सत्यमेव जयते

जल वार्षिकी

WATER YEAR BOOK

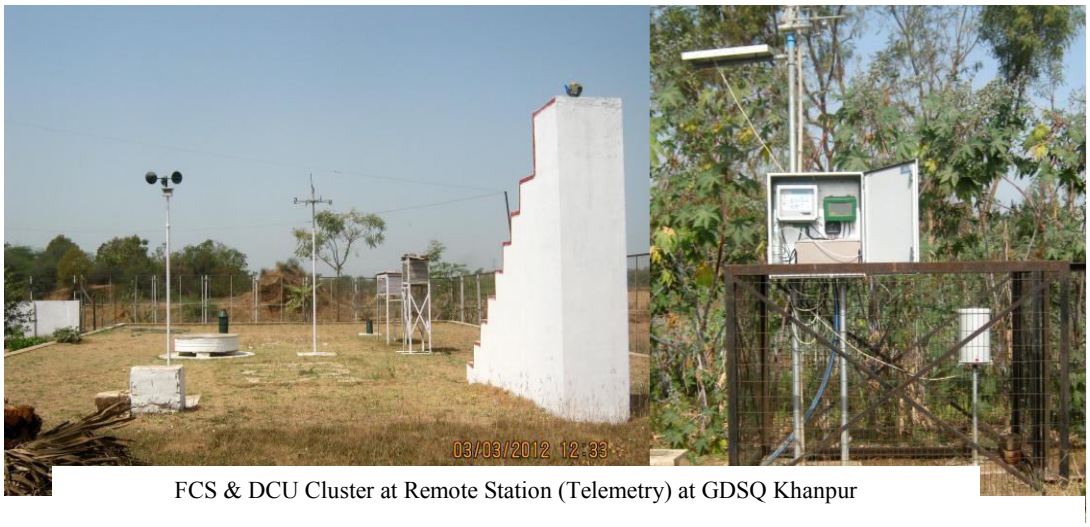
2015 – 16

माही, साबरमती एवं अन्य पश्चिम प्रवाही नदियाँ

(लूनी, बनास, शेत्रुन्जी, भादर, मच्छु, रूपेन और मच्छुंन्द्री)

MAHI, SABARMATI & OTHER WEST FLOWING RIVERS

(Luni, Banas, Shetrunji, Bhadar, Machhu, Rupen & Machhundri)



FCS & DCU Cluster at Remote Station (Telemetry) at GDSQ Khanpur

केन्द्रीय जल आयोग
नर्मदा व तापी बेसिन संगठन
जल विज्ञानीय प्रेक्षण परिमण्डल,
गाँधीनगर (गुजरात)

Central Water Commission,
Narmada & Tapi Basin Organization,
Hydrological Observation Circle,
Gandhinagar (Gujarat)

AUG, 2017

आमुख

राष्ट्रीय जल नीति में मानकीकृत राष्ट्रीय सूचना प्रणाली डेटा वेस और डेटा वैंकों के एक नेटवर्क के साथ गुणवत्ता के आँकड़े, उपलब्ध कराने और प्रसंस्करण क्षमताओं में सुधार के लिए मौजूदा केन्द्रीय और राज्य स्तरीय ऐजेन्सियों के एकीकरण की आवश्यकता पर वल दिया गया है। जल के वहु -उपयोगी स्वरूप एवं उसकी वढती, मांग को पूरा करने हेतु संसाधनों के अनुकूलतम नियोजन के संदर्भ में संवंधित आँकड़ों,का संकलन अतिमहत्वपूर्ण है।

केन्द्रीय जल आयोग, जल संसाधनों के विकास में संलग्न, भारत सरकार, जल संसाधन मंत्रालय के अन्तर्गत देश की एक शीर्षस्थ तकनीकी संस्था है जो जल विज्ञानीय आँकड़ों, के एकत्रीकरण से लेकर परियोजनाओं का मूल्यांकन, अभिकल्पन, प्रवोधन तथा परिचालन करती है।

जल विज्ञानीय प्रेक्षण परिमंडल गाँधीनगर, नर्मदा तापी वेसिन संगठन के अन्तर्गत केन्द्रीय जल आयोग की एक क्षेत्रीय ईकाई है जिसके अन्तर्गत गुजरात, मध्य प्रदेश, महाराष्ट्र, राजस्थान, दादरा नगर हवेली (केन्द्र शासित प्रदेश) एवं दमन तथा दीव (केन्द्र शासित प्रदेश) के भाग से होकर पश्चिम की ओर वहने वाली 17 नदी वेसिनों के अधिसूचित महत्वपूर्ण स्थलों पर जल के सतही प्रवाह के आँकडे, एकत्रित किए जाते हैं ।

माही मंडल गाँधीनगर द्वारा माही, साबरमती एवं अन्य पश्चिम प्रवाही नदियों, लूनी, वनास, शेत्रुन्जी, भादर, मच्छु, रूपेन एवं मच्छुंन्द्री पर, वर्तमान में, 23 स्थलों पर सतही प्रवाह का प्रेक्षण किया जा रहा है। इनके आँकड़े, इस वार्षिकी में संकलित किए गए हैं।

जल वर्ष 2005-06 से जल वार्षिकी का प्रकाशन, केन्द्रीय जल आयोग द्वारा निर्धारित स्वरूप (SWDES) में किया जा रहा है। इस वार्षिकी में सतही प्रवाह के आँकड़ों, के साथ - साथ वेसिन से संवंधित सूचनाएँ जैसे कि जलवायु, भूगर्भ विज्ञान, कृषि, भूमि, आदि भी दिये गए हैं।

इस वार्षिकी में दी गयी सूचना एवं संकलित आँकड़े, उन सभी के लिये उपयोगी होंगे जो जल संसाधन से संवंधित किसी भी क्षेत्र में रूचि रखते हैं, ऐसी आशा है। इसे और उपयोगी वनाने हेतु सुझाव आमंत्रित हैं।

वार्षिकी में प्रकाशित आँकड़ों के संकलन, विश्लेपण तथा प्रकाशन हेतु नर्मदा - तापी वेसिन संगठन के अधीनस्थ जल विज्ञानीय प्रेक्षण परिमंडल एवं माही मंण्डल गाँधीनगर के अधिकारियों एवं कर्मचारियों ने जिस समर्पण एवं लगन से कार्य संपादित किया है वह प्रशंसनीय है।

(विमल कुमार)
अधीक्षण अभियंता

गाँधीनगर (गुजरात)
अगस्त 2017

Preface

The National Water Policy stresses the need for a standardised national information system with a network of data base and data banks, integrating the existing Central and State agencies for providing quality data and improving the processing capabilities. Collection and compilation of data assumes greater importance in the context of optimal resource planning to meet the ever increasing demand for water in its multi-facetted use.

Central Water Commission is an apex organization of the country concerned with planned development and monitoring in water resources sector. CWC has for long been maintaining a Hydrological Observation & Flood forecasting network, which covers almost all the interstate rivers of India.

Hydrological Observation (HO) Circle, Gandhinagar, a field unit in Narmada Tapi Basin Organization of the Central Water Commission, is entrusted with the collection of surface water data (Hydrological Observation) of 17 river basins flowing through Gujarat, Madhya Pradesh, Maharashtra, Rajasthan, Daman & Diu (UT) and DNH (UT).

The Mahi Division, headquartered at Gandhinagar, under HO Circle, is at present, carrying out hydrological observations at 23 sites on river Mahi, Sabarmati & other west flowing rivers viz. Luni, Banas, Shetrunji, Machhu, Rupen, Bhadar and Machhundri, which have been compiled in this Water Year Book. It also includes trend analysis of annual surface runoff for these basins.

The publication of Water Year Book in SWDES format has been started since the water year 2005-06 as per guidelines issued by Central Water Commission, New Delhi. This Year Book not only provides the hydrological data but also provides general information about geology, climate, agriculture, soil, cities/towns, major and medium projects in the basin, etc. It also includes trend analysis of annual surface runoff for these basins.

It is hoped that the information and data compiled herein will be useful to all those concerned with any field related with water resources of the country. Comments and suggestions, if any, on the Water Year Book are most welcome. The efforts put in by all the concerned officers and staffs of Mahi Division and Hydrological Observation Circle, Gandhinagar under NTBO, Central Water Commission is gratefully acknowledged.

Vimal

Gandhinagar
August, 2017

(Vimal Kumar)
Superintending Engineer

C o n t e n t s

List of plates and Figures

Abbreviations and symbols

Av	:	Average
Ann	:	Annual
A.G.R.	:	Automatic Gauge Recorder
C	:	Centigrate
Cum	:	Cubic meter
Cumec	:	Cubic meter per second
c/s	:	Cross section
C.W.C.	:	Central Water Commission
D	:	Days
Dis	:	Discharge
F	:	Float Observation
F.F.	:	Flood Forecasting
G	:	Gauge
GD	:	Gauge and Discharge
GDS	:	Gauge, Discharge and Sediment
GDWQ	:	Gauge, Discharge and Water Quality
GDSWQ	:	Gauge, Discharge, Sediment and Water Quality
GTS	:	Great Trigonometrical Survey
hRs.	:	HouRs
IWYB	:	Integrated Water Year Book
WYB	:	Water Year Book
km	:	Kilo meter
M	:	Million
m	:	Meter
mm	:	milli meter
m^3/s	:	Cubic meter per second

Mm3 / MCM	:	Million Cubic meter
Max.	:	Maximum
Min.	:	Minimum
m.s.l.	:	Mean sea level
MDN	:	Mahi Division, CWC, Gandhinagar
neg.	:	Negligible
NNW	:	National Net Work
R.L.	:	Reduced Level
R.D.	:	Reduced Distance
R.Days	:	Remaining days
R.C.C.	:	Reinforced Cement Concrete
sq km	:	Square Kilometer
TDN	:	Tapi Division, CWC, Surat
WQ	:	Water Quality
W.L.	:	Water Level
W.Year	:	Water Year
WDN	:	Water Resources Investigation Division, Ahmedabad
WRI Circle	:	Water Resources Investigation Circle
80 Key	:	80 Key Hydrological Station Scheme
163 Key	:	163 Key Hydrological Station Scheme
^{0}, ‘ . “	:	Degree (30^{0}) Minutes(56’) Seconds (35”)
*	:	Estimated Discharge
#	:	Discarded and estimated discharge

1.0 I n t r o d u c t i o n

1.1 General

Central Water commission is conducting hydrological observations on major west flowing River Basins under various schemes viz national network, 80-key stations, 163- key stations , 2701 DWRIS Plan and flood forecasting. This water year book presents the data of 23 hydrological observation stations for the water year 2015-16 in Mahi, Sabarmati, Luni, Banas, Shetrunji, Bhadar, Machhu and Rupen basins. The data of 23 sites which are included in this book are collected by Mahi division, Central Water Commission, Gandhinagar under Hydrological Observation Circle, Gandhinagar. Jurisdiction map of Mahi division, CWC, Gandhinagar is enclosed at **Plate-1**.

The schemwise distribution of sites is shown in the following table.

Schemewise distribution of sites

National net work					
Sr.no.	Site	River	Basin	Code	Type
1	Mataji	Mahi	Mahi	01 02 13 001	GDSWQ
2	Kamalpur	Banas	Banas	01 02 02 007	GDSWQ
3	Lowara	Shetrunji	Shetrunji	01 02 09 001	GDSWQ
4	Ganod	Bhadar	Bhadar	01 02 07 001	GDSWQ
5	Gungan	Machhu	Machhu	01 02 03 001	GD
6	Gandhav	Luni	Luni	01 02 01 002	GD
80 key hydrological stations					
Sr.no.	Site	River	Basin	Code	Type
1	Rangeli	Som	Mahi	01 02 13 005	GDWQ
2	Khanpur	Mahi	Mahi	01 02 13 012	GDSWQ
3	Paderdibadi	Mahi	Mahi	01 02 13 006	GDSWQ

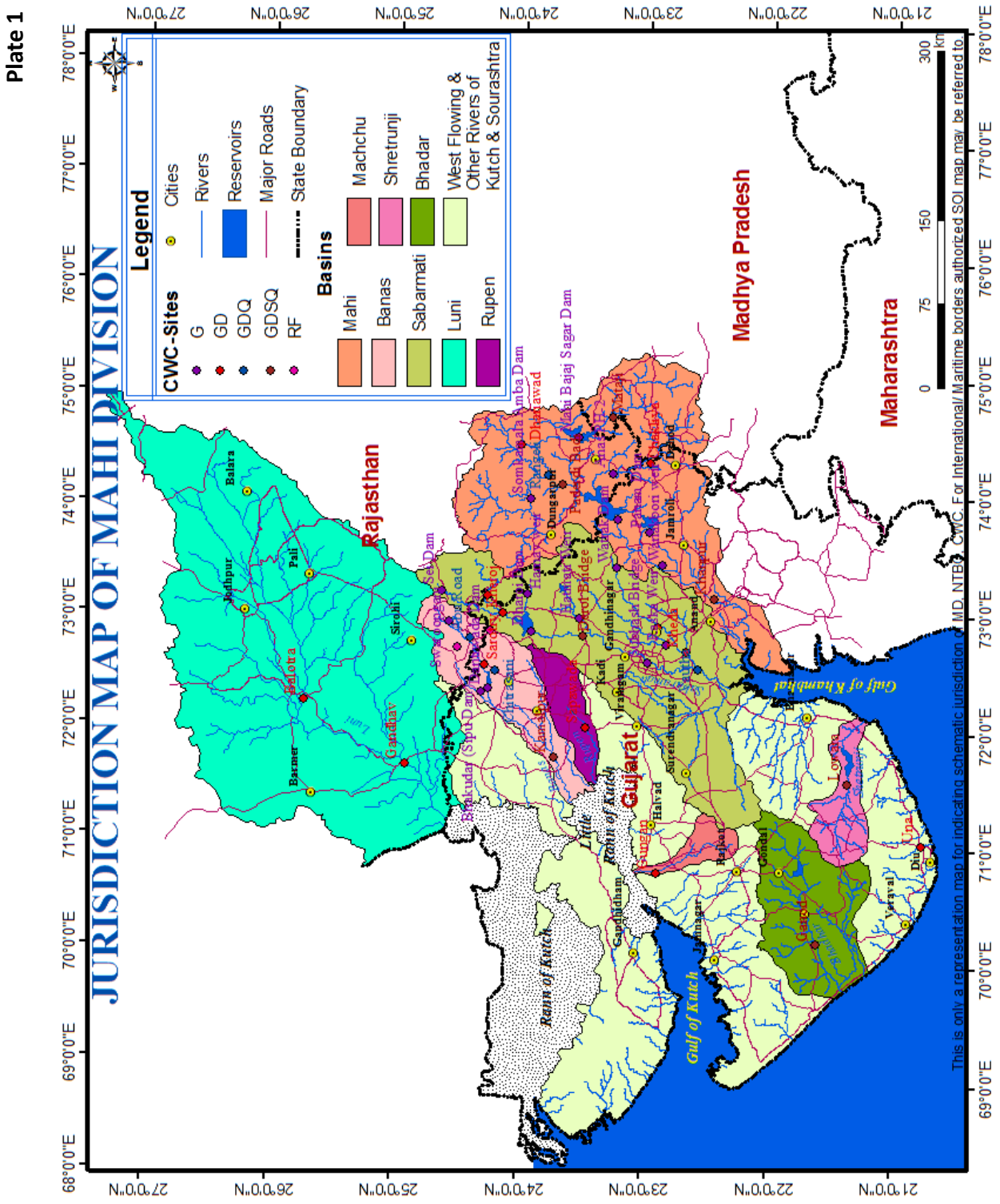
Flood forecasting

Sr.no.	Site	River	Basin	Code	Type
1	Dhariwad	Jakham	Mahi	01 02 13 004	GD
2	Kheda	Watrak	Sabarmati	01 02 12 012	GD
3	Ratanpur	Watrak	Sabarmati	01 02 12 010	GD
4	Kheroj	Sabarmati	Sabarmati	01 02 12 003	GD
5	Jotasan	Wakal	Sabarmati	01 02 12 001	GD
6	Derol Bridge	Sabarmati	Sabarmati	01 02 12 006	GDSWQ
7	Chitrasani	Balaram	Banas	01 02 02 004	GDWQ
8	Sarotry	Banas	Banas	01 02 02 003	GD
9	Abu road	Banas	Banas	01 02 02 002	GDWQ

163 key hydrological stations

Sr.no.	Site	River	Basin	Code	Type
1	Chakaliya	Anas	Mahi	01 02 13 007	GD
2	Balotra	Luni	Luni	01 02 01 001	GD
3	Sapawada	Rupen	Rupen	01 02 04 001	GD
4	Vautha	Sabarmati	Sabarmati	0102 12 013	GDWQ
2701 DWRIS					
1	Una	Machhundri	Machhundri	01 02 14 001	GD

Plate 1


JURISDICTION MAP OF MAHI DIVISION
Legend
Cities
Rivers
Reservoirs
Major Roads
State Boundary
CWC-Sites
G
GD
GDQ
GDSQ
RF
Basins
Mahi
Banas
Sabarmati
Luni
Rupen
Machchu
Shretrunji
Bhadar
West Flowing & Other Rivers of Kutch & Sourashtra
Rajasthan
Madhya Pradesh
Maharashtra
Gujarat
Rann of Kutch
Little Rann of Kutch
Gulf of Kutch
Gulf of Khambhat
Arabian Sea
Jodhpur
Pali
Balotra
Barmer
Sirohi
Gandhinagar
Kheda
Anand
Dungarpur
Jamnagar
Rajkot
Surendranagar
Junagadh
Porbandar
Veraval
Diu
Una
Gondal
Jetpur
Dhoraji
Bhavnagar
Mahuva
Sihor
Talaja
Palitana
Amreli
Savarkundla
Dhari
Lathi
Chotila
Dhrangadhra
Wankaner
Morbi
Halvad
Gandhidham
Bhuj
Mandvi
Mundra
Rapar
Lunawada
Godhra
Dahod
Jhalod
Limkheda
Devgadh Baria
Chhota Udaipur
Sankheda
Vadodara
Padra
Karjan
Jambusar
Amod
Ankleshwar
Bharuch
Vagra
Jhagadia
Dediapada
Valia
Nandod
Rajpipla
Sagbara
Mahuva
Songadh
Vyara
Kukarmunda
Valsad
Pardi
Umbergaon
Dharampur
Kaprada
Chikhli
Navsari
Jalalpur
Gandevi
Bansda
Khergam
Wansda
Mahi
Banas
Sabarmati
Luni
Rupen
Machchu
Shretrunji
Bhadar
West Flowing & Other Rivers of Kutch & Sourashtra
Kadana
Panam
Dharoi
Ukai
Kakrapar
Hathmati
Vatrak
Meshwo
Mazum
Sukhi
Harsol
Sabarmati
Wasna Barrage
Vanakbori
Kadana
Somasila
Mukteshwar
Kankroli
Rajsamand
Gomti
Jaisamand
Udaisagar
Sisarma
Bansi
Som Kamla Amba Dam
Mahi Bajaj Sagar Dam
Panam
Hathmati
Meshwo
Mazum
Sukhi
Harsol
Vatrak
Sabarmati
Wasna Barrage
Vanakbori
Kadana
Somasila
Mukteshwar
Kankroli
Rajsamand
Gomti
Jaisamand
Udaisagar
Sisarma
Bansi
Mahi
Banas
Sabarmati
Luni
Rupen
Machchu
Shretrunji
Bhadar
West Flowing & Other Rivers of Kutch & Sourashtra
0
75
150
300
km
This is only a representation map for indicating schematic jurisdiction of MD, NTBs. CWC. For International/ Maritime borders authorized SOI map may be referred to.

2.0 Description of Various Basins

2.1 Mahi Basin

2.1.1 Geographical description of the Basin

Mahi River is one of the major west flowing inter-state River of India, draining into the gulf of Khambhat. The basin is bound on the north and the north - west by Aravalli hills, on the east by the ridge separating it from the Chambal Basin, on the south by the Vindhyas and on the west by the Gulf of Khambhat. Mahi River originates on the northern slope of Vindhyas at latitude 22^0 35'N and longitude 74^0 58'E near the village of Sardarpur in the Dhar district of Madhya Pradesh at an elevation of 500 m above m.s.l. It has a total length of 583 km and it traverses through the States of Madhya Pradesh, Rajasthan and Gujarat. Total drainage area of Mahi is 34,842 sqkm. Basin map of Mahi basin is enclosed as **Plate -2.1.1**

The State wise distribution of the drainage area is shown in the following table.

Sl.No.	Name of state	River length (km)	Drainage area (sqkm)	Percentage of total
1	Madhya Pradesh	167	6695	19.22
2	Rajasthan	174	16453	47.22
3	Gujarat	242	11694	33.56
	Total	583	34842	100.00

2.1 .2 Description of River system

Initially the river flows northwards through Dhar and Jhabua districts of M.P., then turns left and passes through Ratlam district of M.P. Subsequently turning to north - west, it enters the Banswara district of Rajasthan and flows in south - west directions and thereafter enters the Panchmahal district of Gujarat. Then the river continuously flows in the same direction through Kheda district of Gujarat and finally falls into the Gulf of Khambhat in Arabian sea.

This river receives several tributaries on both the banks, out of which the main tributaries are Som, Anas and Panam.

Som

This is a right bank tributary of Mahi. Som River rises near Som on the eastern slopes of the Aravalli hills in the Udaipur district of Rajasthan at an elevation of 600 m above m.s.l. And

flows in the eastern direction to join the main River Mahi on the right bank 6.3 km upstream of Paderdibadi site in Dungarpur district of Rajasthan. Its total length is about 155 km. The total drainage area of Som is 8707 sqkm Gomti & Jakham are the major right bank sub tributaries of Som.

Anas

This is a left bank tributary of Mahi. Anas River rises near Kalmora on the northern slopes of Vindhyas in Jhabua district in Madhya Pradesh at an elevation of 450 m above m.s.l. And flows in the north - west direction and joins the main River Mahi on left bank in the Dungarpur district in Rajasthan. It has a total length of about 156 km and the total drainage area of 5604 sqkm.

Panam

This is a left bank tributary of Mahi. Panam River rises near Bhadra on northern slopes of the Vindhyas near Jhabua district in Madhya Pradesh at an elevation of about 300 m above m.s.l. And flows in the north - west direction and joins the main River on the left bank in the Panchmahal district of Gujarat. It has a total length of about 127 km and drainage area of about 2470 sqkm.

A line diagram of river system giving information of Mahi basin and its tributaries and sub tributaries etc. indicating location of major structures is enclosed as **Plate -2.1.2.**

2.1.3 Cimatic characterstics

The Mahi Basin experiences 3 marked seasons – Summer (March-May), Monsoon (June-Sep) & Winter (Oct-Feb). From the available data & record, the basin contains two climatic regions, the northern part of the Basin comprises sub tropical wet climate (generally Basin area occupied by Rajasthan). The major part of Basin comprises tropical wet climate, caused mainly due to existence of Vindhyas & the Western ghats. Due to relatively high elevation in forest land, the area of the basin near the origin of the River experiences relatively cooler & moderate rainfall climate which gradually changes to warm & dry climate as the River flows northwards entering into & flowing through Rajasthan. After the River bends south westwards and enters Gujarat the climate gradually changes towards tropical wet climate again.

Temperature (°c) during year 2015-16

Year	Chakaliya		Mataji		Khanpur		Paderdibadi		Dharaiwad	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
2015-16	47	10	47	4	45	7	48	5	45	16

2.1.4 Rainfall

The average rainfall in the Mahi Basin is 785 mm. The Southwest Monsoon sets in by the middle of June and withdraws by the first week of October. About 90 percent of total rainfall is received during the Monsoon months of which 50 percent is received during July and August. Rainfall is mainly influenced by the Southwest Monsoon. The effect is most pronounced in Vadodara lying on the windward side of the Western Ghats. Ratlam also receives similar rainfall, lying between the Arravalli and hill ranges north of Westernghats. Monsoon contributes nearly 91-94% of annual precipitation in Vadodara & Ratlam respectively.

Mean annual rainfall in mm Mahi Basin CWC sites

Name of site	Data available (No of years)	Average rainfall (mm)	Average no. of rainy days	Cum. Rainfall during water year 2015-16	Cum. No of rainy days 2015-16
Chakaliya	25	752	28	298.2	19.0
Mataji	27	878	42	699.2	37
Khanpur	27	951	39	368	22
Paderdibadi	31	733	36	598.4	28
Dharaiwad	27	825	53	684	49
Rangeli	16	742	31	495	23
Mahi dam	14	967	38	725.7	23
Som kamla amba dam	14	741	31	669	25
Kadana dam	15	887	37	680	31
Anas ph-2	14	737	28	682.0	26
Panam dam	14	964	39	632	29
Wanakbori weir	14	1003	39	740.7	22

2.1.5 Wind

Average wind speed is the lowest in Udaipur & the highest in Dahod. In general, wind speed is the lowest in post Monsoon period (Oct-Nov) & the highest in June. The predominant wind direction is from West in Ratlam & Dahod from Northwest in Udaipur and Southwest in Vadodara. The wind direction remains uniform from post Monsoon till early winter i.e. Oct – Feb. Change of direction takes place in March/April. In Ratlam, Vadodara & Dahod the dominant wind direction is from Northeast and East respectively during post Monsoon and in winter changes to westerly and south westerly. In Udaipur, the post Monsoon and winter wind direction is from North & North West which changes to South-westerly & Westerly during the remaining part of the year.

2.1.6 Geology

Hydro geologically the River Basin is categorised by two distinct units

1. **Consolidated formation**

This hydro geological unit is mainly dominated by basaltic lava flows associated with inter trappean, infratrappean and Archean rock formation represented by phyllites, gneisses, quartzite & granites. MP, Rajasthan & North eastern parts of Gujarat are mainly underlain by consolidated rocks.

2. Unconsolidated formation

Ground water occures under water table and unconfined condition in the bed of sand, kankar & gravel that constitutes the alluvial aquifers occurred as discontinuous beds of varying thickness in hard rocks- terrain in the north & northeastern part of Basin.

The valley-fills that are having good ground water potential are quite prominent and significant in the hard rock areas in the district of Jhabua, Chittorgarh, Udaipur, Banswara & Panchmahal. The southern part of the Basin is occupied by quaternary, post Miocene and tertiary sediment deposited over a sinking basement between two major structurally controlled lineaments.

2.1.7 Description of the water storage / diversion structures

At present, there are 15 completed major/medium irrigation/multi purpose projects in Mahi Basin.

List of existing projects (State irrigation) in Mahi Basin

Sl. No	Name of project	River	Storage capacity (Mm3)		Purpose
			Gross	Live	
1	Mahi bajaj sagar	Mahi	2180	1712	Multi-purpose
2	Kadana	Mahi	1542	1203	Multi-purpose
3	Panam	Panam	735.8	679.2	Irrigation \ water supply
4	Jakham	Jakham	141.9	131.6	Irrigation
5	Machhan nalla	Machhan	37.91	29.16	Irrigation
6	Wanakbori weir	Mahi	41.884	36.224	Irrigation
7	Jaisamand	Gomti	414.6	296.1	Irrigation flood control
8	Hadaf	Hadaf	32.26	25.02	Irrigation
9	Kabutary	Kabutary	9.58	8.07	Irrigation
10	Bhadar	Bhadar	46.72	40.06	Irrigation
11	Umaria	Hadaf	13.53	11.67	Irrigation
12	Edalwada	Naleshvar	11.33	10.50	Irrigation
13	Nagalia weir	Jakham	-	-	Irrigation
14	Karmai weir	Karmai	-	-	Irrigation
15	Somkamala amba	Som	126.06	125.83	Irrigation
16	Labriya Dam	Mahi	199.07	135	Irrigation

Salient features of major/important projects viz Mahi Bajaj Sagar, Kadana reservoir, Wanakbori weir & Panam reservoir are as follows.

