	18.31	18.079	69.13	51.00	13.46	12.79
Sep	**I**	**10**	16.29	16.059	61.41	51.00	12.24	11.63
	II	**10**	8.74	8.509	32.54	32.54	7.81	7.81
	III	**10**	6.99	6.759	25.85	25.85	6.20	6.20
Oct	**I**	**10**	7.04	6.809	26.04	26.04	6.25	6.25
	II	**10**	6.59	6.359	24.32	24.32	5.84	5.84
	III	**11**	5.89	5.659	21.64	21.64	5.71	5.71
Nov	**I**	**10**	4.96	4.729	18.08	18.08	4.34	4.34
	II	**10**	3.98	3.749	14.34	14.34	3.44	3.44
	III	**10**	3.79	3.559	13.61	13.61	3.27	3.27
Dec	**I**	**10**	3.68	3.449	13.19	13.19	3.17	3.17
	II	**10**	3.57	3.339	12.77	12.77	3.06	3.06
	III	**11**	3.30	3.069	11.74	11.74	3.10	3.10
Jan	**I**	**10**	3.16	2.929	11.20	11.20	2.69	2.69
	II	**10**	2.55	2.319	8.87	8.87	2.13	2.13
	III	**11**	2.55	2.319	8.87	8.87	2.34	2.34
Feb	**I**	**10**	2.41	2.179	8.33	8.33	2.00	2.00
	II	**10**	2.31	2.079	7.95	7.95	1.91	1.91
	III	**8**	3.24	3.009	11.51	11.51	2.21	2.21
Mar	**I**	**10**	4.05	3.819	14.60	14.60	3.50	3.50
	II	**10**	3.11	2.879	11.01	11.01	2.64	2.64
	III	**11**	3.86	3.629	13.88	13.88	3.66	3.66
Apr	**I**	**10**	4.17	3.939	15.06	15.06	3.61	3.61
	II	**10**	5.13	4.899	18.73	18.73	4.50	4.50
	III	**10**	6.16	5.929	22.67	22.67	5.44	5.44
May	**I**	**10**	7.96	7.729	29.56	29.56	7.09	7.09
	II	**10**	7.40	7.169	27.41	27.41	6.58	6.58
	III	**11**	14.17	13.939	53.30	51.00	13.46	12.79
Total			**255.41**	**247.09**	**944.87**	**893.05**	**218.80**	**215.56**

Annexure 5.4: Annual Energy Generation (MU) for different Installed Capacity (at 100% Plant Capacity)