Mahi Bajaj Sagar project

This project is located across River Mahi near village Barekhera about 16 km Northeast of Banswara town in Rajasthan. It has a catchment area of 6149 sqkm. The project comprises of a composite dam of earth fill and masonry having crest length of about 2800 m, having spillway length of 300 m in the River gorge. The maximum height of the earthen dam is 43 m

and masonry dam is 65.5 m. The live storage capacity of reservoir is 1712 Mm3. The benefits of this project are irrigation, hydropower generation, fisheries and water supply.

Kadana reservoir project

Kadana dam is located in gorge cut by Mahi River through a low range of hills in Dahod of Gujarat just near the border with Rajasthan. The catchment area up to this project is 25,520 sqkm and catchment area intercepted at Banswara in Rajasthan is 6149 sqkm. The dam is composite earth fill and masonry gravity structure rising 58 m above the stream bed with the top length of dam about 1551 m with main spillway of 406 m in River gorge portion and 113 m long additional spillway in right bank. The effective storage capacity of Kadana reservoir is 1203 Mm3. The benefits of this project include irrigation facilities for 12795 ha and hydro - power generation by installation of 4 nos reversible turbines of capacity 60 MW each, with a total capacity of 240 MW. The total estimated cost of this project is Rs.101.86 crores, out of which Rs.49 crores are for hydro power generation.

Wanakbori weir

The weir is constructed across River Mahi near Wanakbori village, Balasinnor tehsil of district Kheda in Gujarat. The weir is also known as Mahi stage-I project. The catchment area up to this project is 30,665 Sqkm.The length at the top of dam is 796 m and maximum height above lowest point of Foundation is 25 m. It has an ogee type spillway of 735 m length. The effective storage capacity of this composite dam is 36.24 Mm^3. The benefit of this project is irrigation for 3, 15,790 ha. The cost of the project is Rs.46.53 crores. The storage capacity of dam is increased to RL 69.240 m by providing 33 nos fuse gates, which will not result in any increase of HFL.

Panam project

The project is located in village Keldezar of tehsil Santrampur in Dahod district of Gujarat across river Panam, a tributary of river Mahi. The length at the top of masonry dam functioning as ogee spillway is 182 m and maximum height above the lowest point of foundation is 56.36 m. It has a catchment area of 2314 sqkm.The live storage capacity of the reservoir is 679.2 Mm^3. The purpose of this project is irrigation for 58,273 ha, water supply, power generation and fisheries. The total estimated cost of the project is Rs.5989.5 lakhs.

2.1.8 Streamflow data

Hydrological observation by CWC

In Mahi Basin, CWC is conducting hydrological observations at 6 sites. Detailed salient features and the availability of data of these gauge and discharge observation sites are given in following tables.

Salient features of sites maintained by CWC in Mahi Basin

Sl.no	Name of site	Station code	Scheme	Type
1.	Mahi at Mataji	01 02 13 001	NNW	GDSWQ
2.	Jakham at Dhariwad	01 02 13 004	F F	GD
3.	Som at Rangeli	01 02 13 005	80 key	GDWQ
4.	Mahi at Paderdibadi	01 02 13 006	80 key	GDSWQ
5.	Anas at Chakaliya	01 02 13 007	163 key	GD
6.	Mahi at Khanpur	01 02 13 012	80 key	GDSWQ

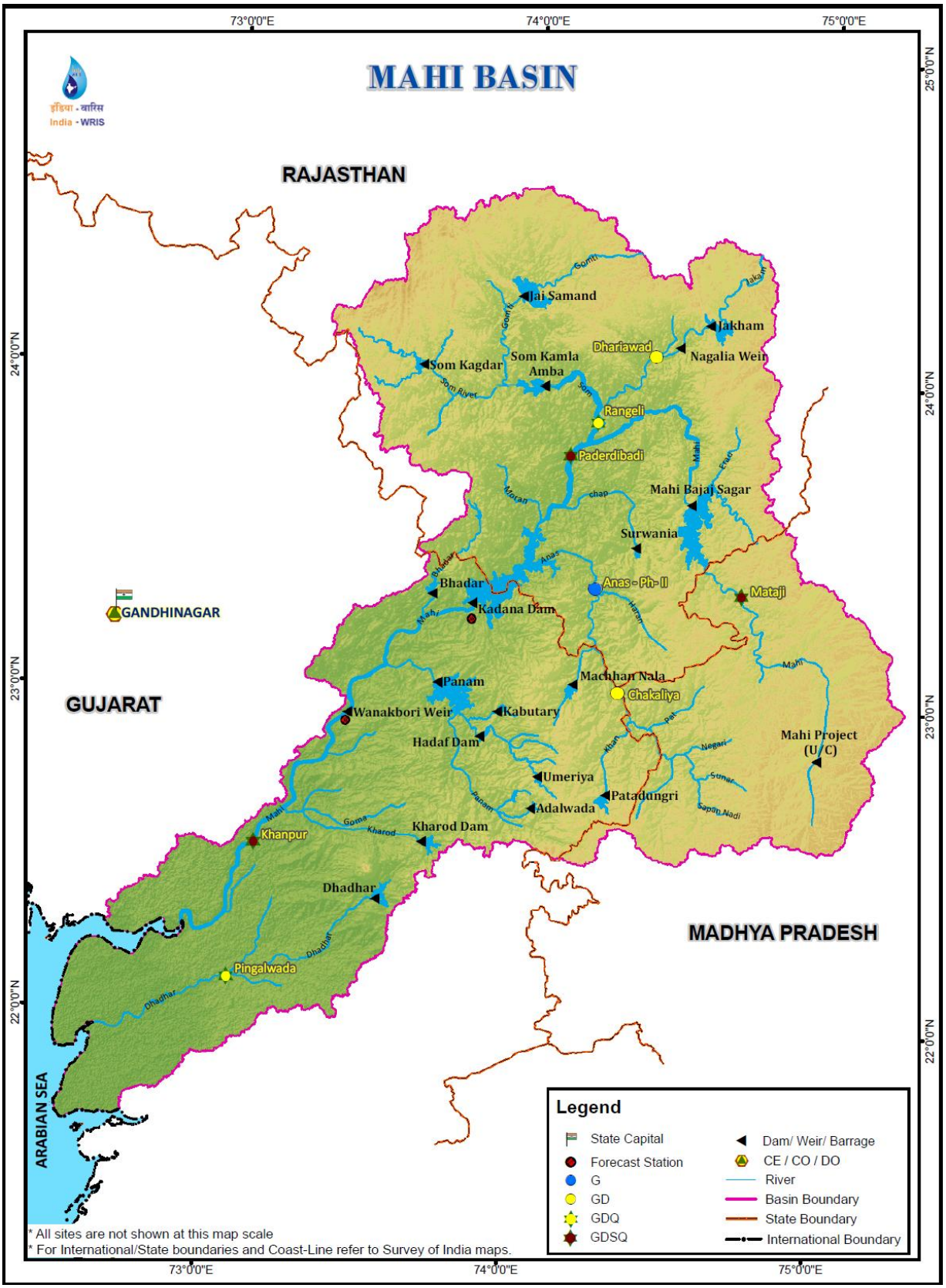
Location name	Local River	Lat. D M S	Long. D M S	Stn. Parameters				Type of gauge	Mode of Discharge Measurement
				Met	Hydro	WQ	Silt Lab		
Mataji	Mahi	23 20 57	74 43 31	SRG	GDS	WQ	Silt lab	Staff G	Wading, bridge, boat, float
Mahi dam	Mahi	23 37 43	74 32 50	SRG	G			Staff G	Dam site
Rangeli	Som	23 52 22	74 13 25	SRG	GD	WQ		Staff G	Wading, bridge, float

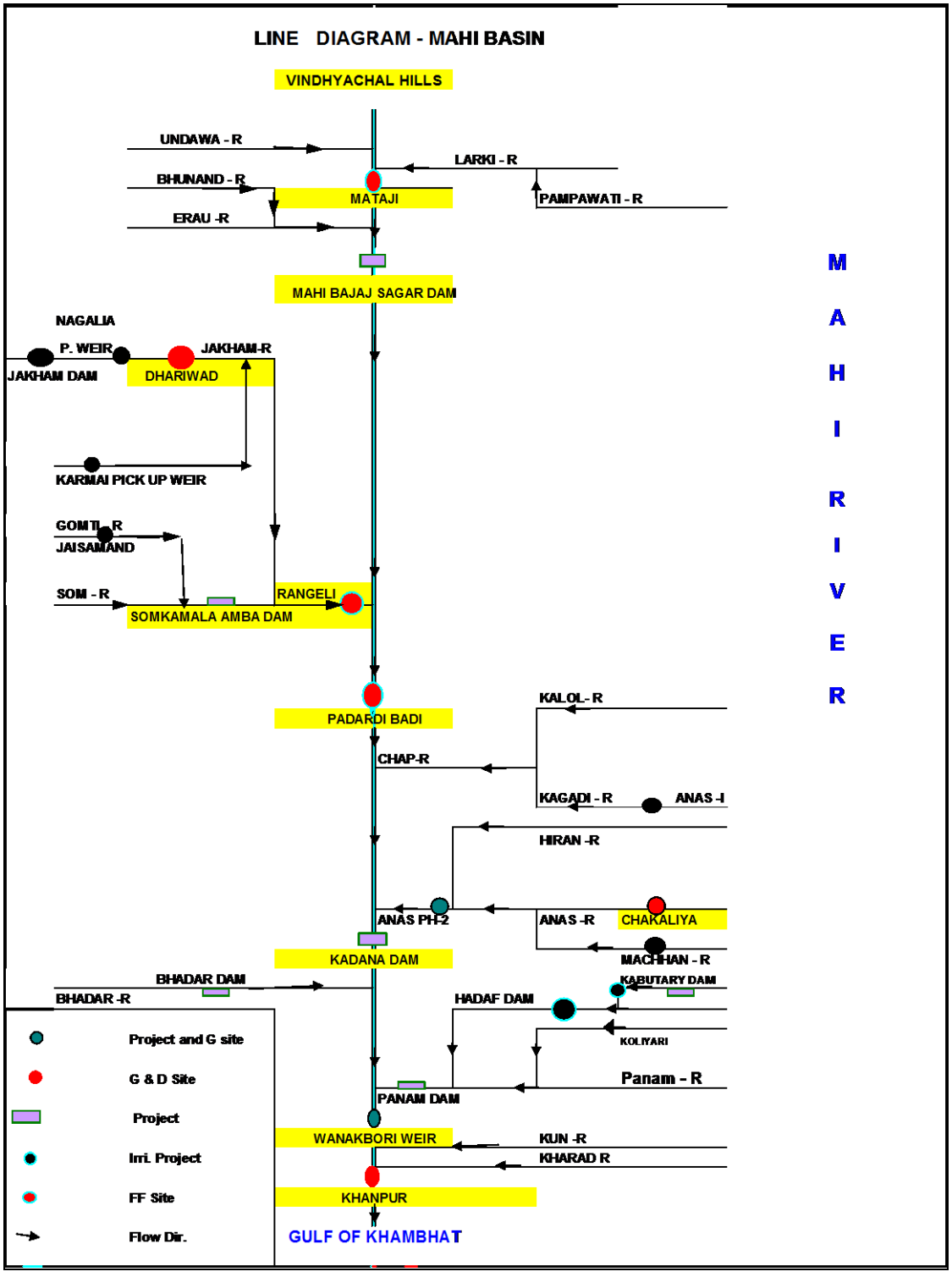
Som kamala amba dam	Som	23 58 36	74 02 00	SRG	G			Staff G	Dam site
Dhariwad	Jakham	24 04 43	74 28 02	SRG	GD			Staff G	Wading, bridge, float
Paderdibadi	Mahi	23 46 03	74 08 12	SRG	GDS	WQ	Silt lab	Staff G	Wading, boat, OBE, float
Chakaliya	Anas	23 02 58	74 19 14	SRG	GD			Staff G	Wading,bridge, float
Anas Ph-2	Anas	23 21 11	74 14 07	SRG	G			Steps	Converted to gauge site only.made seasonal site w.e.f.2002
Kadana dam	Mahi	23 18 16	73 49 31	SRG	G			Staff G	Dam site and ff stn
Panam dam	Panam	23 03 14	73 43 00	SRG	G			Staff G	Dam site
Wanak bori weir	Mahi	22 56 51	73 25 46	SRG	G			Staff G	FF stn
Khanpur	Mahi	22 31 55	73 08 27	FCS	GDS	WQ	Silt lab	Staff G	Wading, float, boat

2.1.9 Data availability

S No.	Site name	Rain Fall	Discharge	Thrice daily water Level	Hourly water level (for Monsoon period only)	Sediment	Water quality
1	Mahi at Mataji GDSWQ	June‘89	July‘82	July ‘82	July ‘82	July‘82	July‘82
2	Jakham at Dhariwad GD	June‘89	June‘84	July ‘84	July‘84	NA	NA
3	Som at Rangeli GDQ	Jan’99	July‘88	July ‘78	July‘78	NA	July ‘88

4	Anas at Chakaliya GD	July‘91	Feb‘91	Feb ‘91	June‘91	NA	NA
5	Mahi at Paderdibadi GDSWQ	Aug‘85	June‘78	Sept‘77	Sept‘77	July ‘80	July‘78
6	Mahi at Khanpur GDSWQ	June‘88	June’88	Dec ‘78	June’79	June ‘87	Jan‘79
7	Som at Som-kamala-amba dam G	Jan’95	---	Jan’95	Jan’95	---	--
8	Anas at Anas ph-2 (seasonal) G	Jun’91	---	Jun’82	Jun’85	--	--
9	Mahi at Kadana dam G	--	--	Jun’78	Jun’78	---	---
10	Panam at Panam dam G	--	--	Jun’80	Jun’80	--	--
11	Mahi at wanak bori weir G	--	--	Jun’79	Jun’79	--	--
12	Mahi at Mahi Bajaj Sagar Dam G	--	--	Jun’82	Jun’82	--	--


MAHI BASIN
इंडिया - वारिस
India - WRIS
RAJASTHAN
GUJARAT
MADHYA PRADESH
GANDHINAGAR
ARABIAN SEA
73°0'0"E
74°0'0"E
75°0'0"E
25°0'0"N
24°0'0"N
23°0'0"N
22°0'0"N
Jai Samand
Jakham
Nagalia Weir
Dhariawad
Som Kagdar
Som Kamla Amba
Som River
Rangeli
Paderdibadi
Mahi Bajaj Sagar
Surwania
Bhadar
Kadana Dam
Anas - Ph- II
Mataji
Panam
Wanakbori Weir
Kabutary
Machhan Nala
Chakaliya
Hadaf Dam
Umeriya
Patadungri
Adalwada
Mahi Project (U/C)
Khanpur
Kharod Dam
Dhadhar
Pingalwada
Legend
State Capital
Forecast Station
G
GD
GDQ
GDSQ
Dam/ Weir/ Barrage
CE / CO / DO
River
Basin Boundary
State Boundary
International Boundary
* All sites are not shown at this map scale
* For International/State boundaries and Coast-Line refer to Survey of India maps.


LINE DIAGRAM - MAHI BASIN
VINDHYACHAL HILLS
UNDAWA - R
LARKI - R
BHUNAND - R
MATAJI
PAMPAWATI - R
ERAU -R
MAHI BAJAJ SAGAR DAM
NAGALIA
P. WEIR
JAKHAM-R
JAKHAM DAM
DHARIWAD
KARMAI PICK UP WEIR
GOMTI - R
JAISAMAND
SOM - R
RANGELI
SOMKAMALA AMBA DAM
PADARDI BADI
KALOL - R
CHAP-R
KAGADI - R
ANAS -I
HIRAN -R
ANAS PH-2
ANAS -R
CHAKALIYA
MACHHAN - R
KADANA DAM
BHADAR DAM
BHADAR -R
KABUTARY DAM
HADAF DAM
KOLIYARI
Panam - R
PANAM DAM
WANAKBORI WEIR
KUN -R
KHARAD R
KHANPUR
GULF OF KHAMBHAT
Project and G site
G & D Site
Project
Irri. Project
FF Site
Flow Dir.
M A H I R I V E R

2.2 Sabarmati Basin

2.2.1 Geographical description of the Basin

Sabarmati river is one of the major west flowing inter-state rivers in India, draining into the Gulf of Khambhat. The Basin is bounded by Aravalli hills in the North and Northeast, by ridge separating it from basins of minor streams and draining into Rann of Kutch and Gulf of Khambhat in west and by Gulf of Khambhat in the South. It is triangular in shape with the main river as the base and the source of the Watrak as the apex point. It originates in the Aravalli hills at latitude 24^0 40'N and longitude 73^0 20'E in Rajasthan state at an elevation of 762 m above m.s.l. The Sabarmati river has a length of 371 km and the drainage area is of 21674 sq km. Basin map of Sabarmati basin is enclosed as **Plate -2.2.1**. The State wise distribution is shown below.

Sl.no.	Name of State	River length (km)	Drainage area (sq.km)	Percentage of total
1	Rajasthan	48	4124	19
2	Gujarat	323	17550	81
	Total	371	21674	100

2.2.2 Description of River system

The Sabarmati river with its origin in Rajasthan, flows generally in South – West direction. It enters in Gujarat state and passes through the plains and continues to flow in the same direction and joins the Gulf of Khambhat in the Arabian sea at the 51 km of its run, the river is joined by the Wakal on the left bank near village Ghanpankari. Flowing generally in the South – West direction at 67^{th} km of its run, it receives the Sei on the right bank near Mahauri and then the Harnav on the left bank at about 103 km. From respective sources beyond this confluence, Sabarmati flows through the Dharoil gorge. Emerging from the gorge it passes through the plains and is joined on its left bank at about 170 km from its source by the Hathmati, which is its major tributary. Continuing to flow in South – West direction, the River passes through Ahmedabad and about 65 km down stream, another major tributary, Watrak joins its on the left bank, flowing for a further distance of 68 km, the River outfalls in the Gulf of Khambhat in Arabian sea.

Description of tributaries

Sei

This is a right bank tributary of Sabarmati river. It rises in the Aravalli hills in Rajasthan and flows in south – west direction for a total distance of 95 km before it joins on its right bank. It drains an area of 946 sq km.

Wakal

This is a left bank tributary of Sabarmati River. It rises in the Aravalli hills in Rajasthan and flows in south – west direction for a total length of 88 km. It joins Sabarmati on its left bank. It drains an area of 1625 sq km. The menas is its main tributary.

Harnav

This is a left bank tributary of Sabarmati River. It rises in the northern portion of the Kulalia hills of Rajasthan ranges and flows in south – west direction for a total distance of 75 km. Harnav joins the left bank of Sabarmati. It drains an area of 972 sq km.

Hathmati

This is a left bank tributary of Sabarmati River this is a left bank tributary of Sabarmati River it rises in southwest foot hills of Rajasthan range in Gujarat state and flows in south west direction for a distance of 122 km to meet the Sabarmati on its left bank.this tributary drains an area of 1526 sq km.

Watrak

This is a left bank tributary of Sabarmati River it rises in panchara hills in Dungarpur district of Rajasthan and flows in southwest direction for a distance of 248 km and joins Sabarmati on the left bank.Watrak and its tributaries drain an area of 8638 sq km.

A line diagram of river system, giving information of Sabarmati Basin, its tributaries and sub tributaries etc. indicating the location of major structures is enclosed as **Plate -2.2.2.**

2.2.3 Climatic characterstics

The Sabarmati Basin experiences 3 marked seasons – summer (March-May), Monsoon (June-Sep) & winter (Oct-Feb). From the available data & record, the Basin contains two climatic regions, the northern part of the Basin comprises sub tropical wet climate (generally Basin area occupied by Gujarat). The major part of Basin comprises tropical wet climate causes mainly

due to existence of Aravalli & the Western ghats. The climate varies from arid in the Saurastra area to semi –arid in north Gujarat to humid in coastal areas.

Temperature (°c) during year 2015-16

Year	Jotasan		Kheroj		Derol bridge		Ratanpur		Kheda		Voutha	
2015-16	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
	46	3	44	6	42	10	48	8	42	17	43	17

2.2.4 Rainfall

Rainfall varies from a meager few mm in Saurastra to over 1000 mm in southern part. The average annual rainfall in the Sabarmati Basin is about 787.5 mm the south - west Monsoon sets in by middle of June and withdraws by the first week of October. The rainfall is mainly influenced by the southwest Monsoon.

Mean annual rainfall in mm Sabarmati Basin CWC sites

Name of site	Data available (No of years)	Average rainfall (mm)	Average no. of rainy days	Rainfall during water year 2015-16	No of rainy days 2015-16
Jotasan	20	731	42	1132.6	32
Kheroj	27	724	49	1055.4	30
Derol Bridge	27	752	44	658.8	27
Watrak dam	29	848	35	748.6	22
Raskaweir	30	642	34	660	16
Ratanpur	24	807	39	526	18
Kheda	31	745	36	420.2	19
Sei dam	15	777	46	1113.4	31
Dharoi dam	15	804	29	1026	32
Himatnagar	15	878	39	765.6	22
Voutha	8	768	32	354.8	17
Subhash bridge	7	862	33	363.4	24

2.2.5 Wind

Average wind speed is the lowest in Udaipur & higher in Ahmedabad district. In general, wind speeds are taken to be moderate over most of the months.

2.2.6 Geology

Hydro geologically the River Basin is categorised by two distinct units

1. Consolidated formation

This hydro geological unit is mainly dominated by basaltic lava flows associated with inter trappean, infratrappean and archean rock formation represented by phyllites gneisses, quartzite & granites. Consolidated rocks mainly underlie north-eastern part of Gujarat

2. Unconsolidated formation

Ground water occures under water table and in confined condition in the bed of sand, kankar & gravel that constitutes the alluvial aquifers occurred as discontinuous beds of varying thickness in hard rocks- terrain in the north & north eastern part of Basin. The valley-fills that are having good ground water potential are quite prominent and significant in the hard rock areas in Udaipur.

In the northern part of the Basin, including areas in Rajasthan and those in sabarkantha district the aquifers available are the highly jointed and fractured or extensively weathered rock zones. Wells tapping some thick rock-formations of this type yield as much as 1, 00,000 litres per hour though – 40,000 litres per hour would be more common. Such aquifer of moderate potential is available within 100-150 m below GL and even as closed as at 30-40 m depth if one was especially fortunate.

The parts of the Basin in Kheda and Surendranagar district have only limited ground water potentials comparable to that in northern parts of the Basin and good confined aquifers are not available. The phreatic aquifers in the alluvial strata are only suited for shallow wells and low yields tube wells.

2.2.7 Description of the water storage / diversion structures

At present there are 13 completed major / medium irrigation schemes which are listed in the following table.

Existing projects in Sabarmati Basin

Sl. No.	Name of project	River	Storage capacity (Mm3)		Purpose
			Gross	Live	
1	Sei dam	Sei	31.34	24.16	DiveRsion
2	Dharoil dam	Sabarmati	907.88	731.99	Irri.water
3	Harnav i	Harnav	----	----	Supply
4	Harnav ii	Harnav	21.67	19.97	Irrigation
5	Guhai	Guhai	62.34	57.04	Irrigation
6	Hathmati	Hathmati	161.0	153.0	Irrigation
7	Meshwo	Meshwo	82.00	77.00	Irri.& flood control
8	Mazam	Mazam	43.86	36.58	Control
9	Watrak	Watrak	176.9	154.3	Irrigation
10	Waidy	Suron	13.60	12.30	Irrigation
11	Raska weir	Meshwo	----	----	Irrigation
12	Moti fatewadi	Sabarmati	----	----	Irrigation
13	Vasana barrage	Sabarmati	----	----	Irrigation

Salient features of important major irrigation schemes namely Dharoil project and Watrak project are as follows.

Dharoi project

The project is located on Sabarmati River at Dharoil village of kheralu thehsil in Mehsana district of Gujarat. This comprises of a composite dam, having earthen dam of 843 m length with central spillway of 219 m. The maximum height from deepest foundation level for masonry dam is 52.00 m and for earth dam is 31 m. The catchment area up to project is 5475 sq km. The live storage capacity of the dam is 731.99 Mm^3. The total estimated cost of the project is Rs.96 crores. The direct benefits of the project are water supply for Ahmedabad city, and providing irrigation facilities to an area of 42800 ha. The project also supports existing irrigation under fatewadi canal system. The indirect benefit of the project is flood control. There is provision for 1.4 m.w. Hydro - power generations also.

Watrak project

This project is located in village Pahadia of Malpur teh. In district Sabarkantha of Gujarat. The project envisages construction of a composite dam across Watrak River having ogee type spillway of length 89 m. The length at top of dam is 313 m and maximum height above the lowest point of Foundation is 43.31 m. The catchment area of this project is 1114 sq km. The live storage capacity of the reservoir is 154.3 $Mm^{3.}$ The purpose of this project is irrigation for 25914 ha. The estimated cost of the project is Rs.47.58 crores.

2.2.8 Streamflow data

Hydrological observation by CWC.

In Sabarmati Basin, the CWC is conducting gauge and discharge observations at 6 sites. The details of these sites alongwith salient features in Sabarmati Basin are given in the following tables.

Sl.no	Name of site	Station code	Scheme	Type
1.	Wakal at Jotasan	01 02 12 001	F F	GD
2.	Sabarmati at Kheroj	01 02 12 003	F F	GD
3.	Sabarmati at Derol Bridge	01 02 12 006	F F	GDSWQ

4.	Watrak at Ratanpur	01 02 12 010	F F	GD
5.	Watrak at Kheda	01 02 12 012	F F	GD
6.	Sabarmati at Vautha	01 02 12 013	163 key	GDWQ

Salient features of sites maintained by CWC in Sabarmati Basin

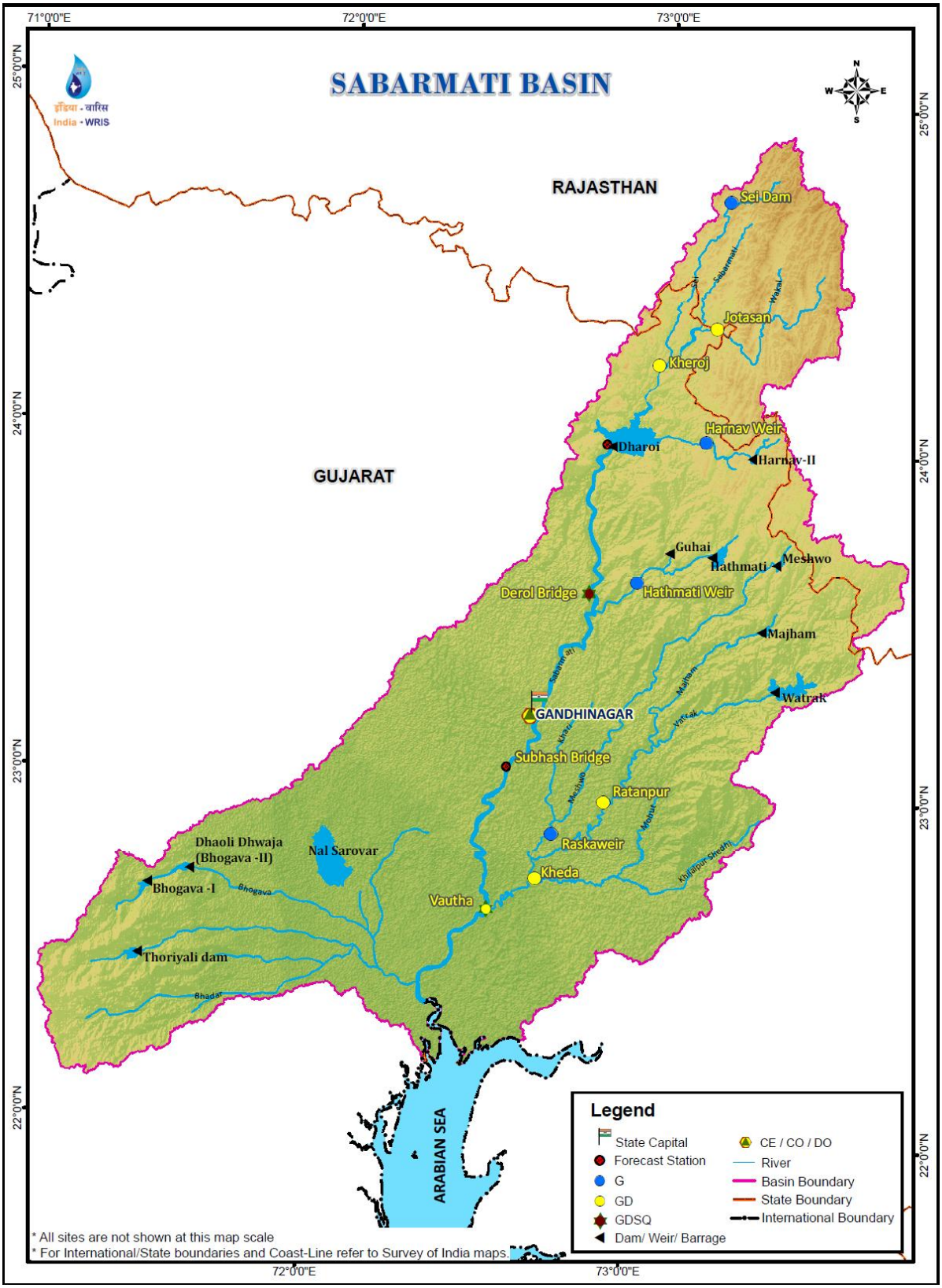
Sr No	Name	Local River / tributory	Lat. N	Long. E	Stn Parameters			Silt Lab	Type of gauge	Mode of Discharge Observation
			D M S	D M S	Met	Hydro	WQ			
1	Jotasan	Wakal	24 21 20	73 10 05	SRG	GD			Staff G	Wading,boat, float
2	Sei dam	Sei	24 45 39	73 19 05	SRG	G			Staff G	Dam sie
3	Kheroj	Sabarmati	24 13 45	73 00 26	SRG	GD			Staff G	Wading, boat, float
4	Harnav weir	Harnav	24 01 49	73 10 23	SRG	G			Staff G	Weir site
5	Dharoil dam	Sabarmati	24 00 13	72 51 24	SRG	G			Staff G	Ff stn dam site
6	Hathmati weir	Hathmati	23 36 20	72 58 00	SRG	G			Staff G	Weir site
7	Derol Bridge	Sabarmati	23 34 24	72 48 25	SRG ARG	GDS	WQ	Silt lab	Staff G	Wading, bridge, float
8	Subhash bridge	Sabarmati	23 03 35	72 35 14	SRG	G			Staff G	Ff stn

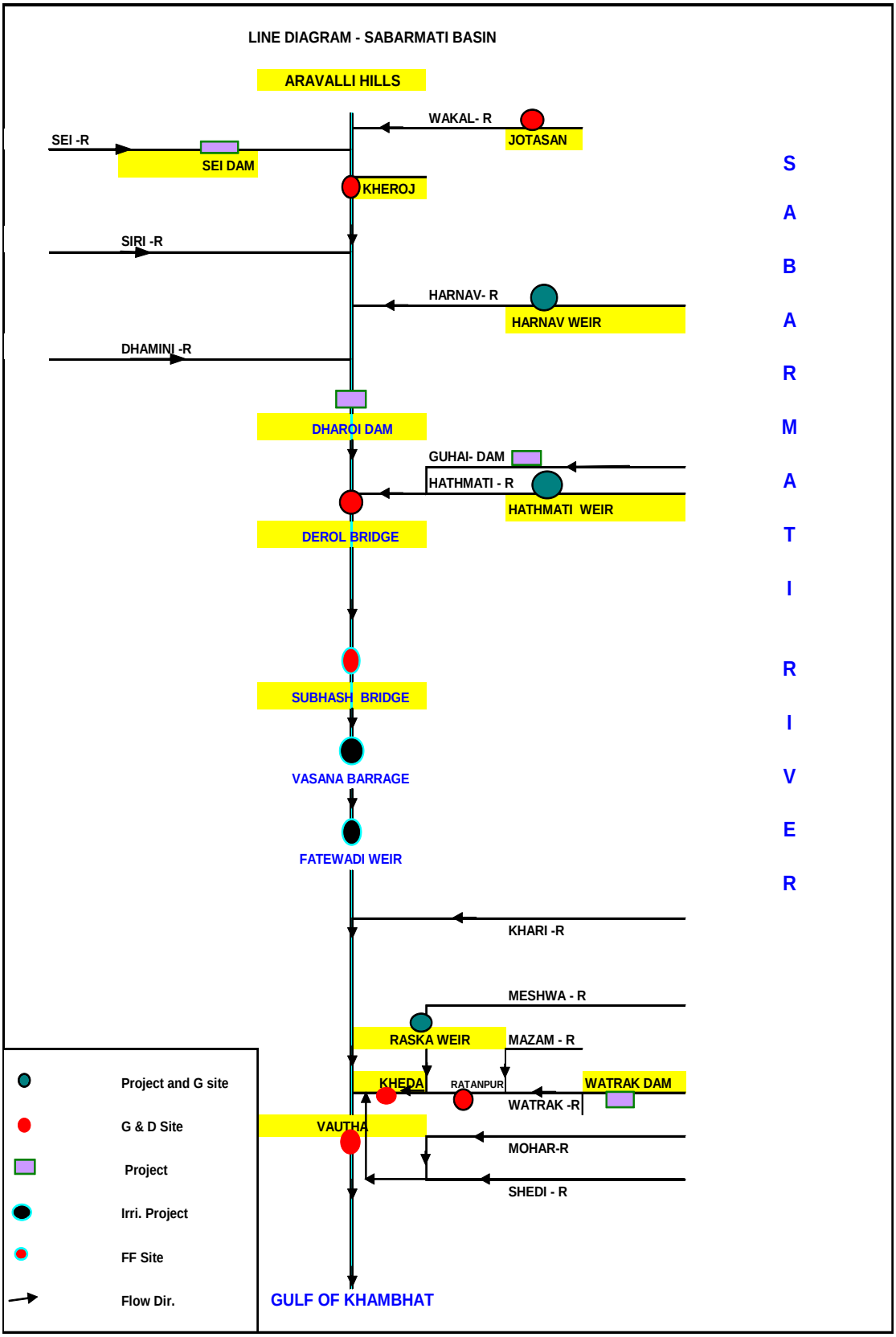
9	Raska weir	Meshwa	22 54 19	72 44 30	SRG	G			Staff G	Weir site
10	Watrak dam	Watrak	23 18 53	73 25 00	SRG	G			Staff G	Dam site
11	Ratanpur	Watrak	22 58 31	72 53 02	SRG	GD			Staff G	Wading, bridge float
12	Kheda	Watrak	22 44 45	72 40 49	SRG	GD			Staff G	Wading, bridge float
13	Vautha	Sabarmati	22 38 59	72 32 08	Na	GD	WQ		Staff G	Wading, boat, float

2.2.9 Data availability

Sl. No	Site name	Rain fall	Disch.	Thrice daily water level	Hourly water level (Monsoon period only)	Sediment	Water quality
1	Sabarmati at Jotasan GD	June‘94	June‘95	June‘95	June ‘95	N A	N A
2	Sabarmati at Kheroj GD	June‘88	June‘81	June‘81	June ‘81	N A	N A
3	Sabarmati at derol GDSQ	June‘88	June‘91	Aug‘80	Aug.80	Sept 92	July 92
4	Watrak at Ratanpur GD	Aug‘85	July ‘89	Mar‘85	June ‘85	N A	N A
5	Watrak at Kheda GD	Jun ‘88	July ‘89	Aprl‘85	June ‘85	N A	N A
6	Sabarmati at Vautha GDQ	N A	June2000	June2000	June2000	N A	June2000
7	Sei dam G	Jun’90	--	Mar’79	Mar’79	---	---
8	Harnav weir G	Jun’79	---	Jul’79	Jul’79	--	--
9	Dharoil dam G	Jun’89	--	Dec’78	Dec’78	--	--
10	Hathmati weir G	Feb’85	--	Jun’80	Jun’80	--	--
11	Subhash bridge G	--	--	Jul’79	Jul’79	--	--
12	Raska weir G	Nov’84	--	Nov’84	Nov’84	--	--
13	Watrak dam G	Jul’85	--	Jul’85	Jul’85	--	--

Plate 2.2.1


SABARMATI BASIN
RAJASTHAN
GUJARAT
Sei Dam
Jotasan
Kheroj
Harnav Weir
Dharoi
Harnav-II
Guhai
Hathmati
Meshwo
Derol Bridge
Hathmati Weir
Majham
Watrak
GANDHINAGAR
Subhash Bridge
Ratanpur
Raskaweir
Kheda
Vautha
Dhaoli Dhwaja
(Bhogava -II)
Nal Sarovar
Bhogava -I
Thoriyali dam
ARABIAN SEA
Legend
State Capital
Forecast Station
G
GD
GDSQ
Dam/ Weir/ Barrage
CE / CO / DO
River
Basin Boundary
State Boundary
International Boundary
* All sites are not shown at this map scale
* For International/State boundaries and Coast-Line refer to Survey of India maps.
71°0'0"E
72°0'0"E
73°0'0"E
25°0'0"N
24°0'0"N
23°0'0"N
22°0'0"N


LINE DIAGRAM - SABARMATI BASIN
ARAVALLI HILLS
WAKAL- R
JOTASAN
SEI -R
SEI DAM
KHEROJ
SIRI -R
HARNAV- R
HARNAV WEIR
DHAMINI -R
DHAROI DAM
GUHAI- DAM
HATHMATI - R
HATHMATI WEIR
DEROL BRIDGE
SUBHASH BRIDGE
VASANA BARRAGE
FATEWADI WEIR
KHARI -R
MESHWA - R
RASKA WEIR
MAZAM - R
KHEDA
RATANPUR
WATRAK DAM
WATRAK -R
VAUTHA
MOHAR-R
SHEDI - R
GULF OF KHAMBHAT
SABARMATI RIVER
Project and G site
G & D Site
Project
Irri. Project
FF Site
Flow Dir.

2.3 Luni Basin

2.3.1 Geographical description of the Basin

Luni is the only River Basin of any significance in western Rajasthan, which forms the bulk of arid zone. Luni originates from western slopes of the Aravalli ranges at an elevation of 772 m above m.s.l. near Ajmer flowing in south west direction and traversing a course of 511 km in Rajasthan, it finally flows into the Rann of Kachchh. Most of its tributories drain the steep north-west of Aravalli hills and join it on left side. Its total catchment area falls in Rajasthan. Luni Basin is situated in between 24^0 11' to 26^0 43' north latitude and 70^0 37' to 74^0 39' east longitude approximately. The peculiarity of this River is that it tends to increase its width rather than deepening the bed because the banks are of soils, which are easily erodable whereas beds are of sand. The floods develop and disappear so rapidly that they have no time to scour the bed. The Aravalli ranges form its east boundary whereas main course of River in Barmer district itself forms north boundary and mostly Banas and initial reach of Chambal River form its southern boundary. Basin map of Luni Basin is enclosed as **Plate -2.3.1**

2.3.2 Description of River system

Luni receives all the main tributaries on its left bank except one i.e. Jojari (Mithri) on the right bank. Luni receives ten tributories namely Lilari, Guhiya, Bandi (Hemawas), Sukri (Hemawas), Sukri, Mithri, Jawai, Khari Bandi, Sukri Bandi and Sugi. Drainage on the left bank of Luni is, therefore, more extensive than on right bank. The Luni drains an area of 32879 sq km in Rajasthan State only.

The catchment area of the Basin up to chittalwana is 32661 sq km. The remaining catchment area of the Luni Basin below chittalwana and up to rann of kachchh is only 218 sq km which is delta where the water spreads out and does not contribute any runoff. The total available runoff From entire Luni Basin is 788 Mm^3, out of which guhiya, Jojari (Mithri), Bandi (Hemawas) and Jawai tributaries contribute runoff of 116 Mm^3, 64 Mm^3, 120 Mm^3 and 125 Mm^3 respectively. The catchment area, length and elevation of source of important tributaries are shown below.

S.no	Name of River	Bank	Elevation of source above m.s.l. (m)	Length (km)	Catchment area (sqkm)
1	Luni	Main	737	511	32879
2	Jojari (Mithri)	Right	312	83	1060
3	Lolari	Left	731	60	1611
4	Guhiya & Sukri (Hemavas)	Left	237	125	4126
5	Bandi (Hemavas)	Left	935	135	3016
6	Sukari	Left	995	140	3280
7	Mithri	Left	459	71	2637
8	Jawai	Left	1099	145	2701
9	Khari bandi	Left	701	84	2671
10	Sukri bandi	Left	588	85	1161
11	Sugi	Left	688	80	1370

A line diagram of River system giving information of Luni Basin & its tributaries and sub tributaries etc is enclosed as **Plate -2.3.2.**

2.3.3 Climatic characterstics

Temperature (°c) during year 2015-16

Year	Balotra		Gandhav	
	Max	Min	Max	Min
2015-16	48.8	7.4	51	5

2.3.4 Rainfall

The 50 cm isohyet approximately follow Aravallies range and is dividing line between arid and semi arid in the west and sub humid in the east and south east. The rainfall is erratic and its distribution is uneven in the catchment.

Mean annual rainfall in mm Luni Basin CWC sites

Name of site	Data available (No of years)	Average rainfall (mm)	Average no. of rainy days	Rainfall during water year 2015-16	No of rainy days 2015-16
Balotra	16	293	15	374.8	17
Gandhav	14	419	8	392	15

2.3.5 Geology

Aravallies form the watershed boundary that divides the state virtually into two broad physio-climatic zones i.e. Arid and semi arid. The arid zone that lies to the west of Aravallies (whole Luni Basin) is covered by vast stretches of sand intercepted by numerous hillocks of low elevation. The North West part of Aravallies shows discontinuity and is full of wide gaps enabling penetration of western sand dunes to east. The drainage system mostly continues to the eastern half of the state; most of the easterly flowing streams drain into Chambal River. On west of Aravallies, only Luni has outlet to the Rann of kachchh.

2.3.6 Description of the water storage / diversion structures

No major irrigation structure exists in the Luni Basin. However, there is a net deficit of the available runoff due to all existing/under construction /proposed schemes in Luni Basin. Below table shows the salient features of Some of the important irrigation schemes.

Description	**Jawai dam**	**Jaswant sagar dam**	**Hemawas**	**Sardar samand**	**Banki bund**
Tehsil	Bali	Bilara	Pali	Sojat	Ahore
District	Sirohi	Jodhpur	Pali	Pali	Jalore
Latitude	24^0 06’40”	26^0 44’45”	25^0 44’00”	25^0 26’54”	24^0 42’00”
Longitude	73^0 09’00”	72^0 44’45”	73^0 20’00”	73^0 20’58”	72^0 53’00”
C.a.(sq km)	787	3367	1124	2072	1716
C.c.a. (ha)	41300	6381	8300	10337	5235
Gross storage Mm3	198	52.8	62.5	88	48.6
Live storage capacity Mm3	184	52.6	62.5	88	34.5
Type of dam	Masonry	Earthen	Earthen	Earthen	Earthen

2.3.7 Streamflow data

Hydrological observations by CWC

In Luni Basin, the central waster commission is conducting hydrological observations i.e. Gauge and discharge observations at 2 sites. The details of the sites are given below

Sl.No.	Name of site	Station code	Scheme	Type
1.	Luni at Gandhav	01 02 01 002	NNW	GD
2.	Luni at Balotra	01 02 01 001	163 key	GD

The data of above two sites have been presented in this book. During the water year 1984-85 and 1985-86, the site Luni at Gandhav was under the administrative control of defunct Jodhpur gauging division.

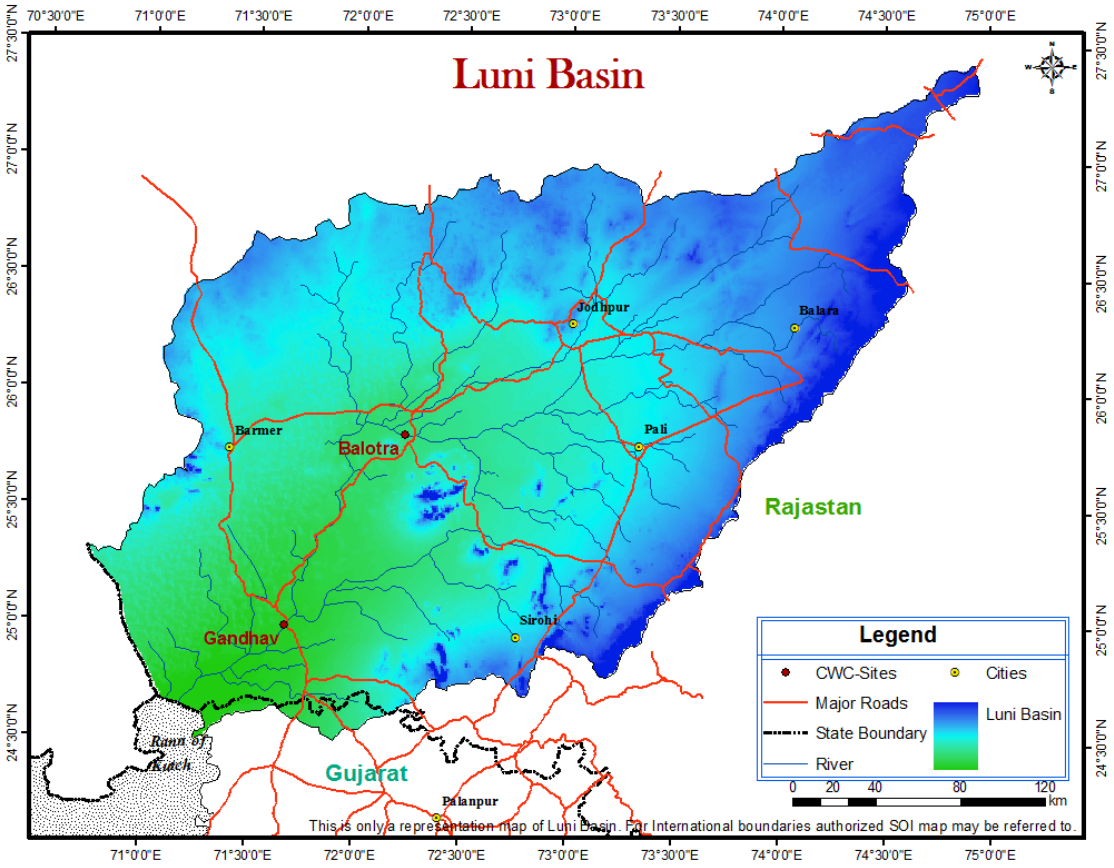
Salient features of sites maintained by CWC in Luni Basin

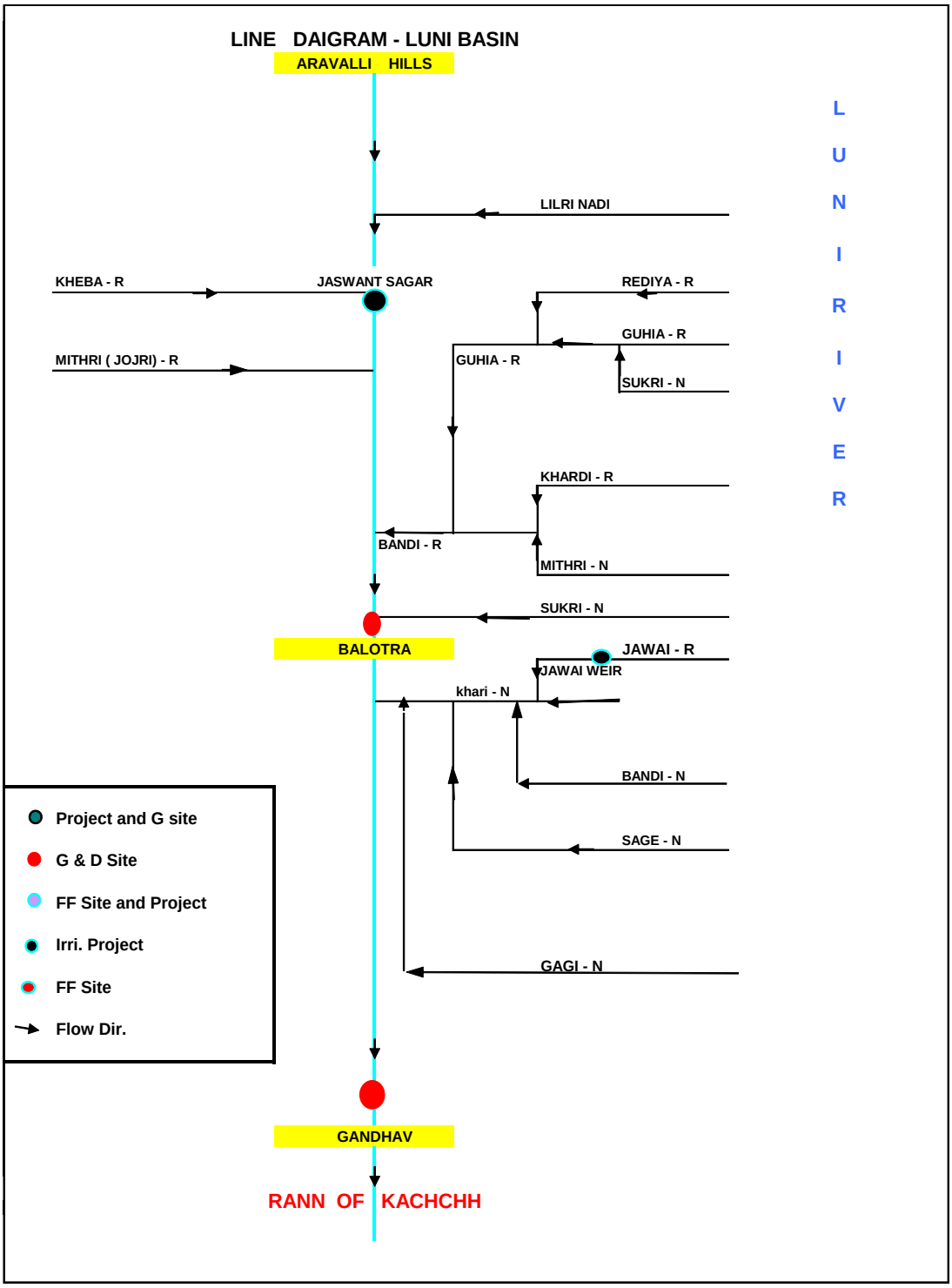
Sr No	Name	Local River	Lat. D M S	Long. D M S	Stn Parameters Met	Stn Parameters Gauge	Type of gauge	Discharge Measurement
1	Gandhav	Luni	24 59 22	71 40 47	SRG	GD	Staff G	Wading, bridge, float
2	Balotra	Luni	25 49 18	72 13 23	SRG	GD	Staff G	Wading, float

2.3.8 Data availability

Sl No	Site name	Rain fall	Discharge	Thrice daily water level	Hourly water level (for Monsoon period only)
1	Luni at Gandhav GD	Jan'99	June '74	June '74	June '74
2	Luni at Balotra GD	July'90	July '90	July '90	July '90

Plate-2.3.1


Luni Basin
70°30'0"E
71°0'0"E
71°30'0"E
72°0'0"E
72°30'0"E
73°0'0"E
73°30'0"E
74°0'0"E
74°30'0"E
75°0'0"E
27°30'0"N
27°0'0"N
26°30'0"N
26°0'0"N
25°30'0"N
25°0'0"N
24°30'0"N
Jodhpur
Balara
Barmer
Balotra
Pali
Rajastan
Sirohi
Gandhav
Rann of Kutch
Gujarat
Palanpur
Legend
CWC-Sites
Cities
Major Roads
State Boundary
River
Luni Basin
0 20 40 80 120
km
This is only a representation map of Luni Basin. For International boundaries authorized SOI map may be referred to.


LINE DAIGRAM - LUNI BASIN
ARAVALLI HILLS
LILRI NADI
KHEBA - R
JASWANT SAGAR
REDIYA - R
GUHIA - R
MITHRI (JOJRI) - R
GUHIA - R
SUKRI - N
KHARDI - R
BANDI - R
MITHRI - N
SUKRI - N
BALOTRA
JAWAI - R
JAWAI WEIR
khari - N
BANDI - N
SAGE - N
GAGI - N
GANDHAV
RANN OF KACHCHH
L U N I R I V E R
Project and G site
G & D Site
FF Site and Project
Irri. Project
FF Site
Flow Dir.

2.4 Banas Basin

2.4.1 Geographical description of the Basin

Banas River originates from Aravalli hills and descends in a south-western direction through Rajasthan state and travels through Banaskantha and Mehsana district of Gujarat before it drains into little Rann of Kutchh. The Banas Basin is the northern Basin and is situated between 23^0 30' 24^0 55' north latitudes and 71^0 15' to 73^0 15' east longitudes approximately. Saraswati and Luni Basins form the southern and northern boundaries of this Basin. The Aravalli hills form its eastern extremity.the Banas drains an area of 8674 sq km, out of which nearly 37.69% lies in Rajasthan state and remaining 62.31% falls in Gujarat state. Basin map of Banas Basin is enclosed as **Plate -2.4.1**

The state and district wise distribution of its drainage area is shown the following table

Sl.no.	**Name of state**	**Name of district**	**Length of River km**	**Drainage area sqkm**	**% of total ca**
1	Rajasthan	Sirohi	78	3269	37.69
2	Gujarat	Banaskantha	119	4638	53.47
3	Gujarat	Mehasana	69	767	8.84
Total			**266**	**8674**	**100.00**

2.4.2 Description of River system

The Banas rises near Pindwara of Sirohi district of Rajasthan at an elevation of 372.51m above m.s.l. Little Rann of Kachchh is the outfall of Banas River. Sipu is the only right bank tributary of Banas, which drains into the main channel. There are 6 tributaries on the left bank of Banas River namely the batria, the Sukli, the Sewaran, the Suket, the Balaram and the Khari which drain into the main channel. Hence the draining system on the left bank of the Banas River is more extensive as compared to the right bank area. The Sipu and the Khari are the two important right and left bank tributories, which together drain nearly 37% of the total catchment area of Banas.