Year	Unrestricted Power (MW)	Unrestricted Energy (MU)	33.50 MU	36.00 MU	38.50 MU	41.00 MU	43.50 MU	46.00 MU	48.50 MU	51.00 MU	53.50 MU	56.00 MU	58.50 MU	61.00 MU	63.50 MU	66.00 MU	68.50 MU	71.00 MU
1977-78	**1801.39**	**440.14**	229.48	239.86	249.72	259.50	269.28	279.06	288.57	297.75	305.48	312.86	320.24	327.52	334.24	340.52	346.64	352.76
1978-79	**1974.65**	**482.26**	239.49	251.45	262.62	273.55	283.31	291.84	299.76	307.55	314.87	322.19	328.98	335.59	341.71	347.36	352.66	357.58
1979-80	**1287.80**	**314.90**	194.59	203.77	212.50	220.80	227.85	234.02	240.14	246.26	252.04	257.56	262.79	267.71	272.63	277.55	282.01	286.33
1980-81	**1506.98**	**368.53**	241.65	252.99	263.71	273.05	282.00	290.58	299.16	307.16	314.61	321.49	328.06	333.75	338.10	341.74	344.80	347.86
1981-82	**1399.26**	**342.56**	224.84	233.73	242.16	249.96	256.34	262.46	268.11	273.14	278.06	282.55	286.87	291.15	294.43	297.55	300.07	302.53
1982-83	**1399.68**	**342.52**	213.11	222.29	231.47	240.65	248.75	256.07	262.86	268.98	275.10	281.13	286.13	291.05	295.44	299.76	304.08	308.40
1983-84	**1457.50**	**355.89**	218.79	226.87	234.79	242.71	250.63	258.50	265.74	272.46	279.18	285.57	291.12	296.18	301.10	305.70	310.02	314.34
1984-85	**944.87**	**231.82**	188.14	193.12	198.10	203.08	207.83	211.61	215.39	218.80	221.93	224.22	226.08	227.94	229.30	230.56	231.66	231.82
1985-86	**1374.18**	**335.44**	209.17	218.35	226.97	235.06	242.12	248.84	255.21	261.33	267.34	272.38	277.30	282.22	287.14	291.95	296.27	300.59
1986-87	**1335.94**	**326.23**	200.33	208.78	216.46	223.84	231.01	237.18	243.25	248.77	254.29	259.81	265.31	270.23	275.15	279.52	283.84	288.16
1987-88	**1151.09**	**281.57**	202.87	211.24	218.69	226.07	232.51	238.63	244.18	249.70	254.87	259.79	264.71	269.21	272.67	275.53	277.78	279.51
1988-89	**1451.92**	**356.02**	238.90	248.47	257.25	265.83	274.00	281.97	288.82	295.60	302.33	308.29	313.87	319.45	324.82	329.27	333.49	336.69
1989-90	**2087.41**	**511.61**	271.15	287.22	302.41	316.45	330.44	343.65	356.49	369.02	380.39	391.37	401.18	409.91	416.70	423.10	429.28	435.08
1990-91	**2879.12**	**701.76**	293.46	315.36	337.26	358.32	378.13	396.67	413.65	430.07	445.78	460.48	474.58	488.62	502.66	516.70	530.38	543.82
1991-92	**2792.39**	**680.61**	293.46	315.36	337.26	359.16	381.06	402.67	421.50	437.64	452.41	466.74	480.30	493.80	507.00	518.83	529.75	540.23
1992-93	**2133.38**	**524.25**	192.53	202.31	212.09	221.87	231.34	240.23	248.24	256.22	264.20	272.18	280.16	288.14	295.54	302.86	309.74	316.46
1993-94	**1378.58**	**336.05**	198.70	206.62	214.54	222.46	230.38	238.30	246.22	253.82	261.14	267.36	273.42	279.11	283.57	287.83	291.90	295.56
1994-95	**2241.17**	**550.95**	230.16	239.88	248.52	256.77	264.75	272.73	280.09	287.41	294.73	301.51	307.63	313.75	319.87	325.99	331.78	337.30
1995-96	**1999.04**	**490.50**	224.38	232.30	240.22	248.14	255.80	263.12	270.44	277.76	285.08	292.40	299.72	306.69	313.41	319.40	324.73	329.07
1996-97	**1741.35**	**426.23**	189.32	197.84	206.36	214.56	222.18	229.50	236.82	244.14	251.46	258.78	266.10	273.42	280.74	288.06	295.38	302.70
1997-98	**2069.14**	**505.80**	267.41	283.91	300.11	315.41	330.71	346.01	358.46	369.50	379.82	389.01	396.94	403.65	409.77	415.56	420.50	424.82
1998-99	**1563.27**	**381.76**	249.87	262.71	275.36	287.16	298.80	310.43	321.35	330.94	339.78	347.76	354.45	359.61	364.10	368.42	372.70	375.80
1999-2000	**1492.72**	**364.34**	262.75	275.82	288.04	299.19	308.84	317.80	325.96	333.23	339.95	344.84	348.84	352.56	355.71	357.57	359.16	360.42
2000-01	**896.84**	**219.63**	163.92	170.94	177.66	183.95	189.47	194.54	198.92	202.25	204.11	205.97	207.27	208.53	209.79	211.05	212.31	213.57
2001-02	**910.34**	**222.89**	169.54	174.46	179.38	184.30	189.22	194.14	198.46	202.18	205.90	209.62	213.34	216.54	218.91	220.27	221.41	222.01
2002-03	**957.94**	**233.98**	169.89	175.77	181.29	186.81	191.79	196.71	201.63	206.52	210.84	215.01	217.94	219.25	220.32	220.92	221.52	222.12
2003-04	**1275.48**	**311.93**	208.54	218.98	229.42	238.86	247.09	255.07	263.05	270.52	277.50	282.99	287.35	291.42	295.14	298.65	301.64	303.61
2004-05	**1002.65**	**244.99**	199.60	208.89	217.40	224.01	228.35	231.30	233.82	235.85	237.71	239.57	241.32	242.58	243.81	244.41	244.99	244.99
2005-06	**1028.76**	**251.43**	184.32	190.21	195.73	200.99	205.04	208.70	211.78	214.84	217.90	220.96	224.02	227.08	230.14	233.20	236.26	238.84
2006-07	**947.54**	**232.49**	172.54	176.26	179.98	183.70	187.13	190.25	193.37	196.49	199.61	202.73	205.85	208.97	212.09	215.04	217.04	218.90
2007-08	**1048.30**	**255.82**	194.79	201.51	208.09	213.99	219.13	223.59	227.52	231.24	234.96	238.68	242.40	244.94	246.74	248.54	250.34	251.85
2008-09	**1747.05**	**427.42**	182.35	190.87	199.39	207.91	215.74	223.06	230.38	237.70	245.02	252.34	259.66	266.98	274.24	280.96	287.32	293.44
2009-10	**1138.05**	**278.26**	188.24	194.70	200.82	206.48	211.56	216.48	221.40	225.89	229.55	232.72	235.78	238.84	241.90	244.70	247.16	249.62