Sipu

Sipu is the principal trtibutary of the Banas rising from Sirohi and Mount Abu hills in Sirohi district of Rajasthan state. Abu hills fall between the Banas and Sipu sub Basin. About 30% of Mount Abu hills direct runoff drains into the Sipu River while about 70% of Mount Abu hills direct runoff flows into the Banas River. The confluence of Sipu and Banas River is 12 km downstream of Dantiwada dam.

Khari

Khari River rises from palanpur (b.k.district) and drains into the Banas River through Mehsana district at 80 km downstream of dantiwada dam.

Sukli

The Sukli tributary rises from Aravalli hills near pindwara of Sirohi district (Rajasthan) and drains into the Banas River downstream of Swaroopganj dam and 9 km upstream of Aburoad in Rajasthan.

Batria

The Batria rises near ambaji hills of Aravalli range and drains into the Banas, 3km upstream of Abu road. It passes through Sirohi district of Rajasthan.

Sewaran, Suket and Balaram

The Sewaran, Suket and Balaram tributaries rises near Ambaji hills of Aravalli ranges. Sewaran and suket before they both drain into Banas River 7.5 km downstream of Abu Road pass from Banaskantha and Sirohi districts. Balaram River totally drains Banaskantha district. Its confluence with Banas is 14 km upstream of Bantiwada dam. A line diagram of River system giving information of Banas, its tributaries and sub tributaries etc indicating the stations showing diversions etc enclosed as **Plate -2.4.2.**

The catchment area, length and elevation of source of the above said tributaries are indicated in the following table.

Sl.no.	Name of River	Bank	Elevation of source above m.s.l. (m)	Length (km)	Catchment area (sq km)
1	Banas	Main	372.51	266	8674
2	Sipu	Right	1150	75	1420
3	Sukli	Left	372.51	38	438
4	Batria	Left	780	24	218

5	Sewaram	Left	850	28	202
6	Suket	Left	606	15	79
7	Balaram	Left	807	40	345
8	Khari	Left	215.285	88	1391

2.4.3 Climatic characterstics

Temperature (°c) during year 2015-16

Year	Kamalpur		Chitrasani		Sarotry		Abu road	
	Max	Min	Max	Min	Max	Min	Max	Min
2015-16	47	7.5	45	6	43	8	47	7

2.4.4 Rainfall

Mean annual rainfall- Banas Basin- CWC sites

Name of site	Data available (No of years)	Average rainfall (mm)	Average no. of rainy days	Rainfall during water year 2015-16	No of rainy days 2015-16
Abu Road	36	662	36	776.2	31
Sarotry	27	780	29	675	21
Chitrasani	36	706	41	998	36
Bhakudar	31	659	26	1059	19
Kamalpur	35	530	28	866.2	12
Dantiwada	17	651	28	969.4	20
Ambaji	17	760	43	1172	26
Mt.abu	17	1381	45	1965.8	37

2.4.5 Description of the water storage / diversion structures

A line diagram of River system giving information of Banas, its tributaries and sub tributaries etc indicating the stations showing diveRsions, etc is enclosed as Fig 3.4.

List of existing projects in Banas Basin

Sl.no.	Name of project	River	Storage capacity (Mm^3)		Purpose
			Gross	Live	
1	Swarupgunj dam	Banas	39.05	-----	Irrigation
2	Dantiwada dam	Banas	464	444	Irrigation
3	Sipu dam	Sipu	177.8	156	Irrigation

2.4.6 Streamflow data

Hydrological observation by CWC

In Banas Basin the central water commission is conducting hydrological observation i.e. Gauge and discharge observation at 4 sites. The details of these four sites are given below.

Sl.no.	**Name of site**	**Station code**	**Scheme**	**Type**
1.	Banas at abu road	01 02 02 002	F F	GDWQ
2.	Banas at Sarotry	01 02 02 003	F F	GD
3.	Balaram at Chitrasani	01 02 02 004	F F	GDWQ
4.	Banas at Kamalpur	01 02 02 007	N.n.w	GDsWQ

Salient features of sites maintained by CWC

Sr No	Location Name	Local River	Lat. D m s	Long. D m s	Stn. Parameters			Silt lab	Type of gauge	Mode of Discharge Measurement
					Met	Gauge	WQ			
1	Swarup-ganj	Banas	24 41 28	72 55 52	SRG	G			Staff G	Weir site
2	Abu road	Banas	24 29 38	72 47 30	SRG	GD	WQ		Staff G	Wading,boat
3	Sarotry	Banas	24 22 04	72 32 48	Arg/SRG	GD			Staff G	Wading,bridge
4	Chitrasani	Balaram	24 17 20	72 29 54	SRG/arg	GD	WQ		Staff G	Wading,bridge
5	Dantiwada dam	Banas	24 20 14	72 20 17	SRG	G			Staff G	Ff stn dam site

6	Bhakudar	Sipu	24 23 56	72 18 02	SRG	G			Staff G	Dam site
7	Kamalpur	Banas	23 47 59	71 45 00	SRG	GDS	WQ	Silt lab	Staff G	Wading,float

2.4.7 Data availability

Sl No	Site name	Rain fall	Disch.	Thrice daily water level	Hourly water level (for Monsoon period only)	Sediment	Water quality
1	Banas at Aburoad GDWQ	Jun-80	July-89	May-78	Jun- 88	NA	Jul- 88
2	Banas at Sarotry GD	Jun-80	Jun-89	Jun-80	Jun-80	NA	NA
3	Balaram at Chitrasani GDWQ	Jun-80	July-90	May-78	Jun-78	NA	Jul-88
4	Banas at Kamalpur GDSWQ	Jun-81	Jul-71	July-71	Aug-71	Aug-83	Jun-73
5	Swarupganj G	--	--	Jul-89	Jul-89	--	--
6	Dantiwada dam G	Jun-85	---	Jul-78	Jul-78	--	--
7	Bhakudar dam G	Jul-85	--	Jun-79	Jun-79	---	--

Plate 2.4.1

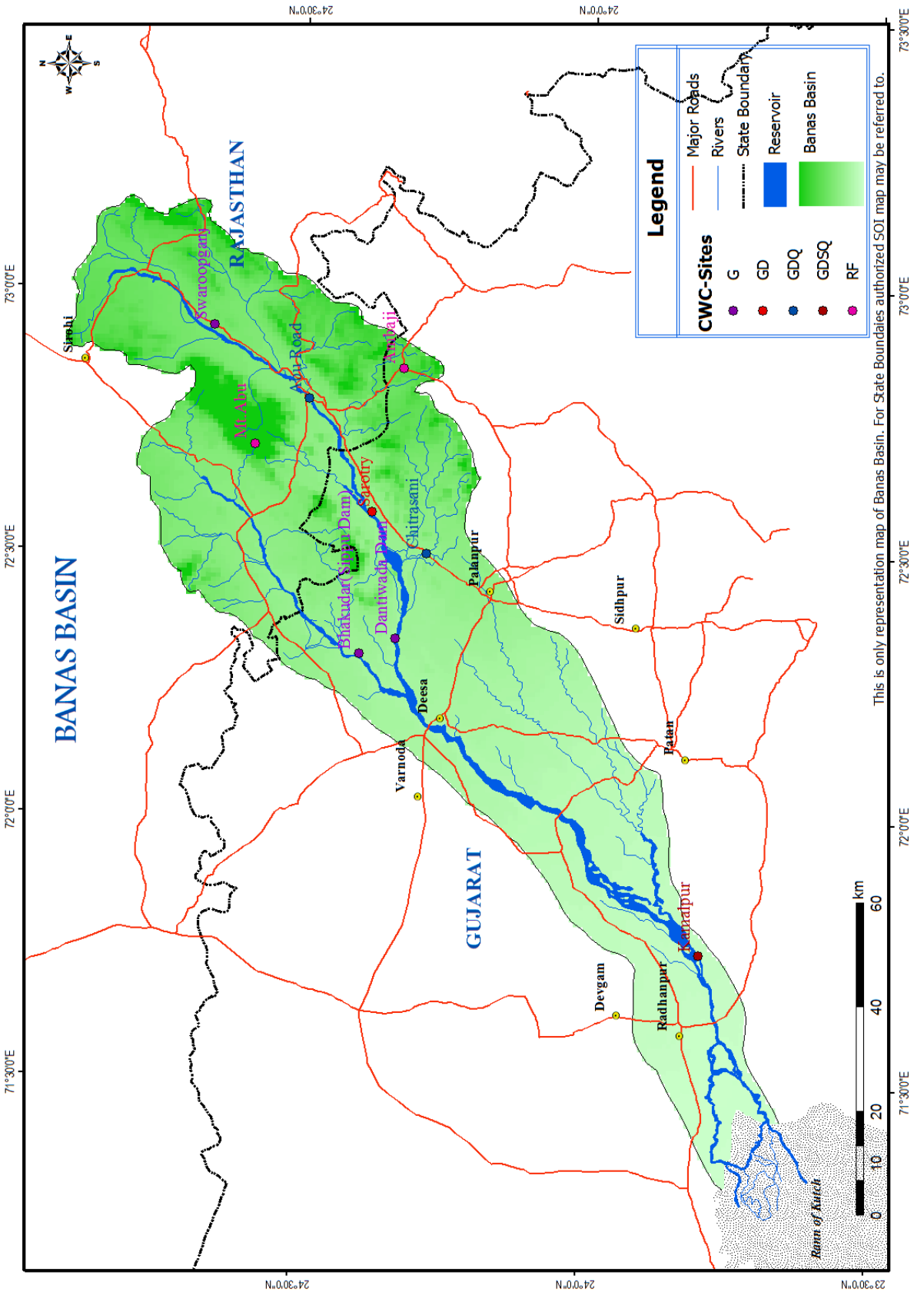
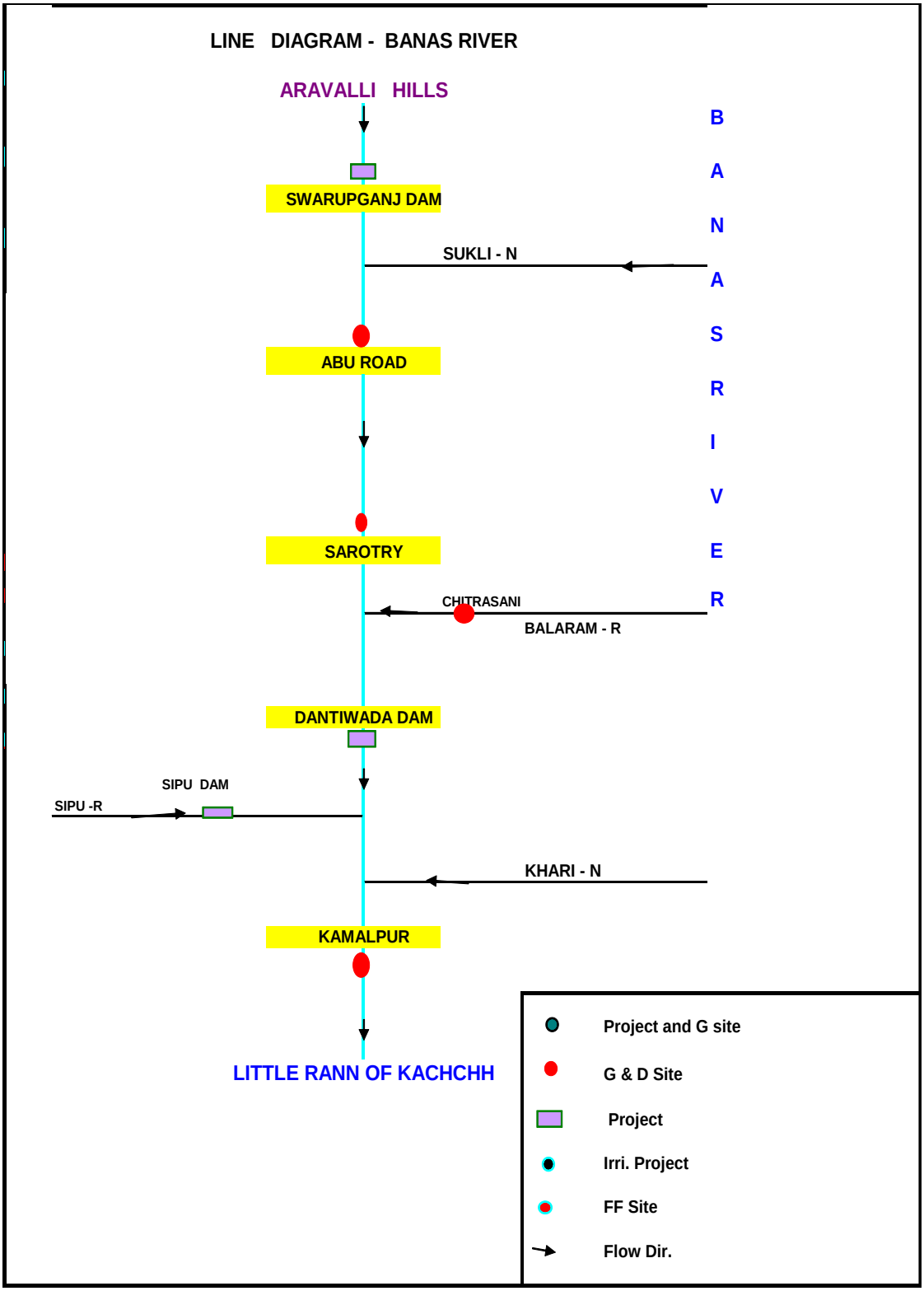

BANAS BASIN
RAJASTHAN
GUJARAT
Legend
Major Roads
Rivers
State Boundary
Reservoir
Banas Basin
CWC-Sites
G
GD
GDQ
GDSQ
RF
Sirohi
Swaroopganj
Abu Road
Mt.Abu
Ambaji
Bhiladar(Sipu Dam)
Saferty
Dantiwada Dam
Chitrasani
Palanpur
Sidhpur
Deesa
Varnoda
Patan
Radhanpur
Kandalpur
Devgam
Rann of Kutch
km
0 10 20 40 60
This is only representation map of Banas Basin. For State Boundaies authorized SOI map may be referred to.

Plate-2.4.2


LINE DIAGRAM - BANAS RIVER
ARAVALLI HILLS
B
A
N
A
S
R
I
V
E
R
SWARUPGANJ DAM
SUKLI - N
ABU ROAD
SAROTRY
CHITRASANI
BALARAM - R
DANTIWADA DAM
SIPU DAM
SIPU -R
KHARI - N
KAMALPUR
LITTLE RANN OF KACHCHH
Project and G site
G & D Site
Project
Irri. Project
FF Site
Flow Dir.

2.5 Shetrunji Basin

2.5.1 Geographical description of the Basin

The Shetrunji is one of the major Rivers of Saurastra. The Shetrunji basin is the eastern most basin of Saurastra and is situated in between 21^0 00' to 21^0 47' north latitude and 70^0 50' to 72^0 10' east longitude. The river Shetrunji originates at Chachai Hills in Gir forest of Junagarh district at 380 m above m.s.l. and flows towards east direction till its fall in the Gulf of Khambhat near Santhrampur port. The river Shetrunji makes fertile the area of Amerli and Bhavnagar districts and some part of Junagarh district of Saurashtra. The Shetrunji drains an area of 5514 sq km out of which more than 50% in Amerli district. Basin map of Shetrunji Basin is enclosed is enclosed as **Plate -2.5.1**

The district wise distribution of drainage area is shown below.

Name of district	Drainage area sq km	% of total area
1. Amreli	2946.68	53.44
2. Bhavnagar	2492.88	45.21
3. Junagarh	74.44	1.350
Total	**5514.00**	**100.00**

2.5.2 Description of River system

The total length of this east flowing river from its origin to the outfall into the Gulf of Khambhat is 182 km. This river receives tidal influence for a length of 5 km from the mouth. The Shetrunji receives several tributaries on both banks. There are 9 tributaries having lengths more than 15 km. Out of which Safara, Shel, Khari and Talaji are the 4 tributaries on the right bank of Shetrunji and the remaining 5 tributaries viz Stali, Thebu, Gagadia, Rajwal and Kharo are on left bank. The drainage system on left bank of Shetrunji is more extensive as compared to the right bank area.

The Stali, Thebi and Gagadia are important tributaries feeding from left bank of Shetrunji and drain nearly 34% of total catchment area of the River Shetrunji. The Gagadia and Theli (Thebu) are the principal tributaries of Shetrunji rising from the high ground near visavadar talukas of Junagarh district. The catchment area, length and elevation of source, of the important tributaries are tabulated in the following table

Sl.no	Name of River	Bank	Elevation of source above m.s.l. (m)	Length (km)	Catchment area(sq km)
1	Shetrunji	Main	380	182	5514
2	Satali	Left	400	35	651
3	Theli	Left	201	18	484
4	Safara	Right	250	34	226
5	Shel	Right	273	42	303
6	Gagaria	Left	180	52	754
7	Kharai	Right	211	39	665
8	Kharo	Left	125	34	261
9	Rajwal	Left	100	34	321
10	Talaji	Right	273	23	134

A line diagram of river system giving information of Shetrunji Basin, its tributaries and sub tributaries etc indicating the stations showing diveRsions etc is enclosed as **Plate -2.5.2.**

2.5.3 Climatic characterstics

The average rainfall in the Shetrunji Basin is 604.52 mm. The south -west Monsoon sets in by middle of June and withdraws by the first week of October. About 90% of total rainfall is received during July and August. Owing to the topographical characteristics climate is variable.

Temperature (°c) during year 2015-16

Lowara		
Year	**Max**	**Min**
2015-16	43	12

Mean annual rainfall in mm Shetrunji Basin CWC sites

Name of site	Data available (No of years)	Average rainfall (mm)	Average no. of rainy days	Rainfall during water year 2015-16	No of rainy days 2015-16
Lowara	27	466	48	574.1	24

2.5.4 Description of the water storage / diversion structures

Major / medium irrigation projects in River Basin Shetrunji

At present, there are 16 completed irrigation schemes (1 major and 15 minor).

A) Major irrigation scheme:

1) Shetrunji irrigation scheme:

B) Mnor irrigation scheme

1	Munjiasar	9	Thebi
2	Vedi	10	Khodiar
3	Popatdi	11	Shel Dedumal-1
4	Bavdi	12	Kodvadri
5	Hanol	13	Rajwal
6	Kharo	14	Hamirpura
7	Pingli	15	Samidhiara
8	Datred (P.W)		

Shetrunji irrigation scheme

The Shetrunji irrigation scheme comprises construction of masonry dam in the River portion and earthen dam on both the banks. The catchment area at dam site is 430 sq km. It has gross capacity of 350 MCM with live storage of 309 Mm^3. It commands gross area of 2, 09,400 acres of land out of which cultivated command area is 1,21,400 acres and irrigable area is 88,000 acres.

2.5.5 Streamflow data

Hydrological observation by CWC

In Shetrunji Basin, the central water commission is conducting hydrological observations at only one site namely Lowara for which data has been finalised and the same is presented in this book. The details of the site are given below.

Sl.no.	Name of site	Station code	Scheme	Type
1.	Shetrunji at Lowara	01 02 09 001	NNW	GDSWQ

Salient features of sites maintained by CWC in Shetrunji Basin

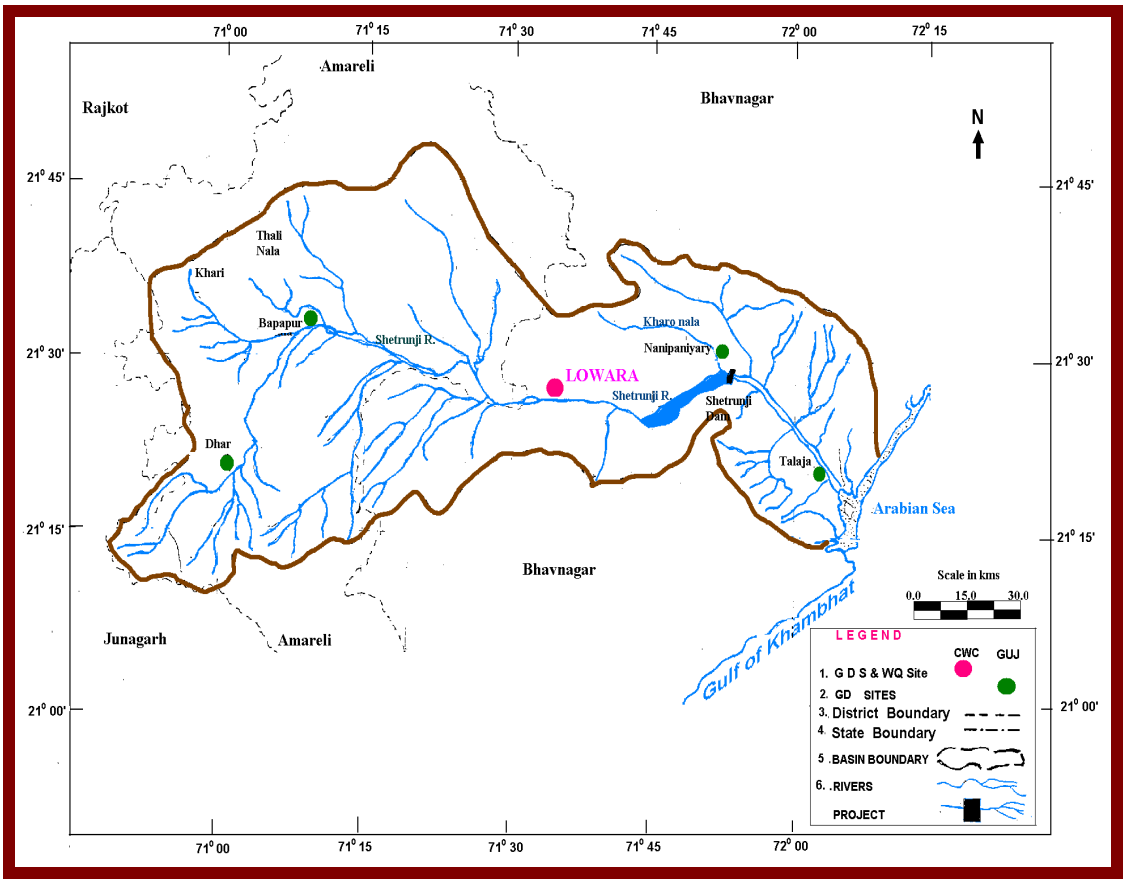
Sr No	Name	Local River	Lat.	Long.	Stn Parameters			Silt lab	Type of gauge	Discharge measure-ment
			D M S	D M S	Met	Gauge	WQ			
1	Lowara	Shetrunji	21 26 36	71 33 42	SRG	GDS	WQ	Silt lab	Staff G	Wading, boat with cable, float

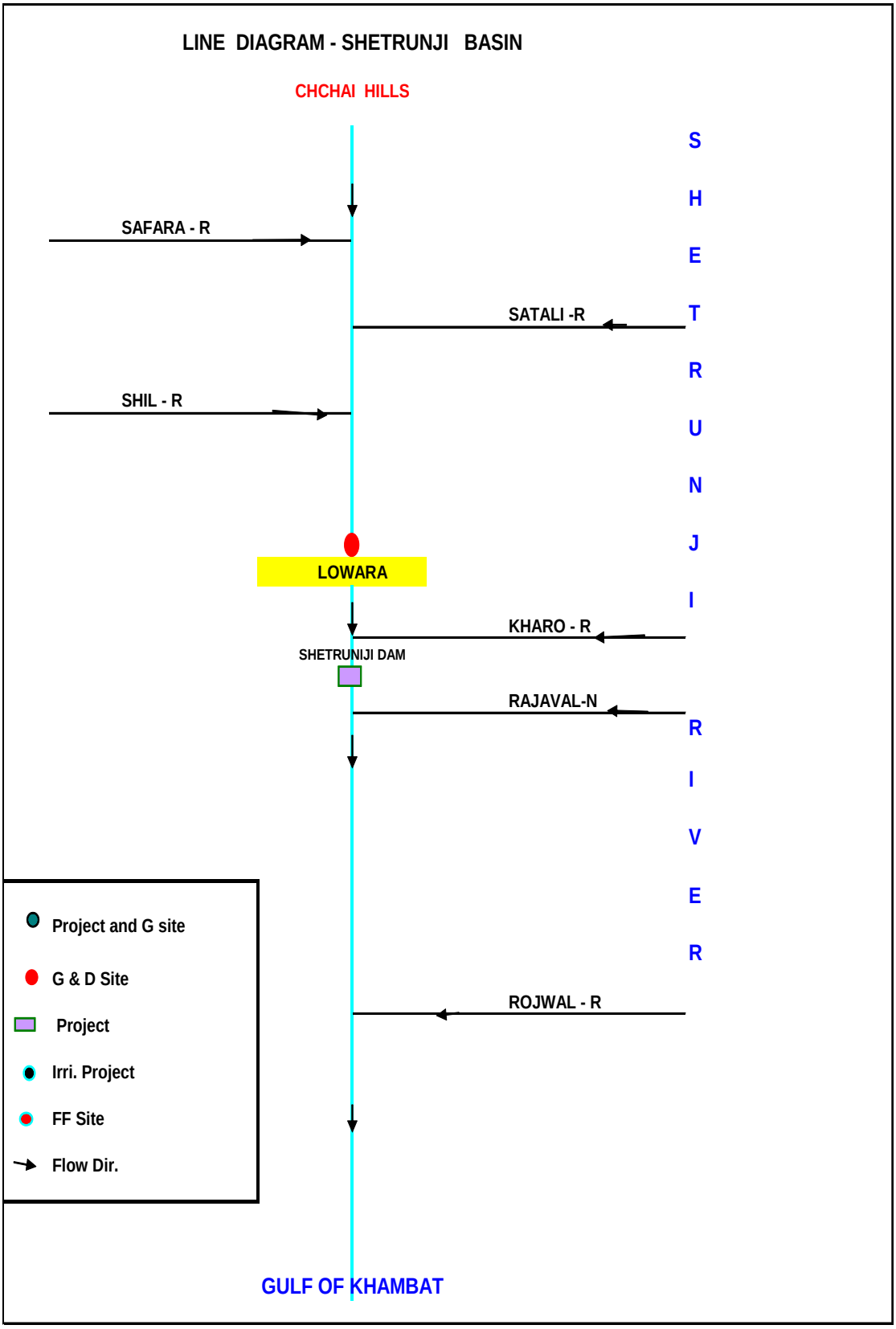
2.5.6 Data availability

Sl No	Site name	Rain fall	Discharge	Thrice daily water level	Hourly water level (for Monsoon period only)	Sedi-ment	Water quality
1	Shetrunji at Lowara GDSQ	June-89	Nov -70	Nov -70	June -71	July -73	July-77

Plate-2.5.1

Shetrunji Basin




LINE DIAGRAM - SHETRUNJI BASIN
CHCHAI HILLS
SHETRUNJI RIVER
SAFARA - R
SATALI -R
SHIL - R
LOWARA
KHARO - R
SHETRUNJI DAM
RAJAVAL-N
ROJWAL - R
GULF OF KHAMBAT
Project and G site
G & D Site
Project
Irri. Project
FF Site
Flow Dir.

2.6 Bhadar Basin

2.6.1 Geographical description of the Basin

Bhadar is one of the major rivers of Saurashtra. It drains about 1/7 th of the area of Saurashtra. The Bhadar Basin is the south western basin and situated between 21^0 25' to 22^0 10' north latitude and 69^0 45' to 71^0 20' east longitude. The river Bhadar originates at an elevation of 261 m above m.s.l. in Vaddi about 26 km north – west of jasdan in Rajkot district and flows towards south upto Jasdan village and then turns towards south – west up to village Jetpur and finally changes its direction towards west till its confluence with Arabian sea at Navibandar (Porbandar). Thus, from Jetpur to Porbandar the river Bhadar makes fertile areas of Rajkot, Jamnagar, Amreli andJjunagarh districts of Saurashtra. The Bhadar drains an area of 7094 sq km out of which 706 sq km in hilly and the rest in plain regions of Saurastra. Basin map of Bhadar Basin is enclosed is enclosed as **Plate -2.6.1.**

The district wise distribution of drainage area is shown in the following table

Name of district	**Drainage area sq km**	**% of total**
1. Rajkot	4902.67	69.11
2. Jamnagar	1047.78	14.77
3. Amreli	715.78	10.09
4. Junagarh	427.77	6.03
Total	7094	100

2.6.2 Description of River system

The total length of this south west flowing river from its origin to its outfall into the sea is 198 km. For the first 150 km the river flows in Rajkot district and the rest of 48 km in Junagarh district. The river receives tidal influence for a length of about 26 km from mouth in Junagarh district. The river Bhadar receives several tributaries on both the banks. There are 9 major tributaries having a length more than 25 km out of which 6 tributaries viz Gondali, Chapparwadi, Phopal, Utawali, Moj and Venu are feeding from right and the remaining 3 tributaries viz Vasavadi, Surwa and Galolia from left. The drainage system on the right bank of river Bhadar is more extensive as compared to the left bank.

Gondali, Chapperwadi, Phopal and Venu, these 4 important right bank tributaries together account for nearly 35% of total catchment area of Bhadar. Venu, which is the principal

tributary of Bhadar also rises in Jamnagar district in hilly range and drains Jamnagar and Rajkot districts. Phopal, another tributary rises at high level range about 5 km north of the town Lodhika. The catchment area, length and elevation of sources of important tributaries are indicated below

Sl.no.	Name of River	Bank	Elevation of source above m.s.l. (m)	Length (km)	Catchment area (sq km)
1	Bhadar	Main	261	198	7094
2	Vasavadi	Left	194	32.18	583
3	Gondali	Right	231	46.66	513.85
4	Surwa	Left	180	30.6	273.6
5	Galolio	Left	160	27	198.25
6	Chappervadi	Right	180	43.45	455.4
7	Phopal	Right	175	48.27	590.5
8	Utawali	Right	146	24	103.6
9	Moj	Right	245	48.27	105.15
10	Venu	Right	180	61.15	953.12

A line diagram of River system giving information of Bhadar Basin, its tributories and sub tributories etc indicating the stations showing diveRsions, etc. is enclosed as **Plate -2.6.2.**

2.6.3 Climatic characterstics:

The average rainfall in Bhadar Basin is 625 mm. The south west Monsoon sets in by the middle of June and withdraws by the first week of October. About 90% of total rainfall is received during July and August. Owing to the topographical characteristics climate is variable

Temperature (°c) during year 2015-16

Ganod		
Year	Max	Min
2015-16	42	7

Mean annual rainfall (mm) for Bhadar Basin (CWC sites)

Name of site	Data available (No of yeaRs)	Average rainfall (mm)	Average no. of rainy days	Rainfall during water year 2015-16	No of rainy days 2015-16
Ganod	35	663	17	365	14

2.6.4 Description of the water storage / diversion structures

Medium irrigation projects in Bhadar River Basin

At present there are 12 completed structures either reservoirs or weirs in Bhadar catchment which are as follows:

1. Jasdan tank (alansagar)
2. Gondali irrigation scheme (near kotesangani)
3. Gondali irrigation scheme (veri tank)
4. Sekroli irrigation scheme
5. Moj dam
6. Venu dam
7. Venu dam ii
8. Irrigation scheme
9. Mewasa bund
10. Rajawadla tank
11. Hamir barrage
12. Bhadar dam

The Bhadar irrigation scheme is on the Bhadar River in Rajkot .The gross storage capacity is 238 MCM and tributary storage capacity is 221 MCM. The cost of project is Rs 4.5475 crores.

2.6.5 Streamflow data

Hydrological observations by CWC

In Bhadar Basin, the central water commission is conducting hydrological observations i.e. Gauge and discharge observation at site Ganod for which data has been finalised and presented in this book. The details of this site are given below.

Sl.no.	Name of site	Station code	Scheme	Type
1.	Bhadar at Ganod	01 02 07 001	NNW	GDSWQ

Salient features of sites maintained by CWC in Bhadar Basin

Sr No	Name	Local River	Lat. D M S	Long. D M S	Stn Met	Stn. Gauge	Stn WQ	Silt lab	Type of gauge	Discharge Measurement
1	Ganod	Bhadar	21 39 53	70 10 52	SRG	GDS	WQ	Silt lab	Staff G	Wading, boat with cable, float

2.6.6 Data availability

Sl. No	Site name	Rain fall	Discharge	Thrice daily water level	Hourly water level (for Monsoon period only)	Sedi-ment	Water quality
1	Bhadar at Ganod GDS WQ	June-81	Nov -70	Nov-70	June -71	July -73	July -77

Plate-2.6.2

Bhadar Basin

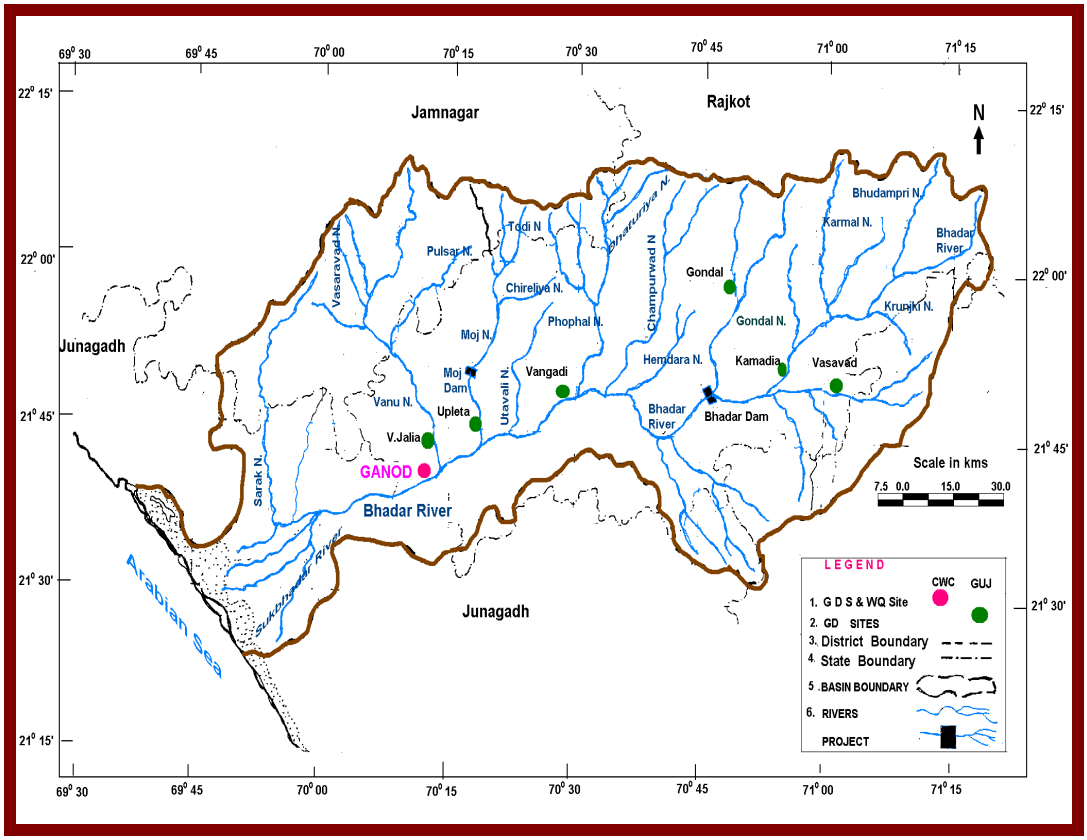
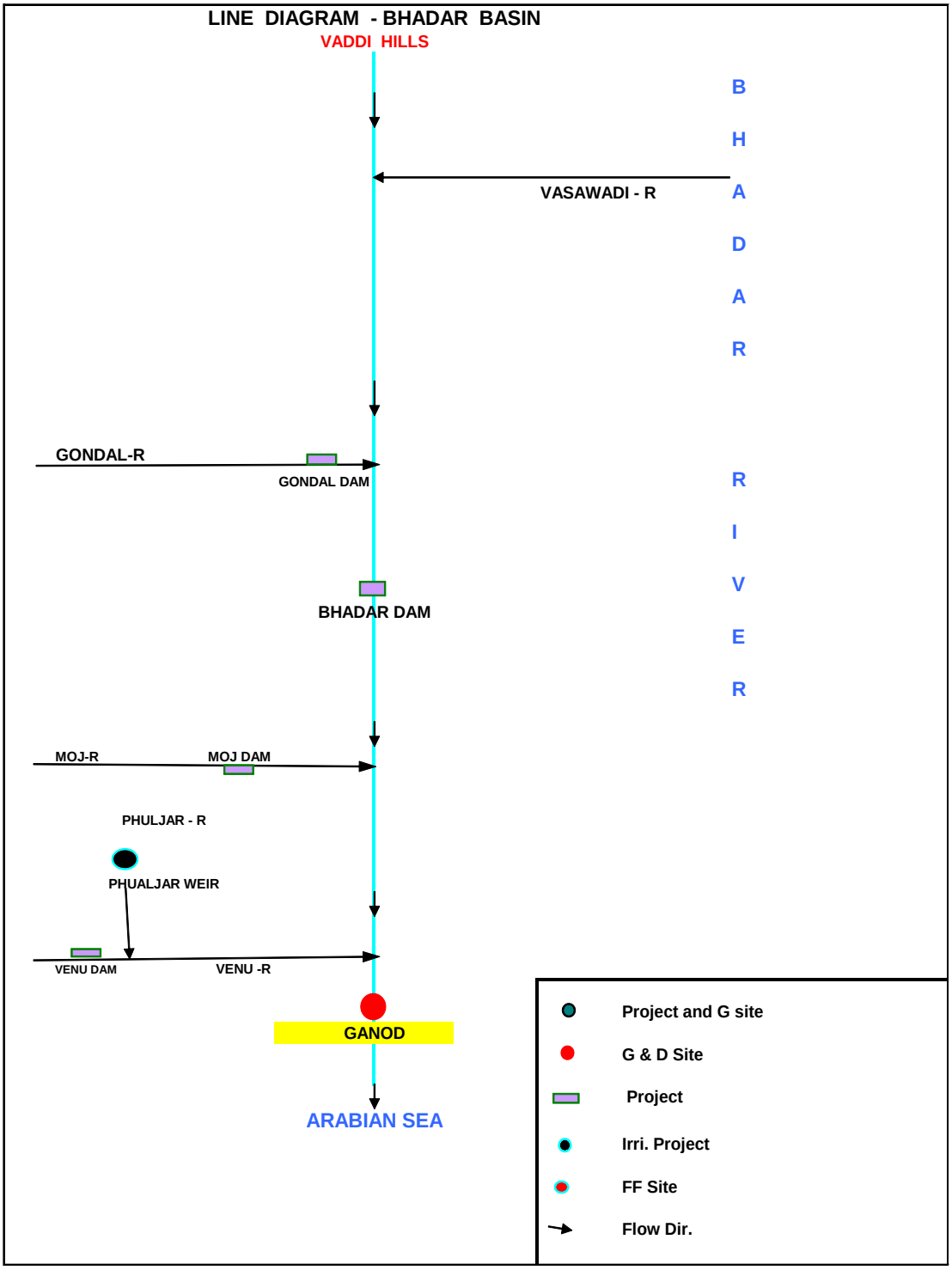


Plate-2.6.2


LINE DIAGRAM - BHADAR BASIN
VADDI HILLS
B
H
A
D
A
R
VASAWADI - R
GONDAL-R
GONDAL DAM
R
I
V
E
R
BHADAR DAM
MOJ-R
MOJ DAM
PHULJAR - R
PHUALJAR WEIR
VENU DAM
VENU -R
GANOD
ARABIAN SEA
Project and G site
G & D Site
Project
Irri. Project
FF Site
Flow Dir.

2.7 Machhu Basin

2.7.1 Geographical description of the Basin

Machhu river rises in the hills of Jasdan near village Khokhara in Chotila taluk of Surendranagar districts at an elevation of 220 m above m.s.l. This is one of the north flowing rivers of Saurashtra in Gujarat state. The Machhu basin is situated between 22^0 10 to 23^0 10' north latitude and 70^0 40' to 71^0 15' east longitude. The river Machhu originates from the hill ranges of Jasdan Sardar and Mandva in Rajkot district and Chotila in Surendranagar district and flows in north westerly direction along the district boundry of Surendranagar and Rajkot upto village Beti and then flows mostly towards north in Rajkot district and finally disappears near Malia in the little Rann of Kachchh. Machhu alongwith its tributaries flows 52 % in the hilly area and 48 % in plain region. The River makes fertile areas of Malia, Morbi, Wankaner, Jasdan and Rajkot taluks of Rajkot districts and part of Chotila taluk in Surendranagar district. Machhu drains an area of 2515 sq km out of which more than 75 % lies in Rajkot district. Basin map is enclosed as **Plate -2.7.1**

The district wise distribution is shown as below

Name of district	**Drainage area sq km**	**% of total**
1. Rajkot	1924	76.51
2. Surendranagar	591	23.49
Total	2515	100.00

2.7.2 Description of River system

The total length of this north flowing river from its origin to its outfall into the little rann of Katchch is 141.75 km. Machhu receives several tributaries on both the banks. There are 6 major tributaries having length more than 25 km out of which 4 tributaries namely Jamburi, Benia, Machhori and Maha feed from the right and the remaining 2 tributories namely Beti and Asoi from the left. The drainage system on the right bank of Machhu is more extensive as compared to the left bank.

The Beti, Asoi, Machhori and Maha, the 4 important tributaries together account for nearly 42.52% of the total catchment area of Machhu. Maha, the principal tributari, rises from Rampura in Chotila taluk of Surendranagar district and drains in north western direction and

fertiles Surendranagar and Rajkot districts and joins main stream Machhu about 1.6. km downstream of Panchaisa village.

Machhori the another important tributari also rises from Chotila taluka and drains towards north direction and meets the main stream about 8.5 km downstream of wankaner in Rajkot district. Asoi tributari rises from the hilly region of village vanjhara of wankaner taluka and drains towards north direction and meets the main stream just upstream of village derali.

The catchment area, length and elevation of sources of important tributaries are given below.

Sl.no.	Name of River	Bank	Elevation of source above m.s.l. (m)	Length (km)	Catchment area (sq km)
1	Machhu	Main	220	141.75	2515.00
2	Beti	Left	280	28.00	235.69
3	Jampuri	Right	300	27.36	119.14
4	Bania	Right	300	27.36	113.96
5	Machhori	Right	260	26.00	140.62
6	Asoi	Left	140	25.75	197.84
7	Maha	Right	200	45.06	507.64

A line diagram of river system giving information of Machhu Basin, its tributaries and sub tributaries etc. indicating the stations showing diversions, flows at terminal sites is enclosed as **Plate -2.7.2.**

2.7.3 Climatic characterstics

The average rainfall in the Machhu Basin is 533.5mm. The south west Monsoon sets in by the middle of June and withdraws by the first week of October. Owing to the topographical characteristics, the climate is variable.

Temperature (°c) during year 2015-16

Gungan		
Year	Max	Min
2015-16	41	11

Mean annual rainfall in mm Machhu Basin CWC site

Name of site	Data available (No of years)	Average rainfall (mm)	Average no. of rainy days	Rainfall during water year 2015-16	No of rainy days 2015-16
Gungan	28	570	17	483.6	12

2.7.4 Description of the water storage / diversion structures

Medium irrigation projrcts in River Basin Machhu

At present there are five medium irrigation schemes completed in the catchment of Machhu.

1 Adhia irrigation scheme

2 Kuvadva irrigation scheme

3 Ghunda irrigation scheme

4 Machhora irrigation scheme

5 Vadsar and Amarsar irrigation scheme.

There are two important irrigation schemes viz Machhu i & Machhu ii. Machhu irrigation scheme no. 1 is on River Machhu in wankaner taluka of distt. Rajkot. The gross storage capacity of this dam at frl is 72.74 Mm^3, having 70.8 Mm^3 as effective storage capacity. The cost of this project is Rs.1.5404 crore.

Machhu irrigation scheme no.2 is on Machhu in Morbi taluka of distt. Rajkot.the gross storage capacity of this dam is 100.55 Mm^3, having 90.8 Mm^3 as effective storage capacity. The estimated cost of this project was 31.61 crore.

2.7.5 Streamflow data

Hydrological observations by CWC

In Machhu Basin, the central water commission is conducting hydrological observations i.e. Gauge and discharge observation at site Gungan .

The details of this site are given below:-

Sl.No.	**Name of site**	**Station code**	**Scheme**	**Type**
1.	Machhu at Gungan	01 02 03 001	N.n.w	GD

Salient features of sites maintained by CWC in Machhu Basin

Sl No	Name	Local River	Lat. N D M S	Long. E D M S	Stn Met	Stn. Gauge	Stn WQ	Silt lab	Type of gauge	Discharge Measurement
1	Gungan	Machhu	22 57 42	70 45 52	SRG	GD	---	--	Staff G	Wading, boat with cable,float

2.7.6 Data availability

Sl No	Site name	Rain fall	Discharge	Thrice daily water level	Hourly water level (for Monsoon period only)
1	Machhu at Gungan GD	June -88	Dec -70	Sep -70	Sep -70

Plate-2.7.1

Machhu Basin

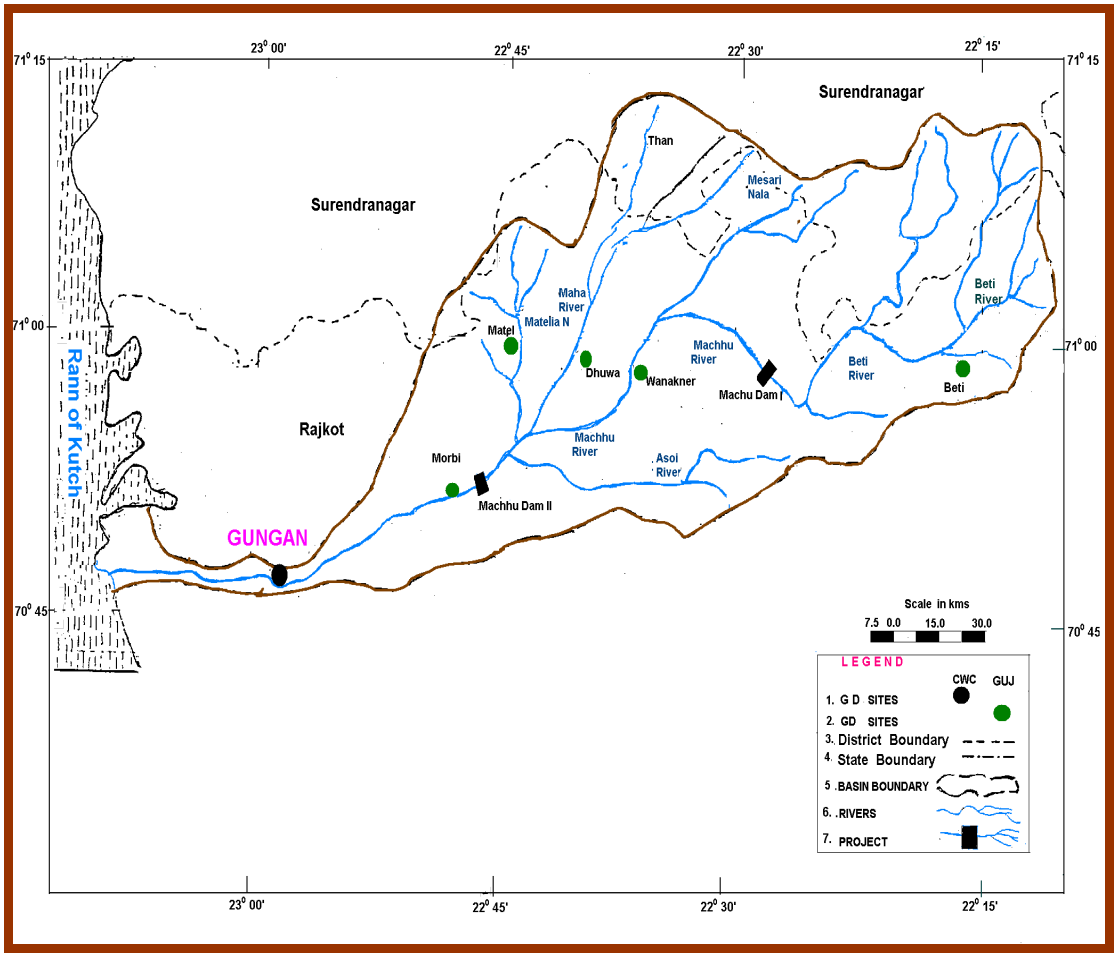
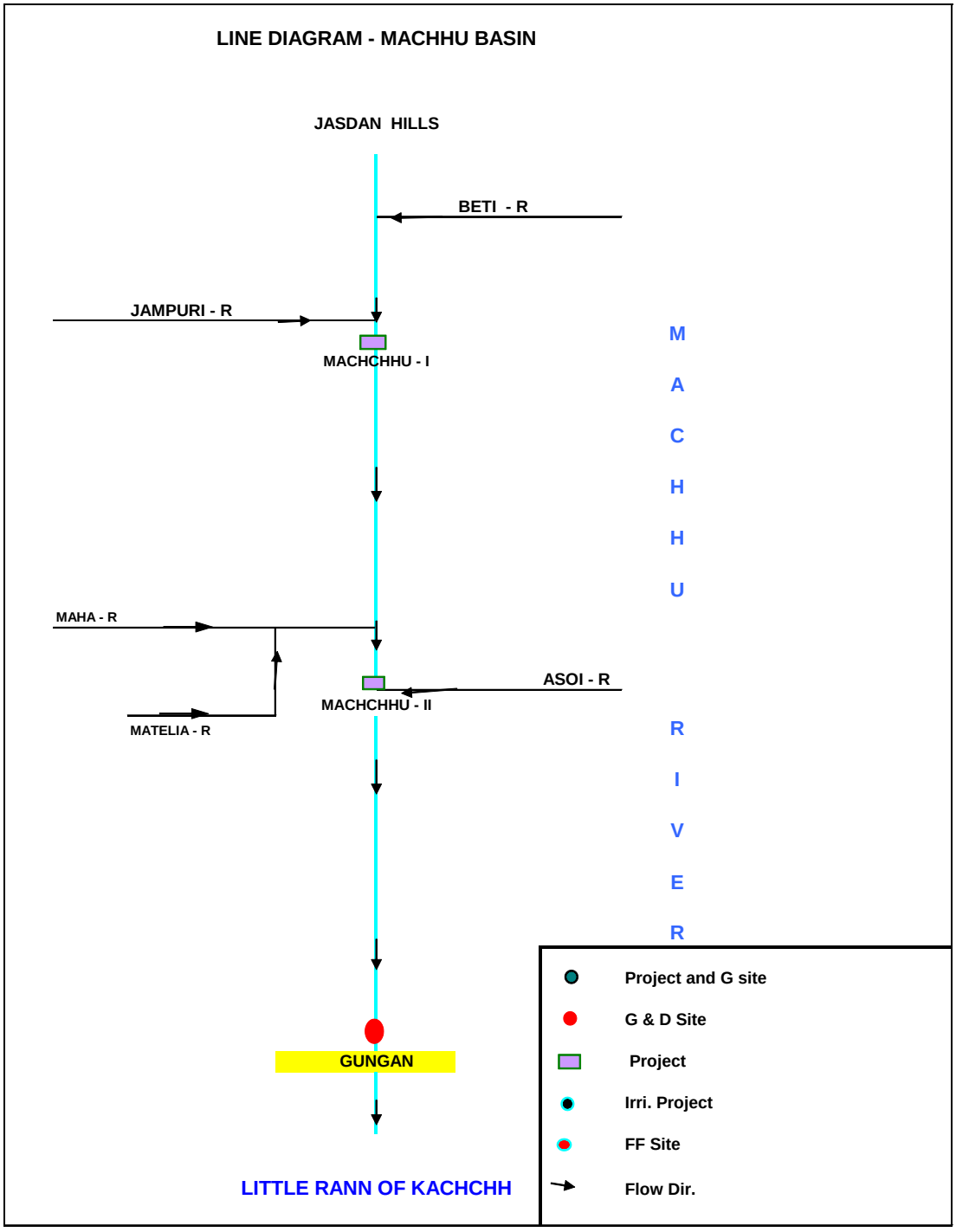


Plate-2.7.1


LINE DIAGRAM - MACHHU BASIN
JASDAN HILLS
BETI - R
JAMPURI - R
MACHCHHU - I
MAHA - R
ASOI - R
MACHCHHU - II
MATELIA - R
GUNGAN
LITTLE RANN OF KACHCHH
M A C H H U R I V E R
Project and G site
G & D Site
Project
Irri. Project
FF Site
Flow Dir.

2.8 Rupen Basin

2.8.1 Geographical description of the Basin

Rupen River originates from Taranga hill ranges near Kheralu taluka of Mehsana district in Gujarat at an elevation of 180 m above m.s.l. And decends in south western direction and travels through Mehsana district before it drains into little Rann of Kachchh. The Rupen Basin is a northern Basin of Gujarat and is situated between 23^0 25' to 24^0 00' north latitude and 71^0 30' to 72^0 46' east longitude approx. Basin map of Machhu Basin is enclosed is enclosed as **Plate -2.8.1**

2.8.2 Description of River system

Pushpavathi and Khari the two right bank tributaries of Rupen River, drains into the main channel. There is only one left bank tributary namely Khari. Hence the drainage system on the right bank of Rupen River is more extensive as compared to left bank area.

Pushpavathi and Khari are the two important tributaries which together drain nearly 24.6 % of the total catchment area of Rupen River. Pushpavathi is the principal tributary of Rupen rising from the hilly ranges upstream of balad village of kheralu taluk, in Mehsana district of Gujarat at an elevation of 183 m above m.s.l. Pushpavathi meets the main River Rupen at upstream of village Sapawada.The catchment area, length and elevation of sources of the above three tributaries are as shown below.

Sl.no.	Name of River	Bank	Elevation of source above m.s.l. (m)	Length (km)	Catchment area (sq km)
1	Rupen	Main	180	156	2500
2	Khari	Left	131	59	180
3	Pushpavati	Right	183	68	446
4	Khari	Right	53	46	170

A line diagram of River system giving information of Rupen Basin, its tributories and sub tributories etc indicating the stations showing diveRsions is enclosed as **Plate -2.8.2.**

2.8.3 Climatic characterstics

The south west Monsoon sets in the last week of June and withdraws by the end of September. Owing to the topographical characteristics the climate is variable.

Temperature (°c) during year 2015-16

Sapawada		
Year	Max	Min
2015-16	42	10

Mean annual rainfall in mm Rupen Basin CWC site

Name of site	Data available (No of years)	Average rainfall (mm)	Average no. of rainy days	Rainfall during water year 2015-16	No of rainy days 2015-16
Sapawada	25	595	17	336.6	15

2.8.4 Streamflow data

Hydrological observations by CWC

In Rupen Basin, the CWC is conducting hydrological observations at Sapawada.