Annexure 5.4: Annual Energy Generation (MU) for different Installed Capacity (at 95% Plant Capacity)

Year	Unrestricted Power (MW)	Unrestricted Energy (MU)	33.50 MU	36.00 MU	38.50 MU	41.00 MU	43.50 MU	46.00 MU	48.50 MU	51.00 MU	53.50 MU	56.00 MU	58.50 MU	61.00 MU	63.50 MU	66.00 MU	68.50 MU	71.00 MU
1977-78	**1801.39**	**440.14**	222.53	232.39	242.19	251.48	260.77	270.06	279.66	288.38	297.58	302.17	311.61	319.32	325.70	332.44	338.25	344.07
1978-79	**1974.65**	**482.26**	231.33	243.11	254.16	265.04	274.85	284.56	292.08	300.08	307.03	310.75	321.12	328.12	333.94	340.08	345.92	350.59
1979-80	**1287.80**	**314.90**	188.44	197.16	205.94	214.80	222.00	228.39	234.20	240.02	246.13	248.74	257.04	261.71	266.38	271.06	276.09	280.20
1980-81	**1506.98**	**368.53**	233.86	245.04	256.13	265.47	274.53	282.69	290.84	299.08	306.78	311.02	320.90	327.74	333.38	337.70	340.61	343.51
1981-82	**1399.26**	**342.56**	218.29	227.59	236.06	244.45	251.01	256.83	262.76	268.12	272.80	274.43	281.82	286.61	290.47	293.44	296.70	299.04
1982-83	**1399.68**	**342.52**	206.96	215.68	224.40	233.12	242.38	249.33	256.92	262.73	268.55	271.58	280.37	285.04	289.95	294.05	298.16	302.26
1983-84	**1457.50**	**355.89**	213.08	221.17	228.69	236.22	243.74	251.76	259.22	265.61	271.99	276.94	284.66	290.18	294.85	300.00	304.10	308.21
1984-85	**944.87**	**231.82**	184.80	189.53	194.26	198.99	204.02	208.14	211.73	215.56	219.23	219.08	223.90	225.67	227.70	228.89	230.75	231.82
1985-86	**1374.18**	**335.44**	203.02	211.74	220.37	228.56	236.27	242.66	249.28	255.09	261.44	263.50	271.54	276.22	280.89	286.25	290.35	294.46
1986-87	**1335.94**	**326.23**	194.59	203.04	210.78	217.79	225.16	231.55	237.89	243.14	248.38	251.96	259.55	264.23	268.90	273.82	277.92	282.03
1987-88	**1151.09**	**281.57**	196.72	205.50	213.01	220.02	227.18	233.00	238.82	244.07	249.61	252.06	258.96	263.94	268.78	272.28	275.23	277.72
1988-89	**1451.92**	**356.02**	231.95	241.87	250.65	258.80	267.06	275.18	282.24	288.68	295.72	299.13	307.34	312.64	318.50	323.49	328.40	332.26
1989-90	**2087.41**	**511.61**	260.18	275.77	291.60	304.94	318.75	331.84	344.04	357.15	368.64	376.11	390.43	400.90	408.09	414.95	420.82	427.16
1990-91	**2879.12**	**701.76**	278.79	299.59	320.40	341.83	361.21	381.04	397.18	413.36	430.05	437.45	458.16	471.49	484.83	498.17	511.97	524.74
1991-92	**2792.39**	**680.61**	278.79	299.59	320.40	341.20	362.01	383.63	404.39	422.04	436.68	443.40	464.51	477.33	491.53	504.42	514.79	525.58