The details of this site are given below.

Sl.no.	Name of site	Statin code	Scheme	Type
1.	Rupen at Sapawada	01 02 04 001	163 key	GD

Salient features of sites maintained by CWC in Rupen Basin

Sr No	Location Name	River	Lat. N D M S	Long. E D M S	Stn Met	Stn. Gauge	Stn WQ	Silt lab	Type of gauge	Mode of Discharge Measure-ment
1	Sapawada	Rupen	23 32 54	72 00 52	SRG	GD	--	----	Staff G	Wading, float

2.8.5 Data availability

Availability of gauge and discharge data of c.w.c sites in Rupen Basin.

Sl No	Site name	Rain fall	Discharge	Thrice daily water level	Hourly water level (for Monsoon period only)	Sediment	Water quality
1	Rupen at Sapawada	June '91	Aug '89	Aug '89	Aug '89	Not available	Not available

Plate-2.8.1

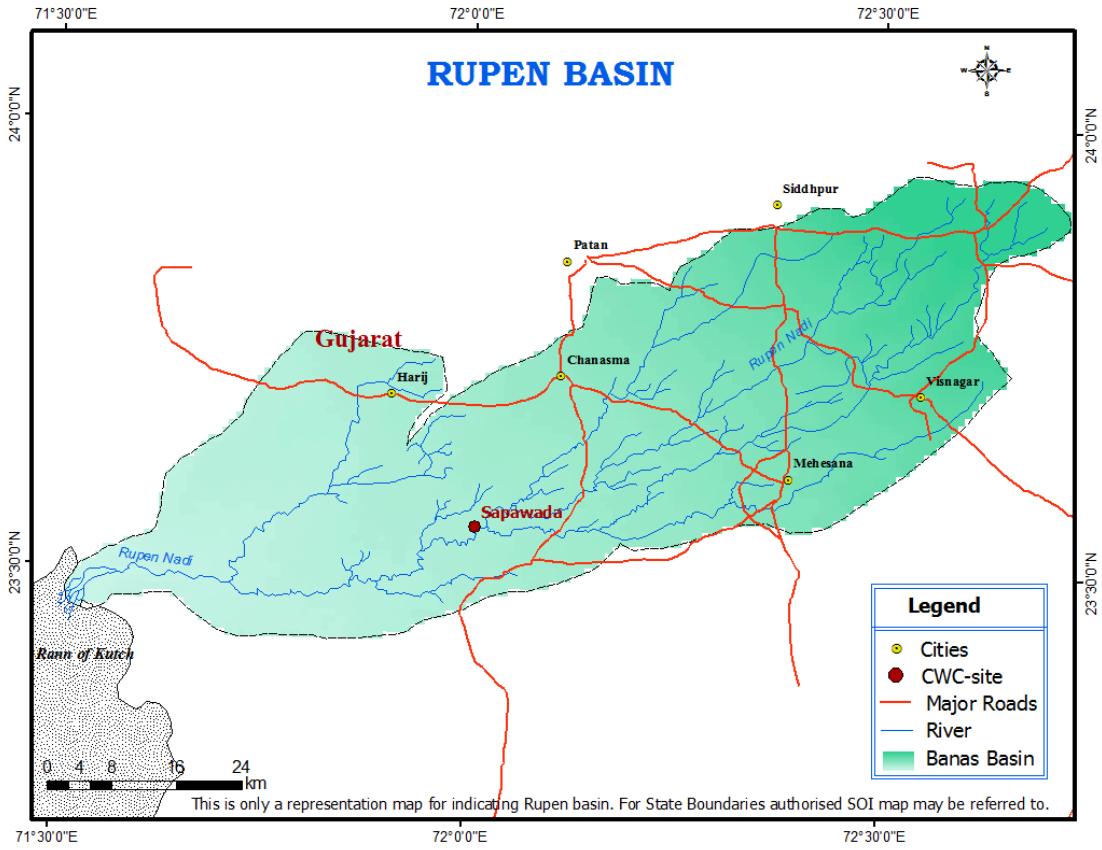
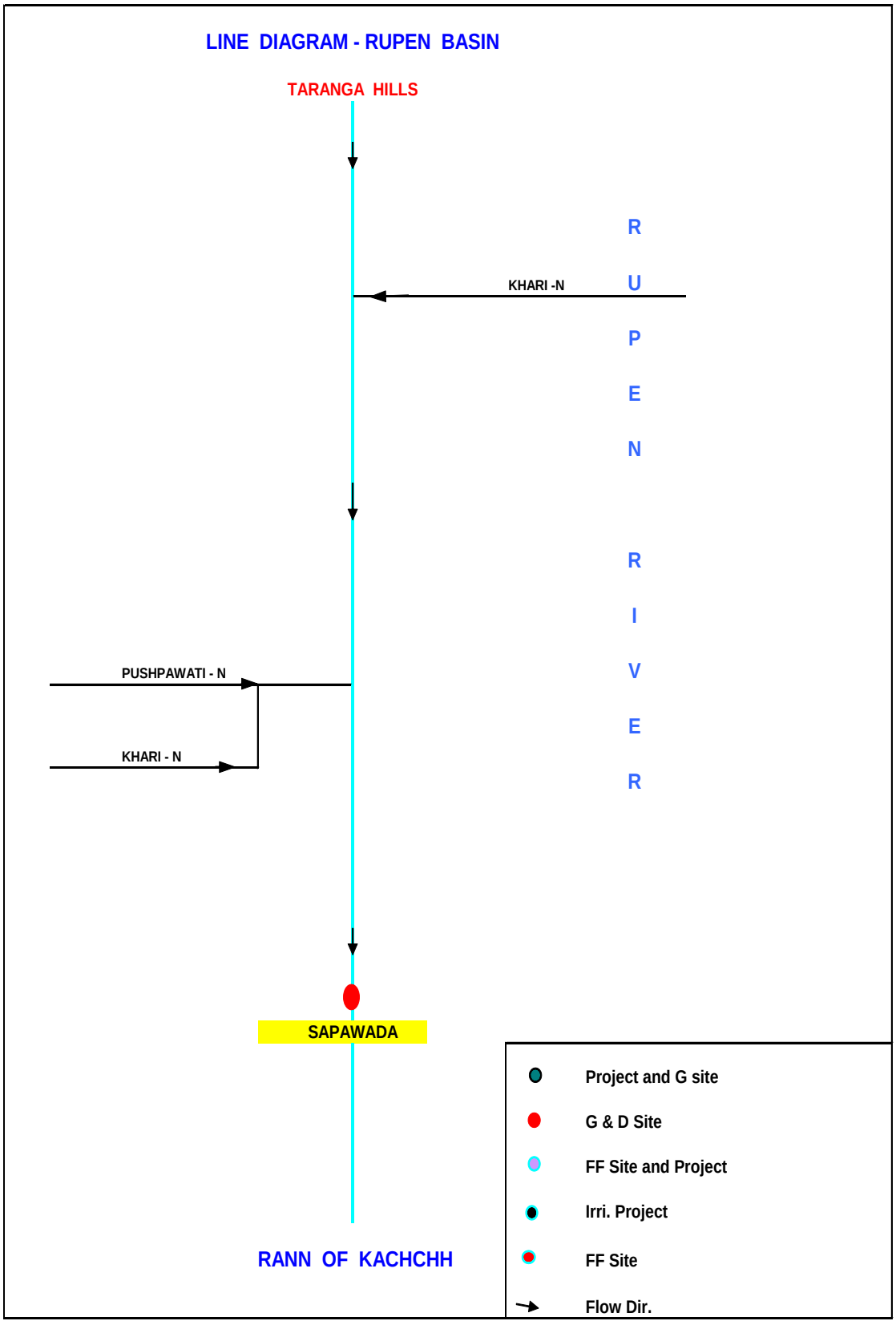


Plate-2.8.2


LINE DIAGRAM - RUPEN BASIN
TARANGA HILLS
KHARI -N
R
U
P
E
N
R
I
V
E
R
PUSHPAWATI - N
KHARI - N
SAPAWADA
RANN OF KACHCHH
Project and G site
G & D Site
FF Site and Project
Irri. Project
FF Site
Flow Dir.

2.9 Machhundri Basin

2.9.1 Geographical description of the Basin

Machhundri river originates from Gir Forest & meets in Arebian sea. Its length is 59 km. & catchment area 406 sq.km. Machhundri dam is situated on this river having 218 sq. km. catchment area. Basin map of Machhundri Basin is enclosed as **Plate -2.9.1**

2.9.2 Climatic characterstics

The south west Monsoon sets in the last week of June and withdraws by the end of September. Owing to the topographical characteristics the climate is variable.

Mean annual rainfall in mm Machhundri Basin CWC site

Name of site	Data available (No of years)	Average rainfall (mm)	Average no. of rainy days	Rainfall during water year 2015-16	No of rainy days 2015-16
Una	1	No enough data	-	701.8	34

2.8.4 Streamflow data

Hydrological observations by CWC

In Machhundri Basin, the CWC is conducting hydrological observations at Una.

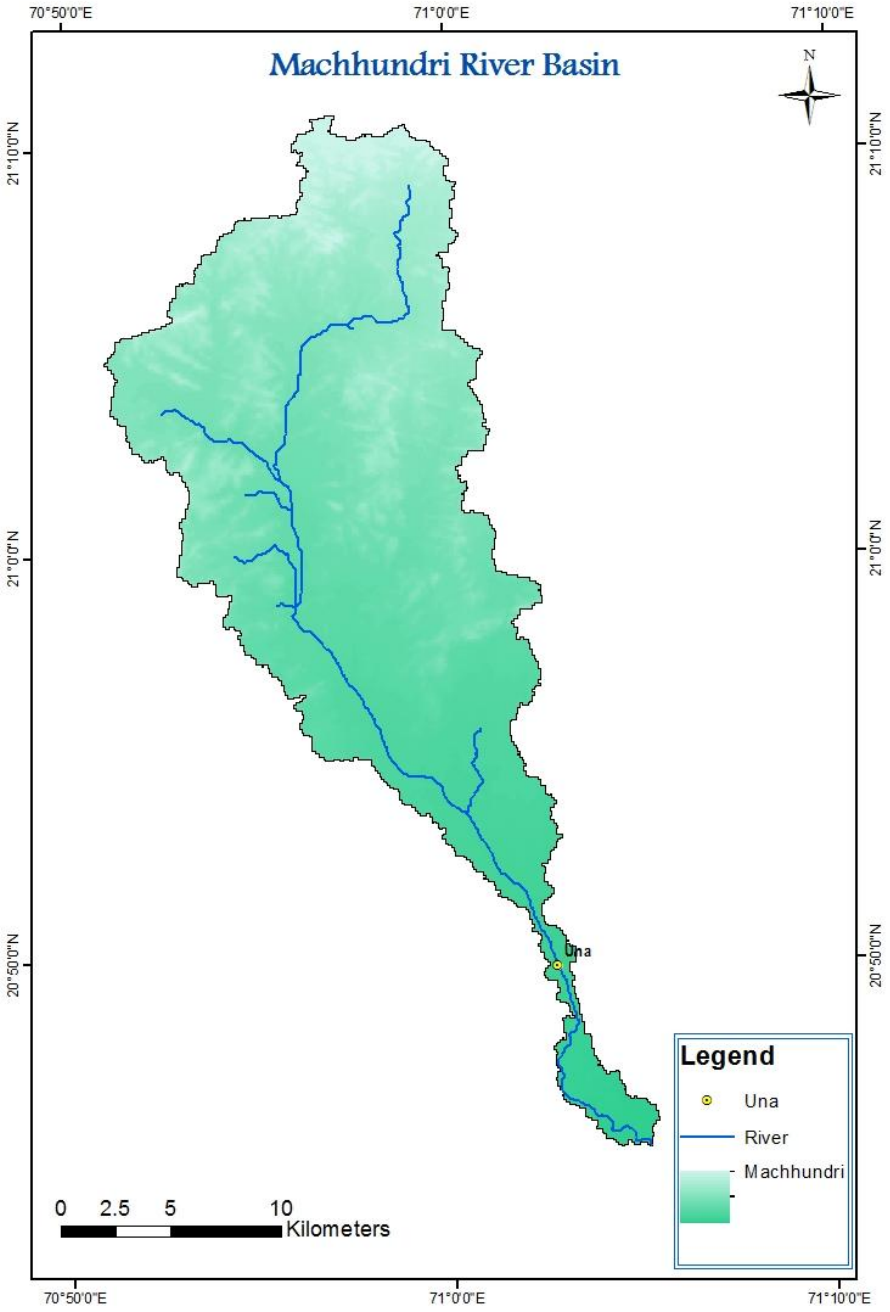
The details of this site are given below.

Sl.no.	Name of site	Statin code	Scheme	Type
1.	Machhundri at Una	01 02 14 001	2701DWRIS	GD

Salient features of sites maintained by CWC in Machhundri Basin

Sr No	Location Name	River	Lat. N D M S	Long. E D M S	Stn Met	Stn. Gauge	Type of gauge	Mode of Discharge Measurement
1	Una	Machhundri	20 49 42	71 02 51	SRG	GD	Staff G	Wading, float

Plate – 2.9.1



3.0 Hydrological observations by State Government

Source of information

Apart from the sites maintained by central water commission the state government of Gujarat, Madhya Pradesh, Rajasthan and Maharashtra are also conducting gauge and discharge observations in among 14 Basins. The Basin wise list of sites and the authority maintaining the sites are listed in the following para.

Basin wise list of sites

Sl. no	Name of Basin	Name of site		Site maintained by
1	Mahi Basin	1 Mahi	At Vasad	Sup. Engineer, WRI
		2 Bhadar	At Khanpur	Circle I, LD Engg.
		3 Bhadar	At Undva	College campus, nr.
		4 Machhan	At Davadia	Gujarat university,
		5 Machhan	At Limdi (Wankol)	Ahmedabad
		6 Hadaf	At Morva	&
		7 Kabutari	At Vadosar	Executive engineer
		8 Panam	At Sant Road	WRI divn., Bhadra
		9 Goma	At Kalol	Fort, Laldarwaja,
		10 Mahi	At Anklav	Ahmedabad Gujarat
		11 Mahi	At Borsad	
		12 Mahi	At Gamla	Superintending
		13 Goma	At Sureli	Engineer, Jakham
		14 Kun	At Khandia	Irrigation circle,
		15 Koliyari	At Rampur	Udaipur, Rajasthan
		16 Wankadi	At Wankadi	
		17 Jakham	At Dhariwad	Chief Engineer,
		18 Jakham	At Nagalia Pickup Weir	Mahi Bajaj Sagar
		19 Jakham	At Karmai Pickup Weir	project , Banswada,
		20 Mahi	At Mahi Dam	Rajasthan
		21 Mahi	At Chandangarh	
		22 Mahi	At Ratangarh	Chief Engineer,
		23 Mahi	At Bhairongarh	survey & Irrigation

		24 Anas	At Anas I	(major projects)
		25 Anas	At Anas Ii	Irrigation dept. E-3 /
		26 Pantalla	At Parwalia	28 - a, Arora colony,
		27 Bhunand	At Sangam	near bus stop II,
		28 Pampawati	At Larki	Bhopal, Madhya
		29 Undwa Nallah	At Ranisingh	Pradesh
	Note: Following River gauge stations are closed from 1st June 2006 *1 Bhadar at Vegadi 2 Aaji-iii at Tarana 3 Jolapuri at Jolapur*			

Name of Basin		**Name of site**	**Site maintained by**
2	Sabarmati Basin	1.Sabarmati At Gandhinagar(Borij) 2.Sabarmati At Subhash Bridge 3.Sabarmati At Derol Bridge 4.Sabarmati At Kheroj 5.Sabarmati At Balwa 6.Abarmati At Dharoil 7.Sabarmati At Kalol 8.Sabarmati At Kanewal 9.Sabarmati At Mhij 10.Sabarmati At Mansa 11.Sabarmati At Nallake 12.Sabarmati At Rasikpur 13.Sabarmati At Red Lazximipura 14.Siri At Ganpipali 15.Dhamini At Momanwas 16.Harnav At Khedbrahma 17.Harnav A Abhapur 18.Guhai At Kadiadra 19.Guhai At Rampur 20.Guhai At Khandiol 21.Vekri At Mathasur 22.Hathmati At Bhiloda	Supt,engineer, WRI circle-I, L.D.Engg.college campus near Gujarat University, Ahmedabad & Executive Engineer, WRI Division, Bhadra Fort, Laldarwaz, Ahmedabad (Gujarat)

		23.Hathmati At Balochpur 24.Hathmati At Himatnagar 25.Hathmati At Mankadi 26.Hathmati At Pal 27.Khari At Prntij 28.Khari At Raipur 29.Meshwo At Kabola 30.Meshwo At Mithajinamuwada 31.Majam At Ambaliyara 32.Majam At Modasa 33.Watrak At Dhabha 34.Watrak At Memdabad 35.Watrak At Bayad 36.Watrak At Meghraj 37.Watrak At Bempoda 38.Khari At Magodi 39.Warasi At Betawada 40.Mahor At Katlal 41.Mahor At Mahadevpura-Mahadevia 42.Shedi At Bilodra 43.Shedi At Dakor	

3	Luni Basin	1 Luni At Luni 2 Luni At Latoti 3 Luni At Alniawas 4 Sagi At Sewadi 5 Bandi At Gadi 6 Bandi At Santhu 7 Rel At Ramsen 8 Sukri At Leta 9 Jawai At Shivganj 10 Sukri At Ghana 11 Khardi At Pali	Executive Engineer Planning & Co - ordination Division I, Adarsh nagar, Raja park, Jaipur, Rajasthan

		12 Mithri At Auwa 13 Rediya At Singari 14 Sukri At Bagri 15Mithri- At Pipar Jojri 16 Lilri At Banjakudi	
4	Banas Basin	1 Banas At Roho 2 Banas At Deesa 3 Banas At Umari 4 Banas At Balundra 5 Banas At Dantiwada Dam 6 Banas At Gadh 7 Banas At Wav 8 Banas At Zerda 9 Sipu At Panthawada 10 Sipu At Bhakudar 11 Balaram At Chitrasani	Sup. Engineer, WRI Circle I, LD Engg. College Campus, near Gujarat University, Ahmedabad & Executive Engineer WRI divn., Bhadra Fort, Laldarwaja, Ahmedabad Gujarat
5	Shetrunji Basin	1 Shetrunji At talaja 2 Shetrunji At dhari 3 Shetrunji At gariyadhar 4 Shetrunji At gopnath 5 Shetrunji At jesar 6 Shetrunji At lathi 7 Rajwal At makhadka 8 kharo At nanipaniyari 9 satli At babapur	Sup. Engineer, WRI Circle I, LD Engg. College Campus, near Gujarat University, Ahmedabad & Executive Engineer WRI divn., Bhadra fort, Laldarwaja, Ahmedabad Gujarat
6	Bhadar Basin	1 Bhadar At Vangadi 2 Bhadar At Kamadhia 3 Bhadar At Chhaparvadi-Ii 4 Bhadar At Dhandhuka 5 Bhadar At Jasdan 6 Bhadar At Kukavav 7 Minsar At Rana-Kandorana 8 Venu Ii At Warjan Jaliya 9 Moj At Upleta 10 Gondali At Gondal 11 Vasawadi At Vasavad	Sup. Engineer, WRI Circle I, LD Engg. College Campus, near Gujarat University, Ahmedabad & Executive Engineer WRI Divn., Bhadra fort, Laldarwaja, Ahmedabad Gujarat
7	Machhu Basin	1 Machhu At Morbi 2 Machhu At Wankaner 3 Machhu At Beti 4 Machhu At Chotila 5 Asoi At Sindhavadar 6 Maha At Dhuwa 7 Matelia At Matel	Sup. Engineer, WRI Circle I, LD Engg. College campus, Near Gujarat University, Ahmedabad & Executive Engineer WRI Divn., Bhadra Fort, Laldarwaja, Ahmedabad Gujarat

8	Rupen Basin	1 Rupen At Delwada 2 Rupen At Valam Ashram 3 Rupen At Dhinoj 4 Rupen At Ranuj 5 Rupen At Viramgam 6 Pushpavati At Aithor 7 Khari At Zillia 8 Khari At Mehsana	Sup. Engineer, WRI Circle I, LD engg. College campus, Near Gujarat University, Ahmedabad & Executive Engineer WRI Divn., Bhadra Fort, Laldarwaja, Ahmedabad, Gujarat

3.1 Methodology: Streamflow measurement

3.1.1 Gauge measurement

Water level or stage of the River is measured as its elevation above the g t s datum. Water level measurement was conducted by reading non-recording gauges. A series of vertical staff gauges as per the specifications laid down in is 4080-1977 have been fixed at three sections at each site i.e. Upstream, station gauge and downstream. The gauge posts are of r.c.c/wooden/ metallic with cut and edge wateRs and are fixed securely in position by installing them in m-150 concrete blocks of suitable size. Enamelled gauge plate with marking in metric unit is fixed on the gauge posts with least count 0.005 m, out of the three gauge lines the central line is used as station gauge line and readings of the other two lines are used for calculating the surface slope. The gauges were read hourly during Monsoon season and three hourly i.e. 0800, 1300 and 1800 hRs., during non Monsoon season at station gauge line.

3.1.2 Discharge observation

Discharge observation is conducted once a day at 0800 hRs, at all the sites by area velocity method except on Sunday and holidays in non Monsoon period. However additional observations were conducted during floods to cover different stages, irrespective of holidays.The River width is generally divided into 15 to 25 segments based on the degree of accuracy as outlined in is: 1192-1981. The width of the River is measured by steel/metallic tape or wire rope stretched across the River with segment markings indicated thereon, when the River width is quite small and the flow depths permit wading. For larger width and deeper flow conditions and in unmanageable flood conditions segment points vertically are located by measuring the navigation craft with reference to pivot point and segment blocks constructed at sites.the depth measurement is carried out by using sounding rod for depths up to 3 metres and by using long bamboos for depths between 3 metres and 6 metres. For depths exceeding 6 metres sounding reel measurements at segment points are resorted to, and in Some cases, the depths are measured by echo sounder or are computed from the most recent x-sections of the

River.the velocity is measured as per is 3918 - 1976 by using a cup type current meter conforming to is 3910 - 1976. The current meter is lowered to the requisite depth i.e. 0.6 of total depth down the vertical at every segment point by suspension equipment as specified in is 6064 - 1981 and where the depth is less than 0.3 metres, the velocity is observed just below the water surface in medium and high stages with significant flow velocities, boats fitted with power engines are used. Measurements of velocity are sometimes carried out from the bridges when the River flow condition does not permit the boat to be kept stable for velocity observation. When none of the above procedures are possible, the velocity is measured by float observations.

The data observed as above at the site is entered in the prescribed standard format to compute the total River discharge and it is further scrutinised at various levels before finalisation.
The daily observed/estimated discharge data is presented in this book.

Equipment used for observation:

Sl. No	Name of equipment	By wading	By boat	Bridge	By float
1	Current meter	√	√	√	X
2	Pigmy current meter	√	X	X	X
3	Stop watch	√	√	√	√
4	Wading rod	√	X	X	X
5	Nylon rope & tag	√	X	X	X
6	Measuring tape	√	X	X	X
7	Protractor	√	√	√	X
8	Ranging rod	√	√	X	√
9	Sounding rod	√	√	X	X
10	Automatic battery counter	√	√	√	X
11	Thermometer	√	√	√	√
12	Prismatic compass	X	X	X	√
13	Balloon	X	X	X	√
14	Sounding cable with fish weight	X	√	X	X
15	Echo sounder	X	√	√	X
16	Bridge out fit	X	X	√	X
17	Boat out fit	X	√	X	X

3.1.3 Explanatory notes

Explanatory notes given here have been designed to assist in the data interpretation of hydrological parameters contained in the data presented. The notes are therefore, applicable in so far as the data presented in this book.

1. Water Year covers the period from June 1st of one calendar year to May 31st of next calendar year and includes one complete hydrological cycle.

2. Discharge is given in cubic metres per second.

3. Discharges given are daily observed / estimated discharges.

4. The zero of gauge is a datum level / RL Fixed for a given site, which is kept 1 or 2 m lower than the lowest water level recorded in a perennial stream. In a non - perennial stream, it is kept 1 or 2 m lower than the lowest bed level of the stream.

5. Maximum and minimum discharges are taken from the daily observed flows / estimated.

6. Runoff in "mm" is the notional depth of water in millimetres over the catchment area equivalent to annual runoff calculated at the discharge measurement station.

$$\text{Runoff (mm)} = \frac{\text{Annual runoff (Mm3)}}{\text{Catchment area (km}^2\text{)}} \times 1000$$

7. Peak and lowest flows correspond to the highest and lowest water levels recorded during the period of record.

8. Measuring authority refers to the field division responsible for the operation of the gauge station. The name of the division is abbreviated by taking first alphabet of the River name followed by alphabets "DN" for division. For example Mahi division is denoted by MDN. These abbreviations are given cross-reference in the list of abbreviations and symbols.

9. Gauging station code number is a unique nine-digit reference number, which facilitates retrieval of flow data in data bank. The first two digits denote the measuring authority. The third and fourth digits are the Basin/zone identifier and fifth and sixth digits are the independent River Basin identifier. The last three digits of the code number indicate gauging site no. which is given from origin to mouth.

11. The month and the year from which data are available in the data bank are indicated against the record available.

3.1.4 Method of presentation

The data presented in this book is processed discharge data obtained from application of SWDES/HYMOS software.

The stationwise hydrological data is presented comprising history sheet, daily flow table and pictorial summary.The sequence of hydrological station arranged from its outfall to origion giving inter-priority to an intermediate tribuetory station.

4.0 Hydrological data

The hydrological data presented hereby mainly consist of the following

History sheet

Its manly consist of some salient features of particular site as Site name, state, district, river basin, tributary, catchment area, latitude / logitude, opening / closing date for various types of data & maximum –minimum discharge values.

Data sheet

It consists of stage- discharge data (both observed & estimated from stage discharge curve for the season), for the current year with mean water level during the discharge observation and peak observed and computed discharge with corresponding water level with date during the year, lowest discharge with corresponding water level with date during the year, Peak discharge with corresponding water level with date since inception, Lowest discharge with corresponding water level with date since inception.

Stage discharge curve

It gives a relationship between the stage of the river and the corresponding discharge.

Annual run-off

It gives the value of Annual run off in MCM for all the years from the opening of the site.

Water level v/s time graph

Hourly observed water level for one to three important highest peak flood events of current Water Year covering the period well before the start and upto well beyond the completion of these flood events.

Charts / maps

Basin map showing sites / projects
The site-wise pre – Monsoon and post – Monsoon crossections
The site-wise Pie chart
Site-wise Bar charts
The site-wise hydrographs (flood events)

HISTORY SHEET

Water Year : 2015-16

Site	**:**	**Mahi at Khanpur**	**Code**	**:**	**01 02 13 012**
State	:	Gujarat	District		Anand
			Independent		
Basin	:	Mahi	River	:	Mahi
Tributary	:	Mahi	Sub Tributary	:	
Sub-Sub					
Tributary	:		Local River	:	Mahi
Division	:	Mahi Division, Gandhinagar	Sub-Division	:	Mahi Sub Divn., Kadana
Drainage Area	:	32510 Sq. Km.	Bank	:	Right
Latitude	:	22°31'55" N	Longitude	:	73°08'27" E
Zero of Gauge					
(m)	:	8.22 (m.s.l)	21/12/78	-	
		Opening Date	Closing Date		
Gauge	:	21/12/78			
Discharge	:	21/12/78			
Sediment	:	01/05/88			
Water Quality	:	01/01/79			

Annual Maximum / Minimum discharge with corresponding Water Level (m.s.l)

	Maximum			Minimum		
Year	**Q (cumecs)**	**WL (m)**	**Date**	**Q (cumecs)**	**WL (m)**	**Date**
1979-1980	6168	14.570	12/08/79	3.800	8.600	17/04/80
1980-1981	2417	14.005	01/09/80	5.400	8.450	06/04/81
1981-1982	9880	23.600	17/08/81	4.300	8.625	06/04/82
1982-1983	2121	13.605	19/08/82	5.000	8.800	29/03/83
1983-1984	4416	15.348	16/08/83	0.300	8.660	08/05/84
1984-1985	12880	21.810	20/08/84	9.200	8.850	28/05/85
1985-1986	1524	11.645	08/10/85	7.700	8.845	30/05/86
1986-1987	3652	15.570	16/08/86	6.200	8.685	05/04/87
1987-1988	5241	18.435	27/08/87	2.670	8.567	14/07/87
1988-1989	7515	19.295	06/08/88	8.300	8.760	13/04/89
1989-1990	2680	13.720	20/08/89	7.989	8.935	30/05/90
1990-1991	20127	26.320	24/08/90	7.754	8.704	04/07/90
1991-1992	10293	20.870	01/08/91	8.571	8.690	23/05/92
1992-1993	199.6	9.473	08/09/92	8.747	8.740	12/03/93
1993-1994	8391	19.295	18/07/93	5.800	8.770	06/07/93
1994-1995	16590	22.795	07/09/94	12.00	8.600	23/06/94
1995-1996	1022	10.920	31/07/95	6.500	8.940	24/03/96
1996-1997	7796	17.460	09/09/96	11.00	9.080	30/03/97
1997-1998	11956	21.370	02/08/97	7.740	8.935	25/05/98
1998-1999	5751	16.865	18/09/98	10.00	9.010	06/09/98
1999-2000	291.7	10.020	21/07/99	4.785	8.680	29/04/00
2000-2001	884.5	11.495	14/07/00	2.844	8.850	03/01/01
2001-2002	378.6	10.440	08/08/01	4.845	8.830	21/07/01
2002-2003	992.5	11.130	04/09/02	1.490	8.870	15/03/03
2003-2004	1677	12.210	27/09/03	1.800	8.850	15/06/03
2004-2005	9717	19.020	15/08/04	10.00	9.070	25/07/04
2005-2006	1675	12.750	03/08/05	15.80	8.770	24/04/06
2006-2007	31062	26.820	12/08/06	17.150	8.770	03/07/06
2007-2008	11480	21.235	10/07/07	15.05	8.720	21/05/08
2008-2009	441.7	10.690	13/08/08	10.01	8.700	23/04/09
2009-2010	465.4	10.850	31/08/09	5.203	8.690	18/05/10
2010-2011	1156	11.795	05/08/10	3.273	8.750	31/05/11
2011-2012	4362.8	15.240	13/09/11	2.371	8.470	29/05/12
2012-2013	12403.0	20.820	07/09/12	2.346	8.470	06/06/12
2013-2014	5348	16.695	03/08/13	7.011	8.52	07/06/13
2014-2015	4868	16.35	10/09/14	8.482	8.29	25/04/15
2015-2016	7091	16.14	29/07/15	9.978	8.37	19/05/16

Stage-Discharge Data for the period 2015 - 2016

Station Name : Mahi at Khanpur (01 02 13 012) **Division : Mahi Division, Gandhinagar**

Local River : Mahi **Sub-Division : Mahi Sub Divn., Kadana**

Day	Jun		Jul		Aug		Sep		Oct		Nov	
	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q
1	8.360	11.98	8.840	42.22	11.315	1087	8.560	24.62	8.670	30.19	8.480	16.80 *
2	8.370	13.07	8.630	25.84	10.510	549.8 *	8.550	24.75	8.550	22.16 *	8.490	17.02
3	8.380	12.34	8.490	19.09	10.410	483.9	8.590	27.64	8.500	20.87	8.500	18.66
4	8.380	12.27	8.460	17.40	10.360	584.2	8.555	24.49	8.540	21.35 *	8.500	17.25
5	8.410	14.32	8.460	15.41 *	10.310	554.5	8.520	24.11	8.610	23.74	8.490	18.89
6	8.430	15.12	8.450	14.77	10.455	673.4	8.610	27.41 *	8.610	24.14	8.500	17.15
7	8.430	13.46 *	8.470	17.77	11.730	1339	8.625	32.43	8.590	23.77	8.500	17.57
8	8.420	14.61	8.520	17.98	10.630	627.6	8.545	22.79	8.550	22.61	8.500	18.25 *
9	8.400	14.06	8.500	16.48	10.050	355.4 *	8.500	23.18	8.615	23.41	8.500	16.85
10	8.400	14.02	8.500	15.24	9.720	234.3	8.550	24.48	8.530	22.22	8.500	17.75
11	8.410	14.18	8.500	15.20	9.350	138.9	8.530	23.76	8.530	20.55 *	8.500	18.25 *
12	8.410	14.54	8.620	28.34 *	9.150	87.14	8.500	23.18	8.585	22.76	8.500	17.55
13	8.430	15.56	8.610	28.38	10.205	558.8	8.500	18.25 *	8.530	20.21	8.530	19.78
14	8.460	15.41 *	8.670	33.21	10.470	582.9	8.500	19.29	8.495	19.16	8.510	17.01
15	8.460	16.73	8.790	41.18	10.700	643.7 *	8.490	17.04	8.565	22.48	8.500	18.25 *
16	8.450	16.49	8.770	39.71	10.620	603.2 *	8.565	24.36	8.580	25.12	8.500	17.89
17	8.440	15.22	8.670	25.90	10.470	694.4	8.610	27.41 *	8.520	19.83	8.500	17.66
18	8.440	15.34	8.560	22.99 *	10.420	608.8	8.610	22.14	8.500	18.25 *	8.500	17.95
19	8.440	15.07	8.510	19.00 *	9.975	344.4	8.830	50.78	8.490	17.88	8.490	15.74
20	8.440	15.11	8.490	18.03	10.485	636.5	9.310	136.2 *	8.485	18.24	8.490	17.45
21	8.440	14.09 *	8.530	19.28	10.180	468.4	9.090	76.39	8.480	17.55	8.490	16.69
22	8.440	14.43	8.645	26.86	9.840	318.2	8.795	39.59	8.490	17.51 *	8.490	17.51 *
23	8.440	13.20	9.215	94.83	9.600	208.8 *	8.745	40.60	8.530	20.19	8.500	17.97
24	8.450	17.41	9.155	78.73	9.530	188.0	8.645	29.87	8.510	19.00 *	8.500	14.94
25	8.600	24.99	9.040	91.61	9.210	113.2	8.620	28.34 *	8.490	17.51 *	8.490	17.51 *
26	9.845	248.7	9.080	90.43 *	9.035	75.53	8.600	24.22	8.490	17.22	8.490	16.10
27	9.510	143.1	9.195	93.21	8.975	66.71	8.760	43.22 *	8.490	19.36	8.490	16.29
28	9.180	109.1 *	10.170	339.6	8.870	60.09	8.780	46.03	8.490	18.29	8.490	16.41
29	8.895	53.92	16.140	7091 #	8.875	59.18	8.760	36.32	8.540	19.63	8.490	17.51 *
30	8.800	43.96	12.930	2377 #	8.710	37.52 *	8.645	28.94	8.510	19.04	8.490	16.64
31			12.075	1405	8.595	29.22			8.485	17.13		
Ten-Daily Mean												
I Ten-Daily	8.398	13.53	8.532	20.22	10.549	648.9	8.561	25.59	8.576	23.45	8.496	17.62
II Ten-Daily	8.438	15.37	8.619	27.19	10.184	489.9	8.644	36.24	8.528	20.45	8.502	17.75
III Ten-Daily	8.860	68.28	10.380	1064	9.220	147.7	8.744	39.35	8.500	18.40	8.492	16.76
Monthly												
Min.	8.360	11.98	8.450	14.77	8.595	29.22	8.490	17.04	8.480	17.13	8.480	14.94
Max.	9.845	248.7	16.140	7091	11.730	1339	9.310	136.2	8.670	30.19	8.530	19.78
Mean	8.565	32.39	9.216	393	9.960	419.8	8.650	33.73	8.534	20.69	8.497	17.38

Annual Runoff in MCM = 2692 Annual Runoff in mm = 83

Peak Observed Discharge = 7091 cumecs on 29/07/2015 Corres. Water Level :16.14 m

Lowest Observed Discharge = 9.978 cumecs on 19/05/2016 Corres. Water Level :8.37 m

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff

Stage-Discharge Data for the period 2015 - 2016

Station Name : Mahi at Khanpur (01 02 13 012) **Division : Mahi Division, Gandhinagar**

Local River : Mahi **Sub-Division : Mahi Sub Divn., Kadana**

Day	Dec		Jan		Feb		Mar		Apr		May	
	W.L	Q	WL	Q	WL	Q	WL	Q	WL	Q	WL	Q
1	8.490	16.95	8.470	17.20	8.460	16.91	8.480	14.57	8.470	17.36	8.420	12.84 *
2	8.490	17.56	8.470	16.83	8.460	15.57	8.480	14.18	8.470	16.81	8.420	12.34
3	8.490	17.34	8.470	16.10 *	8.460	15.53	8.470	15.43	8.470	16.10 *	8.420	12.34
4	8.490	18.19	8.470	16.64	8.450	15.67	8.470	15.65	8.490	16.81	8.420	12.49
5	8.490	17.21	8.470	17.79	8.450	15.45	8.470	13.88	8.490	16.37	8.420	12.41
6	8.490	17.51 *	8.470	17.15	8.450	15.47	8.450	14.74 *	8.480	16.47	8.420	13.35
7	8.490	15.92	8.470	17.26	8.450	14.74 *	8.430	13.06	8.480	16.76	8.420	13.16
8	8.490	17.18	8.470	17.65	8.450	15.58	8.450	14.04	8.460	15.12	8.440	14.09 *
9	8.490	16.70	8.470	17.45	8.450	14.39	8.470	15.14	8.450	12.79	8.460	14.95
10	8.490	16.62	8.470	16.10 *	8.450	13.70	8.470	15.52	8.450	14.74 *	8.460	14.95
11	8.490	16.15	8.470	16.99	8.450	13.44	8.470	16.28	8.450	15.17	8.460	18.00
12	8.480	15.82	8.470	17.53	8.460	13.89	8.470	16.30	8.450	14.78	8.460	17.45
13	8.480	16.80 *	8.470	16.40	8.460	13.77	8.480	16.80 *	8.450	14.83	8.460	15.92
14	8.470	15.71	8.470	16.10 *	8.460	15.41 *	8.470	16.30	8.450	14.74 *	8.440	14.04
15	8.470	15.64	8.470	16.66	8.460	15.17	8.470	16.24	8.450	15.04	8.440	14.09 *
16	8.470	16.62	8.470	17.11	8.470	18.40	8.490	16.42	8.450	14.97	8.440	14.07
17	8.470	16.83	8.470	16.10 *	8.470	17.49	8.480	15.94	8.450	14.74 *	8.390	10.55
18	8.470	16.67	8.470	15.87	8.480	17.05	8.480	15.37	8.450	14.44	8.390	10.59
19	8.470	16.95	8.470	16.27	8.480	16.97	8.480	14.74	8.450	14.17	8.370	9.978
20	8.470	16.10 *	8.470	16.11	8.460	16.86	8.470	16.10 *	8.450	14.74 *	8.370	10.36
21	8.470	16.96	8.460	16.16	8.480	16.80 *	8.470	15.22	8.460	14.22	8.370	9.970 *
22	8.470	16.87	8.450	16.38	8.480	17.03	8.470	15.29	8.450	14.50	8.390	11.07 *
23	8.470	16.86	8.450	16.04	8.480	16.36	8.470	15.06	8.450	14.00	8.420	13.11
24	8.470	16.10 *	8.460	15.41 *	8.480	16.27	8.470	16.10 *	8.450	14.74 *	8.440	13.46
25	8.470	16.10 *	8.450	16.12	8.480	17.07	8.470	16.10 *	8.450	13.99	8.440	13.66
26	8.470	16.90	8.460	15.41	8.490	17.25	8.470	15.48	8.420	10.85	8.440	13.29
27	8.470	16.10 *	8.460	16.93	8.480	16.23	8.470	16.10 *	8.410	11.45	8.440	13.16
28	8.470	16.97	8.460	17.07	8.480	16.80 *	8.470	15.90	8.410	11.04	8.440	13.29
29	8.470	17.67	8.460	16.56	8.480	15.51	8.470	16.15	8.420	11.30	8.450	14.74 *
30	8.470	16.93	8.460	16.78			8.470	16.28	8.420	12.40	8.460	13.59
31	8.470	17.45	8.460	15.41 *			8.470	16.38			8.460	13.49
Ten-Daily Mean												
I Ten-Daily	8.490	17.12	8.470	17.02	8.453	15.30	8.464	14.62	8.471	15.93	8.430	13.29
II Ten-Daily	8.474	16.33	8.470	16.51	8.465	15.84	8.476	16.05	8.450	14.76	8.422	13.50
III Ten-Daily	8.470	16.81	8.457	16.21	8.481	16.59	8.470	15.82	8.434	12.85	8.432	12.98
Monthly												
Min.	8.470	15.64	8.450	15.41	8.450	13.44	8.430	13.06	8.410	10.85	8.370	9.970
Max.	8.490	18.19	8.470	17.79	8.490	18.40	8.490	16.80	8.490	17.36	8.460	18.00
Mean	8.478	16.75	8.465	16.57	8.466	15.89	8.470	15.51	8.452	14.52	8.428	13.25

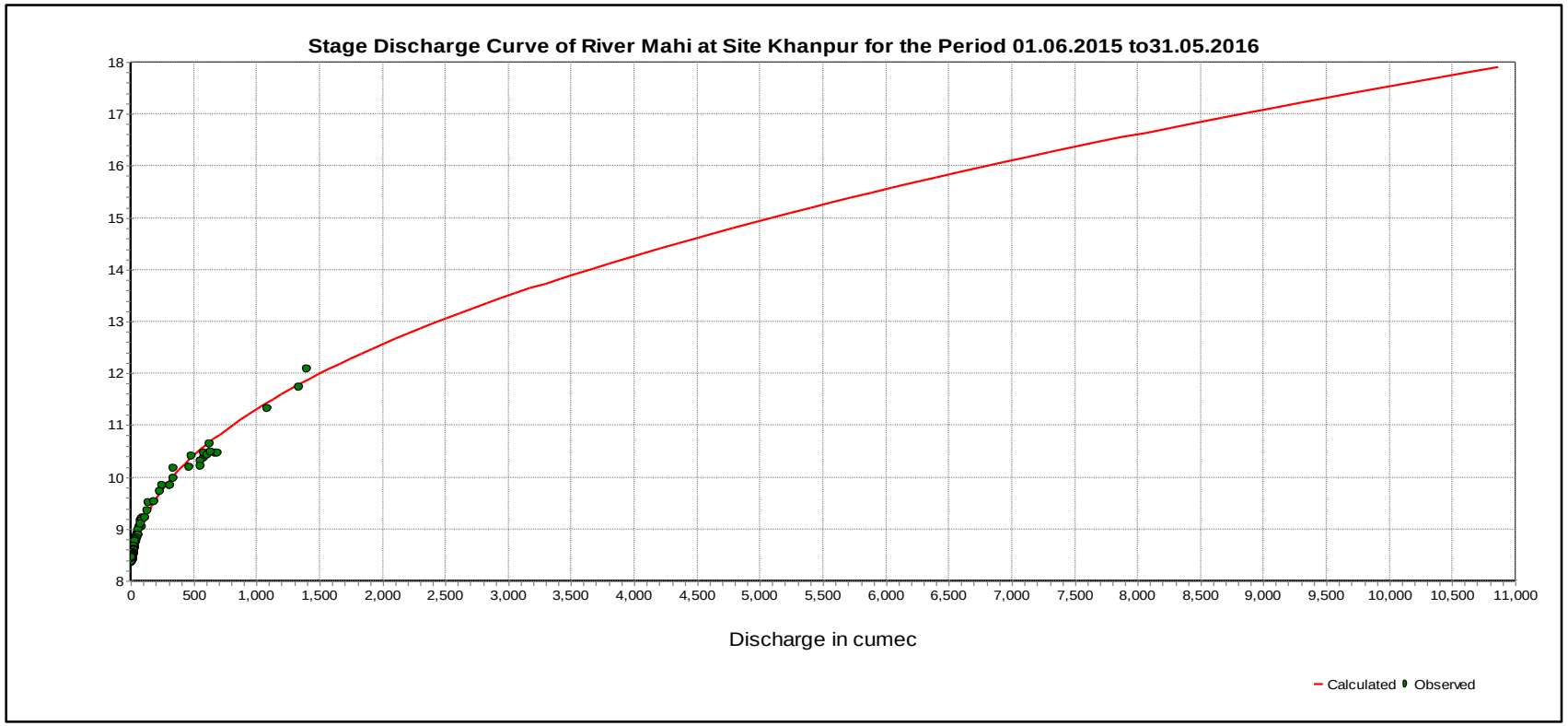
Peak Computed Discharge = 643.7 cumecs on 15/08/2015 Corres. Water Level :10.7 m

Lowest Computed Discharge = 9.970 cumecs on 21/05/2016 Corres. Water Level :8.37 m

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff



Procedure - Standard

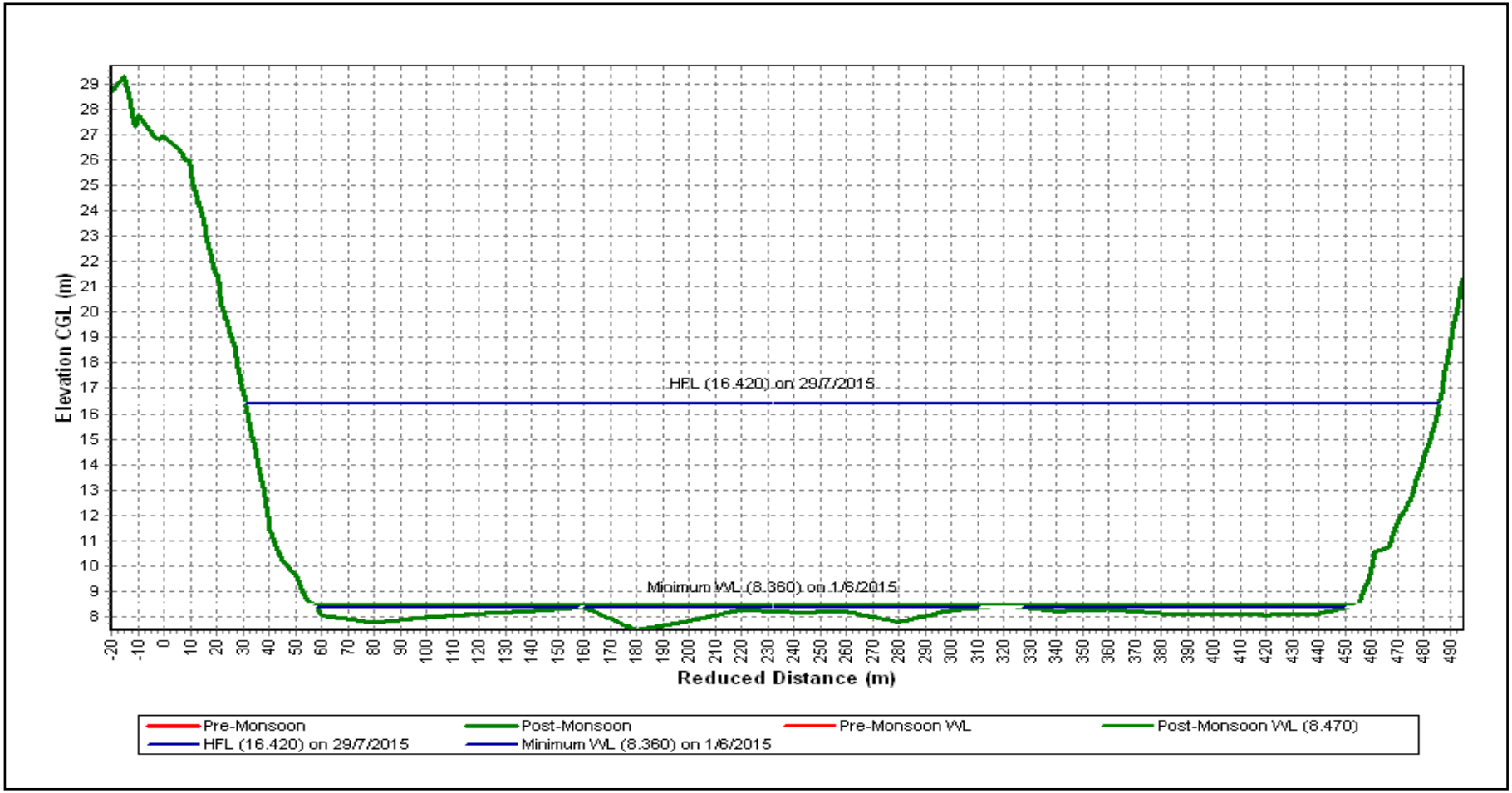
Equation Type - Power $Q=c*(h+a)^b$

LB	UB	a	b	c
8.3	18	-7.9601	2.1937	70.54

Pre-Monsoon & Post-Monsoon X-Section for Water Year : 2015-2016

Station Name : Mahi at Khanpur (01 02 13 012) **Division : Mahi Division, Gandhinagar**

Local River : Mahi **Sub-Division : Mahi Sub Divn., Kadana**



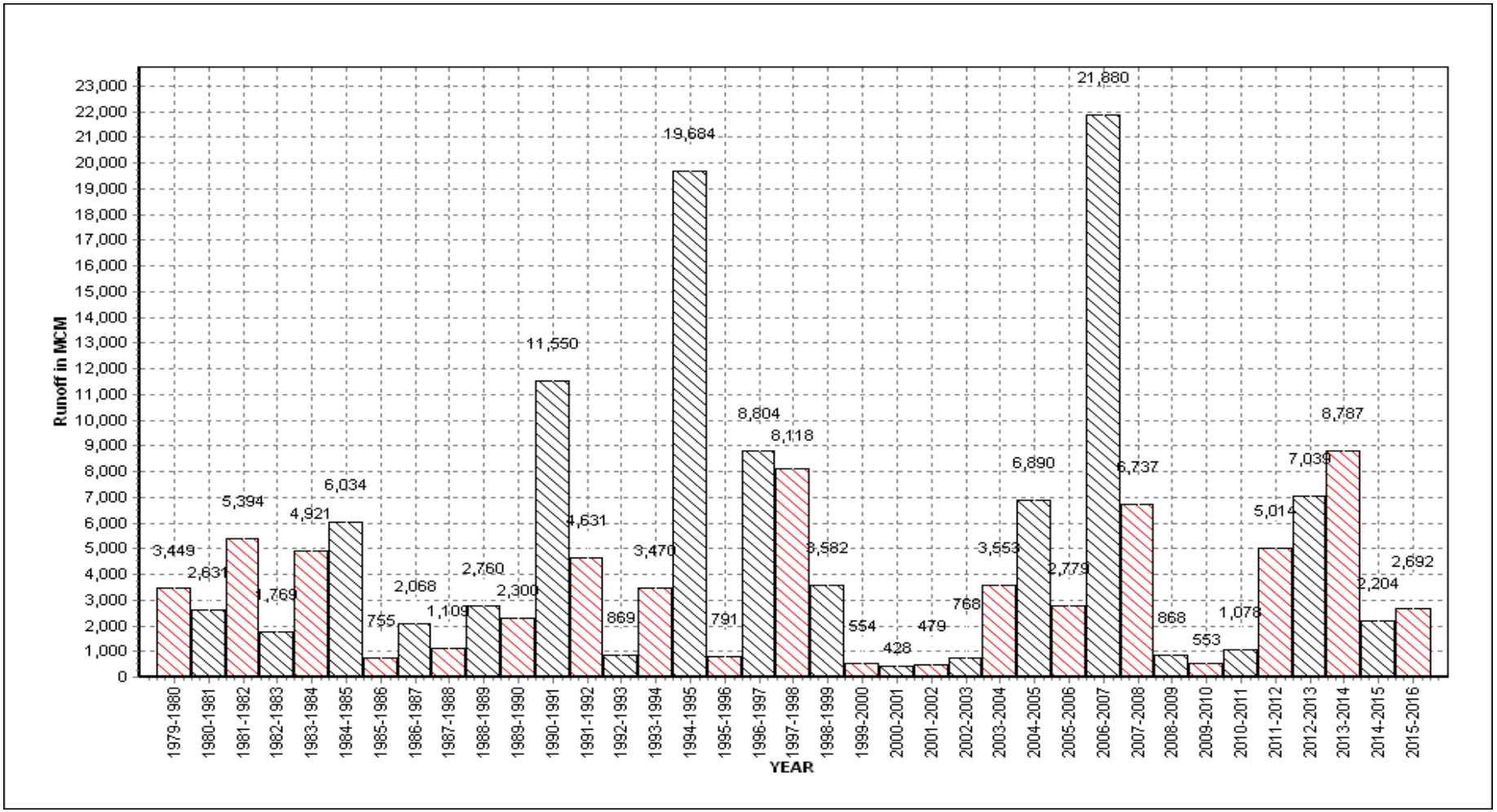
Historic Flood Level - 28.270 m on 24.08.1990 at 1600 hrs

Note: HFL marked on graph denotes Maximum Water Level observed during the Water Year 2015-16

Annual Runoff Values for the period: 1979 - 2016

Station Name : Mahi at Khanpur (01 02 13 012) **Division : Mahi Division, Gandhinagar**

Local River : Mahi **Sub-Division : Mahi Sub Divn., Kadana**



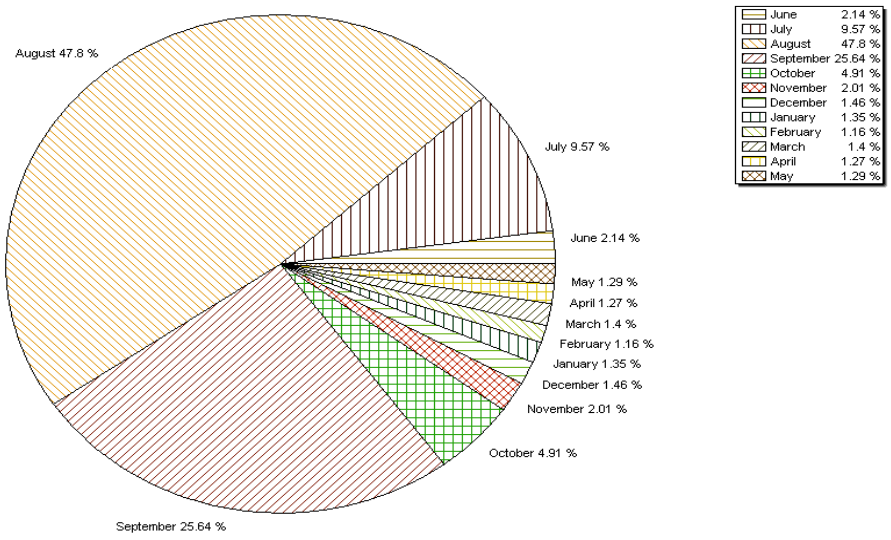
Note: Missing values have not been considered while arriving at Annual Runoff