1992-93	**2133.38**	**524.25**	185.98	195.27	204.56	213.85	223.35	232.33	240.50	248.08	255.66	261.65	270.83	278.41	286.24	293.20	300.54	306.92
1993-94	**1378.58**	**336.05**	193.40	200.92	208.44	215.97	223.49	231.02	238.54	246.36	253.31	258.62	266.33	272.45	278.16	282.20	286.88	290.36
1994-95	**2241.17**	**550.95**	223.17	233.66	241.87	250.23	257.81	265.39	272.99	279.95	286.90	292.21	300.47	306.28	312.10	317.91	324.21	329.46
1995-96	**1999.04**	**490.50**	219.07	226.60	234.12	241.65	249.43	256.38	263.34	270.29	277.24	283.69	291.15	298.50	304.88	312.11	317.99	322.94
1996-97	**1741.35**	**426.23**	183.61	191.71	199.80	208.06	215.82	222.77	229.72	236.68	243.63	249.60	257.54	264.49	271.45	278.40	285.36	292.31
1997-98	**2069.14**	**505.80**	256.36	272.03	288.33	302.86	317.40	331.93	347.75	358.24	369.36	372.79	388.38	396.18	402.00	408.27	414.58	418.69
1998-99	**1563.27**	**381.76**	241.27	253.47	265.94	277.61	288.67	300.27	311.23	321.58	330.60	334.71	347.22	353.61	358.61	362.72	367.68	371.45
1999-2000	**1492.72**	**364.34**	253.35	267.01	279.08	291.17	300.86	309.91	318.22	326.37	332.76	333.04	344.49	348.02	353.34	355.11	357.43	358.63
2000-01	**896.84**	**219.63**	159.02	166.10	172.49	179.42	184.66	190.01	194.73	200.35	202.12	199.38	205.79	206.99	208.19	209.39	210.58	211.78
2001-02	**910.34**	**222.89**	166.25	170.92	175.59	180.27	184.94	189.62	194.85	198.38	201.92	204.32	208.99	213.46	216.48	218.60	220.59	221.16
2002-03	**957.94**	**233.98**	165.75	171.80	177.04	182.29	187.51	192.18	196.85	202.11	206.22	209.08	215.83	217.79	219.56	220.13	220.70	221.27
2003-04	**1275.48**	**311.93**	201.55	211.47	221.38	231.28	240.15	247.73	255.31	263.05	270.95	272.27	282.29	286.88	290.41	294.53	298.27	300.96
2004-05	**1002.65**	**244.99**	193.05	202.28	212.23	219.49	225.11	228.98	231.37	233.95	235.71	233.28	239.85	241.05	243.05	243.62	244.99	244.99
2005-06	**1028.76**	**251.43**	179.81	186.24	191.48	196.96	201.85	205.33	208.81	211.71	214.62	215.44	220.44	223.34	226.25	229.16	232.06	235.35
2006-07	**947.54**	**232.49**	170.05	173.59	177.12	180.65	184.41	187.37	190.34	193.30	196.27	198.72	202.19	205.16	208.12	211.71	214.49	216.26
2007-08	**1048.30**	**255.82**	190.29	196.68	203.38	209.47	214.85	219.62	223.91	227.45	230.98	232.44	238.05	242.75	244.46	246.17	247.88	250.15
2008-09	**1747.05**	**427.42**	176.64	184.73	192.83	200.92	209.37	216.32	223.28	230.23	237.19	243.13	251.09	258.05	265.70	272.09	278.94	284.75
2009-10	**1138.05**	**278.26**	183.70	190.30	196.11	201.95	207.28	211.96	216.63	222.16	225.63	226.41	232.20	235.10	238.01	241.45	243.79	246.13

Annexure 5.5: Monthly Energy Generation (MU) for IC of 51.0 MW

Month	Jun	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	April	May	Total
1977-78	26.49	36.05	36.05	34.88	26.23	17.81	12.50	12.35	10.72	19.88	21.89	36.05	290.90
1978-79	34.88	36.05	36.05	34.88	25.14	17.40	11.41	12.11	14.39	17.49	29.98	32.41	302.19
1979-80	33.08	36.05	36.05	33.84	26.79	11.26	6.99	7.24	2.44	8.30	13.26	23.70	238.98
1980-81	34.88	36.05	36.05	34.88	29.82	19.32	15.91	11.00	8.35	22.15	22.84	29.93	301.18
1981-82	34.05	36.05	36.05	31.71	24.88	19.57	11.68	9.55	8.24	15.47	16.01	27.46	270.72
1982-83	34.55	36.05	36.05	33.52	19.54	13.03	10.75	9.45	8.30	14.24	17.14	32.89	265.50
1983-84	34.31	36.02	36.05	34.88	19.98	22.01	19.49	12.47	10.85	11.20	11.12	18.70	267.08
1984-85	19.34	33.63	35.72	25.93	18.23	11.36	9.59	7.37	4.34	10.09	13.92	26.76	216.26
1985-86	30.20	36.05	36.05	34.88	27.60	15.18	8.19	9.43	7.08	9.60	18.83	24.75	257.83
1986-87	32.33	36.05	36.05	29.48	19.22	12.23	9.91	7.06	4.60	12.05	14.12	31.08	244.18
1987-88	34.88	36.05	36.05	27.57	14.97	8.88	7.63	4.73	1.87	17.28	22.14	29.41	241.46
1988-89	27.03	36.05	36.05	31.23	31.77	15.92	15.40	13.76	10.31	16.41	23.28	34.55	291.75
1989-90	34.88	36.05	36.05	34.88	32.29	21.67	15.12	16.10	26.77	33.30	34.71	36.05	357.87
1990-91	34.88	36.05	36.05	34.88	36.05	33.43	31.41	31.79	32.06	36.05	34.88	36.05	413.58
1991-92	34.88	36.05	36.05	34.88	36.05	33.33	34.97	34.32	32.15	36.05	34.88	36.05	419.66
1992-93	34.88	36.05	36.05	34.88	24.90	10.47	4.97	6.95	4.73	3.56	11.37	33.85	242.66
1993-94	34.88	36.05	36.05	34.88	23.95	15.37	11.46	10.45	9.63	6.82	9.45	17.22	246.21
1994-95	27.32	36.05	36.05	34.88	33.83	23.03	16.29	11.38	9.66	12.04	15.66	26.68	282.86
1995-96	34.88	36.05	36.05	34.88	22.12	15.83	16.49	15.38	11.64	14.01	15.59	20.45	273.36
1996-97	33.50	36.05	36.05	34.88	24.62	7.69	9.67	9.19	8.88	10.04	12.05	16.40	239.02
1997-98	22.60	36.05	36.05	34.88	35.65	33.86	30.40	13.63	12.90	33.08	34.88	36.05	360.03
1998-99	34.88	36.05	36.05	34.88	35.56	34.29	19.32	16.08	14.20	15.20	16.43	29.78	322.73
1999-2000	33.74	36.05	36.05	34.88	35.47	28.79	24.39	19.46	15.40	14.23	20.03	29.60	328.08
2000-01	29.69	35.93	35.43	31.61	16.21	5.24	0.00	0.00	0.00	2.48	8.08	13.77	178.43
2001-02	24.23	36.05	36.05	23.70	10.98	6.76	0.00	4.43	7.15	13.07	13.66	17.02	193.09
2002-03	24.62	36.05	36.05	29.96	9.68	7.24	0.00	6.37	3.81	8.01	11.24	22.79	195.82
2003-04	31.17	36.05	36.05	34.88	35.59	22.45	7.81	7.35	8.07	9.18	11.72	24.40	264.72
2004-05	31.37	31.72	36.05	30.21	28.50	20.77	12.33	2.11	4.11	10.46	9.77	13.54	230.93
2005-06	18.33	36.05	34.28	28.45	26.31	14.11	8.52	7.07	6.88	7.77	10.65	16.49	214.91
2006-07	12.02	32.19	36.05	24.71	15.63	9.14	7.09	2.13	3.78	10.86	17.52	19.40	190.50
2007-08	26.99	35.73	36.05	30.59	16.21	11.02	10.09	9.60	9.94	11.93	11.83	20.77	230.73
2008-09	33.30	36.05	36.05	34.88	29.87	8.69	8.18	7.27	6.31	6.61	8.16	16.96	232.32
2009-10	22.59	32.37	35.71	34.84	23.59	11.04	5.59	0.00	0.00	7.49	14.96	22.12	210.31
Avg	**30.05**	**35.60**	**35.96**	**32.58**	**25.37**	**16.91**	**12.53**	**10.53**	**9.68**	**14.44**	**17.64**	**25.85**	**267.15**

1 MU = 1 Gwhr

Annexure 6.1: HYDRAULIC DESIGN OF DESILTING TANK

Design discharge for power generation	Q =	13.34	m3/s
Design discharge for desilting tank design	Q_d =	Q/.85	
		15.69	m3/s

Desilting tank consists of 2 desilting chambers

Design Discharge of each Chamber	Q_{td}=	Q_d/2	
		7.85	m3/s

Particle Size to be removed	d=	0.2	mm

Permissible flow through velocity, V_f, is taken as critical velocity according to T.R.camp

For 1mm > d > 0.1 mm,	a=	44	
Therefore,	V_f=	a*(√d)/100	
		0.197	m/s

Cross Sectional Area Required	A_{req}=	Q_{td}/V_f	
		39.88	m2

Assume,

Width of Tank	W=	5	m
Depth of Tank	D=	8	m

Therefore, Actual Flow Velocity	$V_{f/actual}$=	Q_{td}/(WD)	
		0.196	m/s

Using Van Rijn's equation for calculating settling velocity,

Specific Gravity	s=	2.65	
Kinematic Viscocity	ν=	1x 10^{-6}	
Acceleration due to Gravity	g=	9.81	m/s2
Diameter of the Particle	d=	0.0002	m

Fall velocity is given by the equation :

$$V_s = 10*\frac{\nu}{d}\left[\left(1+\frac{0.01(s-1)g.d^3}{\nu^2}\right)^{0.5}-1\right] = 0.026\text{m/s}$$

Moderated settling velocity

$$V_m = V_s - 0.132 * \frac{Vf/actual}{\sqrt{D}} = 0.017\text{m/s}$$

Settling length

$$L_s = V_{f/actual} * \frac{D}{Vm} = 94.657\text{m}$$

Provide length of the desilting chamber as 100 m.

As per above calculations the required dimensions of the desilting chamber are as given below;

Number of chambers in desilting tank = **2**

Length of the each chamber = **100 m**

Depth of the chamber = **8 m**

Width of the chamber = **5 m**

Annexure 9.9: Economical Diameter of Head Race Tunnel (HRT)

1 Purpose

1.1 To determine Economical Diameter Head Race Tunnel

2 Design Basis & Assumptions

Operating Levels

HWL	H1=	1959	m
TWL / Turbine CL	H2=	1514	m
Adopted HL for PPS	HL1=	13.37	m

Installed Capacity

Installed Capacity	IC=	51	MW
No. of Unit	NU=	2	
Max Load	Pmax=	100	%
Min. Load	Pmin=	0	%

Efficiency

Turbine Efficiency	ηt=	92	%
Generator Efficiency	ηg=	98	%
Combined Efficiency	η=	90.16	%
Factor	FC=	8.84	
Plant Availability		95	%

Head Loss in Penstock

Length of Pressure Shaft	L1=	874.2	m
Penstock Diameter	D1=	2	m
Coeff. Of friction in Penstock	f1=	0.01	

Head Loss in HRT

Shape		Modified Horse Shoe	
Coeff of friction in HRT	f2=	0.02	
Length of HRT	L2=	6624	m

HRT Data

Max. velocity in HRT	Vmax=	2.5	m/s

3 References

3.1 IS: 11639 (Pt.-1) - 1986

3.2 CERC notification on tariff

4 Computations

Gross Head	HG= H1 - H2	445.80	m
Adopted Net Head	Hn= HG - HL1	432.43	m
Approx. Discharge / Unit	QU= IC*1000/(NU*FC*Hn)	6.67	m3/s
Total Design Discharge	Q= NU*QU	13.34	m3/s
X-Sectional area of Penstock	At= f(D1,shape)	3.14	m2
Velocity through Penstock	Vt= Q/At	4.25	m/s
Head Loss in Penstock	HL= f1*L1*V1^2/(2gD1)	4.02	m
Min. HRT diameter due to limiting velocity		2.61	m

5 Results & Conclusions

The most economical HRT diameter is=	3.00 m	
For Adequate Velocity in tunnel, adopt D=	3.00 m	Modified Horse Shoe Shape