Monthly Average Runoff based on period : 1979-2015

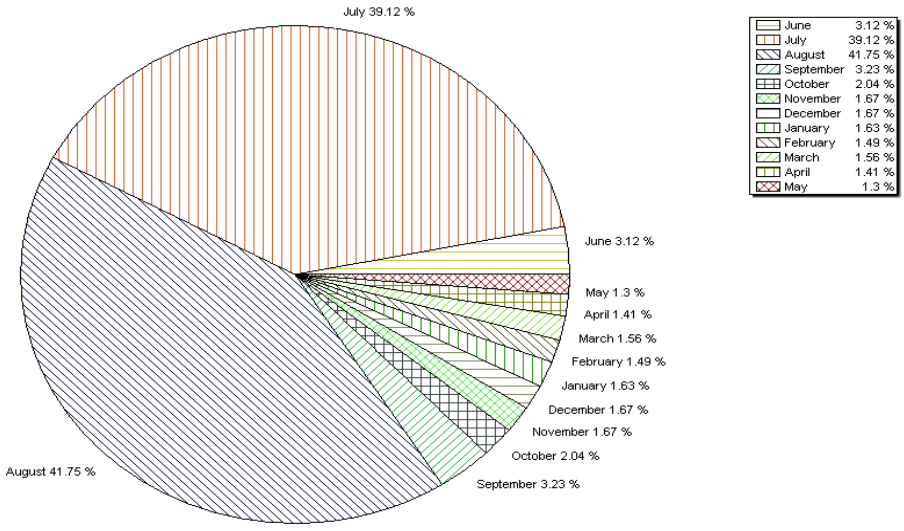
Station Name : Mahi at Khanpur (01 02 13 012) **Division : Mahi Division, Gandhinagar**

Local River : Mahi **Sub-Division : Mahi Sub Divn., Kadana**

Monthly Average Runoff based on period : 1979-2015



Monthly Runoff for the Year : 2015-2016

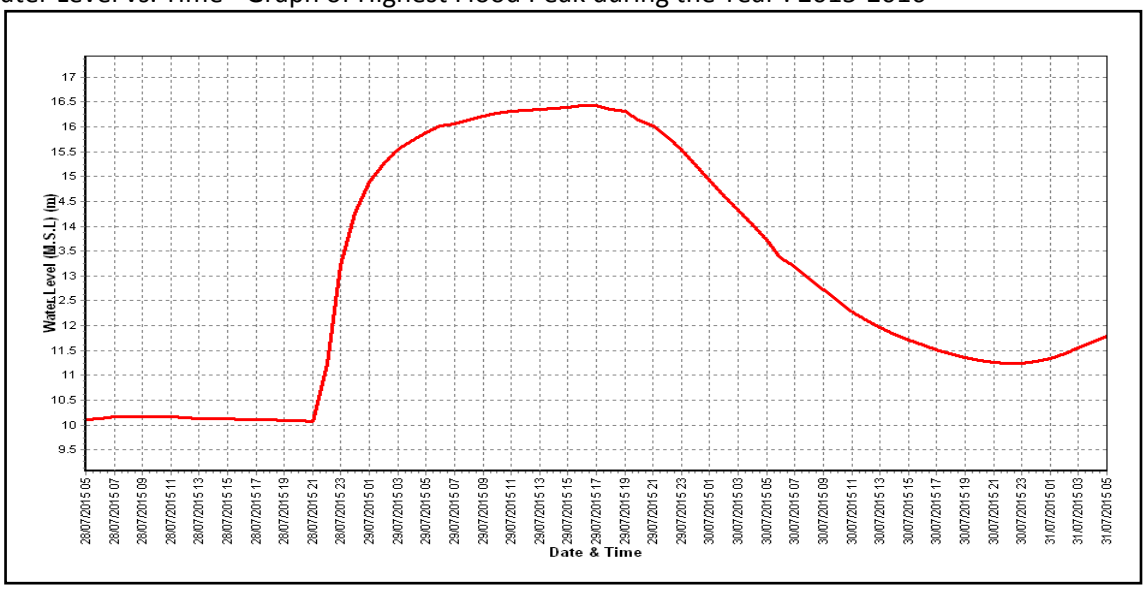


Water Level vs. Time - Graph of Highest Flood Peak during the Year : 2015-2016

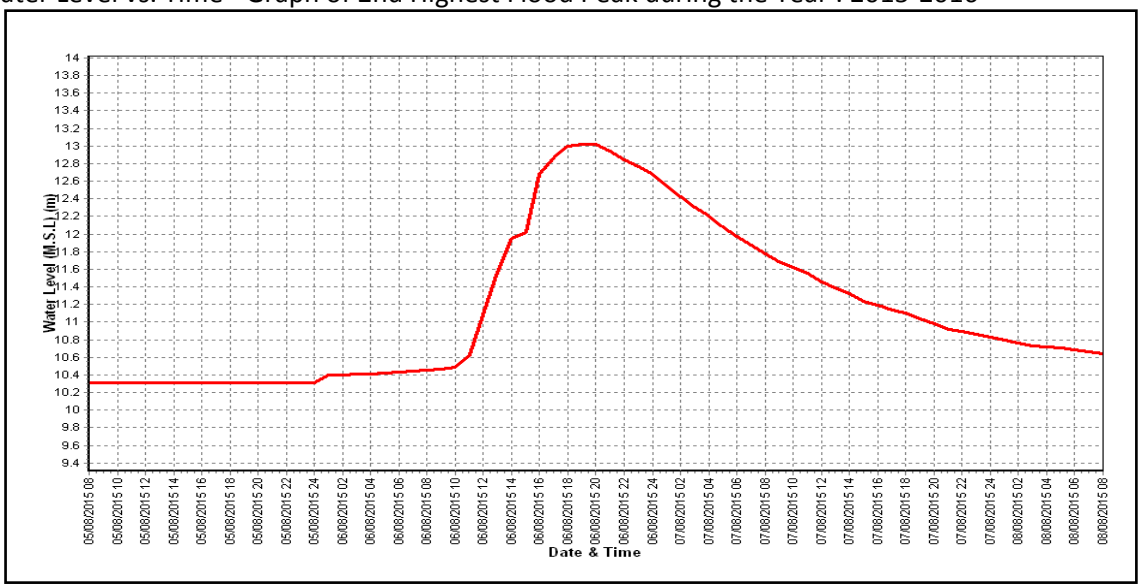
Station Name : Mahi at Khanpur (01 02 13 012) **Division : Mahi Division, Gandhinagar**

Local River : Mahi **Sub-Division : Mahi Sub Divn., Kadana**

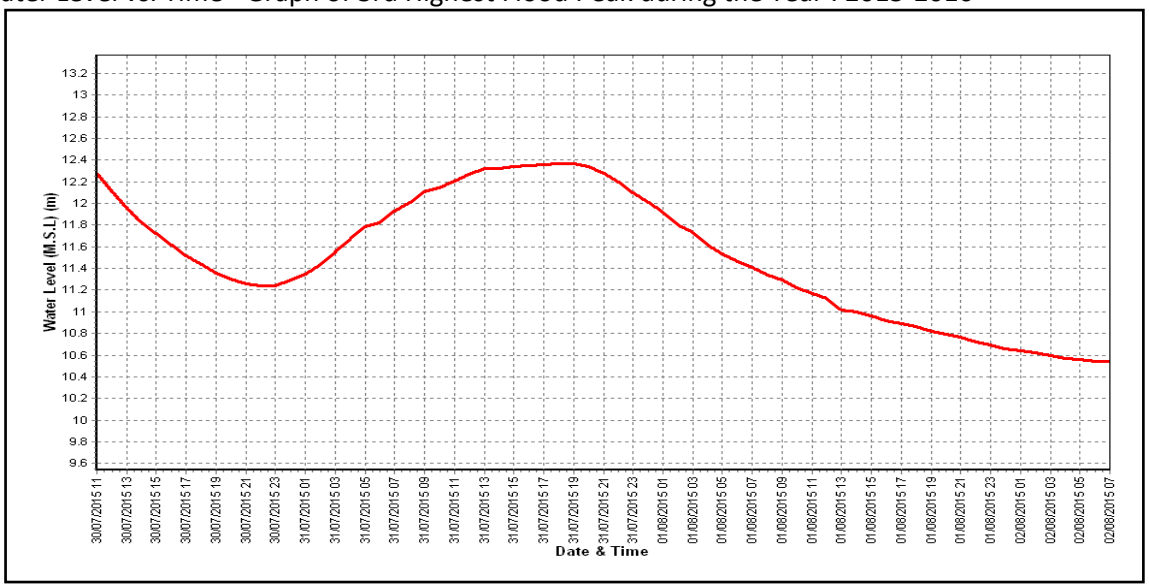
Water Level vs. Time - Graph of Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 2nd Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 3rd Highest Flood Peak during the Year : 2015-2016



Time Span: 72 Hrs

HISTORY SHEET

Water Year : 2015-16

Site	:	**Anas at Chakaliya**	**Code**	:	**01 02 13 007**
State	:	Gujarat	District		Panchmahal
Basin	:	Mahi	Independent River	:	Mahi
Tributary	:	Anas	Sub Tributary	:	
Sub-Sub Tributary	:		Local River	:	Anas
Division	:	Mahi Division, Gandhinagar	Sub-Division	:	Mahi Sub Divn., Kadana
Drainage Area	:	3121 Sq. Km.	Bank	:	Left
Latitude	:	23°02'58" N	Longitude	:	74°19'14" E
Zero of Gauge (m)	:	180 (m.s.l)	01/03/91	-	30/04/03
		215 (m.s.l)	01/05/03	-	
		Opening Date	Closing Date		
Gauge	:	13/02/91			
Discharge	:	13/02/91			
Sediment	:	-			
Water Quality	:	-			

Annual Maximum / Minimum discharge with corresponding Water Level (m.s.l)

	Maximum			Minimum		
Year	**Q (cumecs)**	**WL (m)**	**Date**	**Q (cumecs)**	**WL (m)**	**Date**
1991-1992	2583	188.125	31/07/91	0.000	181.360	29/04/92
1992-1993	674.3	183.925	07/09/92	0.000	180.890	15/06/92
1993-1994	3717	192.100	17/07/93	0.000	181.350	04/04/94
1994-1995	4128	190.000	07/09/94	0.000	181.440	17/04/95
1995-1996	1387	184.350	25/07/95	0.000	180.760	09/05/96
1996-1997	3933	188.525	28/07/96	0.000	181.400	22/04/97
1997-1998	3419	187.400	01/08/97	0.000	181.490	12/05/98
1998-1999	1505	182.320	26/09/98	0.000	181.160	11/06/98
1999-2000	223.0	182.950	20/06/99	0.000	181.350	13/01/00
2000-2001	60.00	182.200	13/08/00	0.000	181.370	14/11/00
2001-2002	1525	185.050	18/06/01	0.000	River Dry	23/01/02
2002-2003	4226	189.800	03/09/02	0.000	River Dry	25/03/03
2003-2004	3228	223.950	24/08/03	0.000	217.410	22/02/04
2004-2005	5874	224.250	14/08/04	0.000	217.250	01/03/05
2005-2006	6956	224.350	28/07/05	0.000	216.920	01/06/05
2006-2007	5474	226.900	11/08/06	0.000	River Dry	01/06/06
2007-2008	3227	224.650	08/08/07	0.000	217.360	01/06/07
2008-2009	691.0	219.700	12/08/08	0.000	217.020	12/05/09
2009-2010	736.2	220.675	23/07/09	0.000	218.200	04/11/09
2010-2011	630.5	220.550	31/08/10	0.000	218.060	20/05/11
2011-2012	258.5	219.700	02/09/11	0.000	River Dry	21/06/11
2012-2013	2858.0	226.200	06/09/12	0.000	218.150	01/06/12
2013-2014	1025	222.1	02/08/13	0.000	218.22	01/06/13
2014-2015	486.2	222.275	09/09/14	0.000	218.14	01/06/14
2015-2016	1032	222.76	28/07/15	0.000	218.33	17/06/15

Stage-Discharge Data for the period 2015 - 2016

Station Name : Anas at Chakaliya (01 02 13 007) **Division : Mahi Division, Gandhinagar**

Local River : Anas **Sub-Division : Mahi Sub Divn., Kadana**

Day	Jun		Jul		Aug		Sep		Oct		Nov	
	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q
1	218.280	0.000	218.390	2.290 *	219.360	139.8 #	218.490	8.621	218.450	7.836	218.380	1.760 *
2	218.280	0.000	218.380	1.760 *	219.200	109.5 #	218.520	11.40	218.440	5.510 *	218.380	2.096
3	218.280	0.000	218.370	1.280 *	219.000	75.07 #	218.610	14.79	218.440	6.501	218.380	2.024
4	218.280	0.000	218.360	0.840 *	218.890	57.92 #	218.590	14.61	218.440	5.510 *	218.380	1.929
5	218.280	0.000	218.350	0.470 *	219.970	273.9 #	218.540	11.89	218.430	6.352	218.380	1.808
6	218.280	0.000	218.350	0.470 *	219.170	123.2	218.520	12.14 *	218.430	6.271	218.380	1.739
7	218.280	0.000	218.350	0.470 *	219.070	86.67 #	218.500	8.893	218.430	6.067	218.380	1.611
8	218.280	0.000	218.330	0.000 *	219.000	75.07 #	218.480	8.434	218.430	5.858	218.380	1.760 *
9	218.280	0.000	218.330	0.000 *	218.900	59.43 *	218.460	8.065	218.420	5.555	218.380	1.760 *
10	218.280	0.000	218.330	0.000 *	218.850	52.80	218.440	7.937	218.420	5.130	218.380	1.760 *
11	218.280	0.000	218.330	0.000 *	218.820	51.46	218.420	7.248	218.420	4.120 *	218.390	2.290 *
12	218.280	0.000	218.320	0.000 *	218.800	47.82	218.410	6.769	218.410	4.883	218.390	2.067
13	218.340	0.000	218.320	0.000 *	218.780	39.70	218.430	4.800 *	218.410	4.768	218.390	2.010
14	218.350	0.470 *	218.320	0.000 *	218.850	56.34	218.420	7.226	218.400	4.515	218.380	1.656
15	218.350	0.470 *	218.320	0.000 *	218.810	46.35 *	218.420	7.202	218.400	4.324	218.380	1.760 *
16	218.350	0.470 *	218.320	0.000 *	218.830	49.17 *	218.430	7.191	218.400	4.111	218.380	1.621
17	218.330	0.000 *	218.310	0.000 *	218.800	46.92	218.440	5.510 *	218.400	3.532	218.380	1.612
18	218.340	0.170 *	218.310	0.000 *	218.760	38.23	218.440	7.721	218.390	2.290 *	218.380	1.545
19	218.340	0.170 *	218.330	0.000 *	218.770	38.85	218.440	7.707	218.390	3.050	218.380	1.377
20	218.340	0.170 *	219.380	130.9	218.730	28.68	218.440	5.510 *	218.390	2.934	218.380	1.332
21	218.340	0.170 *	219.100	111.6	218.700	25.11	218.460	8.079	218.390	2.853	218.380	1.253
22	218.340	0.170 *	218.980	57.91	218.670	23.40	218.470	8.381	218.390	2.290 *	218.380	1.760 #
23	218.330	0.000 *	218.970	53.95	218.650	25.79 *	218.460	8.077	218.390	2.594	218.380	1.189
24	218.330	0.000 *	218.870	40.52	218.640	17.49	218.450	7.918	218.390	2.290 *	218.380	1.124
25	218.340	0.170 *	218.680	27.44	218.630	15.35	218.460	7.010 *	218.390	2.290 *	218.370	1.280 *
26	218.390	2.290 *	223.000	1244 *	218.600	14.85	218.470	8.388	218.390	2.529	218.370	0.961
27	218.440	5.510 *	221.270	725.8	218.580	13.47	218.460	7.010 *	218.390	2.476	218.370	0.908
28	218.440	5.510 *	222.760	1032	218.550	12.13	218.460	8.024	218.380	2.281	218.370	0.895
29	218.440	5.510 *	220.710	469.4 #	218.530	10.97	218.450	7.799	218.380	1.760 *	218.370	1.280 *
30	218.400	2.860 *	220.100	469.4 #	218.510	11.22 *	218.450	7.637	218.380	1.760 *	218.370	1.139
31			219.700	305.9 #	218.500	9.284			218.380	1.991		
Ten-Daily Mean												
I Ten-Daily	218.280	0.000	218.354	0.758	219.141	105.3	218.515	10.68	218.433	6.059	218.380	1.825
II Ten-Daily	218.330	0.192	218.426	13.09	218.795	44.35	218.429	6.688	218.401	3.853	218.383	1.727
III Ten-Daily	218.379	2.219	220.195	412.5	218.596	16.28	218.459	7.832	218.386	2.283	218.374	1.179
Monthly												
Min.	218.280	0.000	218.310	0.000	218.500	9.284	218.410	4.800	218.380	1.760	218.370	0.895
Max.	218.440	5.510	223.000	1244	219.970	273.9	218.610	14.79	218.450	7.836	218.390	2.290
Mean	218.330	0.804	219.030	150.8	218.836	54.07	218.468	8.4	218.406	4.007	218.379	1.577

Annual Runoff in MCM = 597 Annual Runoff in mm = 191

Peak Observed Discharge = 1032 cumecs on 28/07/2015 Corres. Water Level :222.76 m

Lowest Observed Discharge = 0.000 cumecs on 01/06/2015 Corres. Water Level :218.28 m

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff

Stage-Discharge Data for the period 2015 - 2016

Station Name : Anas at Chakaliya (01 02 13 007) **Division : Mahi Division, Gandhinagar**

Local River : Anas **Sub-Division : Mahi Sub Divn., Kadana**

Day	Dec		Jan		Feb		Mar		Apr		May	
	W.L	Q	WL	Q	WL	Q	WL	Q	WL	Q	WL	Q
1	218.370	0.968	218.370	1.280	218.360	0.840 *	218.350	0.470	218.350	0.470	218.340	0.172
2	218.370	0.923	218.370	1.280 *	218.360	0.840 *	218.350	0.470 *	218.350	0.470 *	218.340	0.172
3	218.370	0.879	218.370	1.280 *	218.360	0.840 *	218.350	0.470 *	218.350	0.470 *	218.340	0.172
4	218.370	0.827	218.370	1.280 *	218.360	0.840 *	218.350	0.470 *	218.350	0.470 *	218.340	0.172
5	218.370	0.833	218.370	1.280 *	218.360	0.840 *	218.350	0.470 *	218.340	0.172 *	218.340	0.172
6	218.370	1.280 *	218.370	1.280 *	218.360	0.840 *	218.350	0.470 *	218.340	0.172 *	218.340	0.172
7	218.370	0.737	218.370	1.280 *	218.360	0.840 *	218.350	0.470 *	218.340	0.172 *	218.340	0.172
8	218.370	1.280 *	218.370	1.280 *	218.360	0.840 *	218.350	0.470 *	218.340	0.172 *	218.340	0.172
9	218.370	1.280 *	218.370	1.280 *	218.360	0.840 *	218.350	0.470 *	218.340	0.172 *	218.340	0.172
10	218.370	0.683	218.370	1.280 *	218.360	0.840 *	218.350	0.470 *	218.340	0.172 *	218.340	0.172
11	218.370	0.646	218.370	1.280 *	218.360	0.840 *	218.350	0.470 *	218.340	0.172 *	218.340	0.172
12	218.370	1.280 *	218.370	1.280 *	218.360	0.840 *	218.350	0.470 *	218.340	0.172 *	218.340	0.172
13	218.370	1.280 *	218.370	1.280 *	218.360	0.840 *	218.350	0.470 *	218.340	0.172 *	218.340	0.172
14	218.370	1.280 *	218.370	1.280 *	218.360	0.840 *	218.350	0.470 *	218.340	0.172 *	218.340	0.172
15	218.370	1.280 *	218.370	1.280 *	218.350	0.470 *	218.350	0.470 *	218.340	0.172 *	218.340	0.172
16	218.370	1.280 *	218.360	0.840 *	218.350	0.470 *	218.350	0.470 *	218.340	0.172 *	218.340	0.172
17	218.370	1.280 *	218.360	0.840 *	218.350	0.470 *	218.350	0.470 *	218.340	0.172 *	218.340	0.172
18	218.370	1.280 *	218.360	0.840 *	218.350	0.470 *	218.350	0.470 *	218.340	0.172 *	218.340	0.172 *
19	218.370	1.280 *	218.360	0.840 *	218.350	0.470 *	218.350	0.470 *	218.340	0.172 *	218.330	0.000
20	218.370	1.280 *	218.360	0.840 *	218.350	0.470 *	218.350	0.470 *	218.340	0.172 *	218.330	0.000
21	218.370	1.280 *	218.360	0.840 *	218.350	0.470 *	218.350	0.470 *	218.340	0.172 *	218.330	0.000
22	218.370	1.280 *	218.360	0.840 *	218.350	0.470 *	218.350	0.470 *	218.340	0.172 *	218.330	0.000
23	218.370	1.280 *	218.360	0.840 *	218.350	0.470 *	218.350	0.470 *	218.340	0.172 *	218.330	0.000
24	218.370	1.280 *	218.360	0.840 *	218.350	0.470 *	218.350	0.470 *	218.340	0.172 *	218.330	0.000
25	218.370	1.280 *	218.360	0.840 *	218.350	0.470 *	218.350	0.470 *	218.340	0.172 *	218.330	0.000
26	218.370	1.280 *	218.360	0.840 *	218.350	0.470 *	218.350	0.470 *	218.340	0.172 *	218.330	0.000
27	218.370	1.280 *	218.360	0.840 *	218.350	0.470 *	218.350	0.470 *	218.340	0.172 *	218.330	0.000
28	218.370	1.280 *	218.360	0.840 *	218.350	0.470 *	218.350	0.470 *	218.340	0.172 *	218.330	0.000
29	218.370	1.280 *	218.360	0.840 *	218.350	0.470 *	218.350	0.470 *	218.340	0.172 *	218.330	0.000
30	218.370	1.280 *	218.360	0.840 *			218.350	0.470 *	218.340	0.172 *	218.330	0.000
31	218.370	1.280 *	218.360	0.840 *			218.350	0.470 *			218.330	0.000
Ten-Daily Mean												
I Ten-Daily	218.370	0.969	218.370	1.280	218.360	0.840	218.350	0.470	218.344	0.291	218.340	0.172
II Ten-Daily	218.370	1.217	218.365	1.060	218.354	0.618	218.350	0.470	218.340	0.172	218.338	0.137
III Ten-Daily	218.370	1.280	218.360	0.840	218.350	0.470	218.350	0.470	218.340	0.172	218.330	0.000
Monthly												
Min.	218.370	0.646	218.360	0.840	218.350	0.470	218.350	0.470	218.340	0.172	218.330	0.000
Max.	218.370	1.280	218.370	1.280	218.360	0.840	218.350	0.470	218.350	0.470	218.340	0.172
Mean	218.370	1.159	218.365	1.053	218.355	0.649	218.350	0.47	218.341	0.211	218.336	0.1

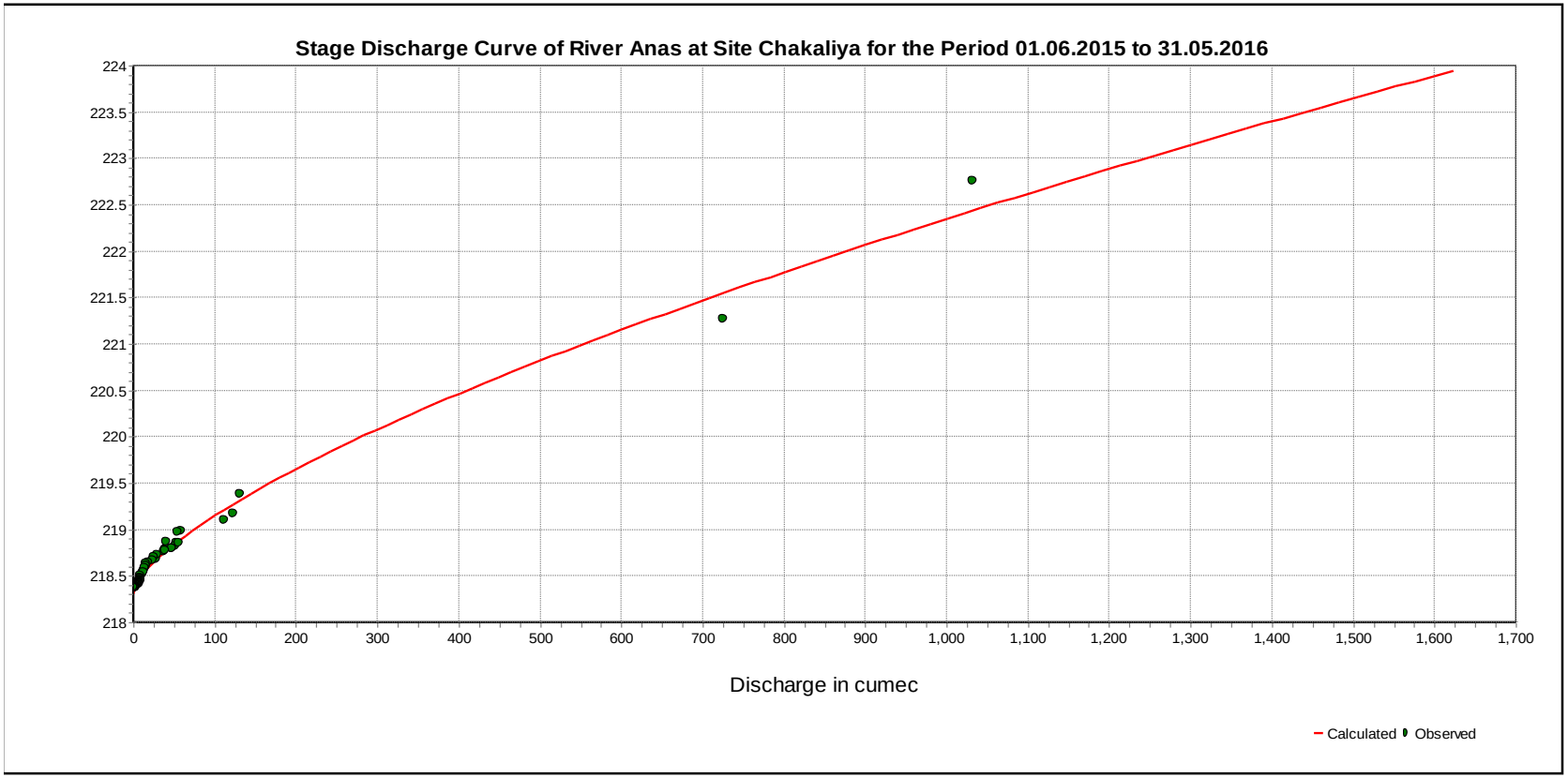
Peak Computed Discharge = 1244 cumecs on 26/07/2015 **Corres. Water Level :223 m**

Lowest Computed Discharge = 0.000 cumecs on 17/06/2015 **Corres. Water Level :218.33 m**

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff



Procedure - Standard

Equation Type - Power $Q=c*(h+a)^b$

LB	UB	a	b	c
218.3	224	-218.33	1.446	133.96

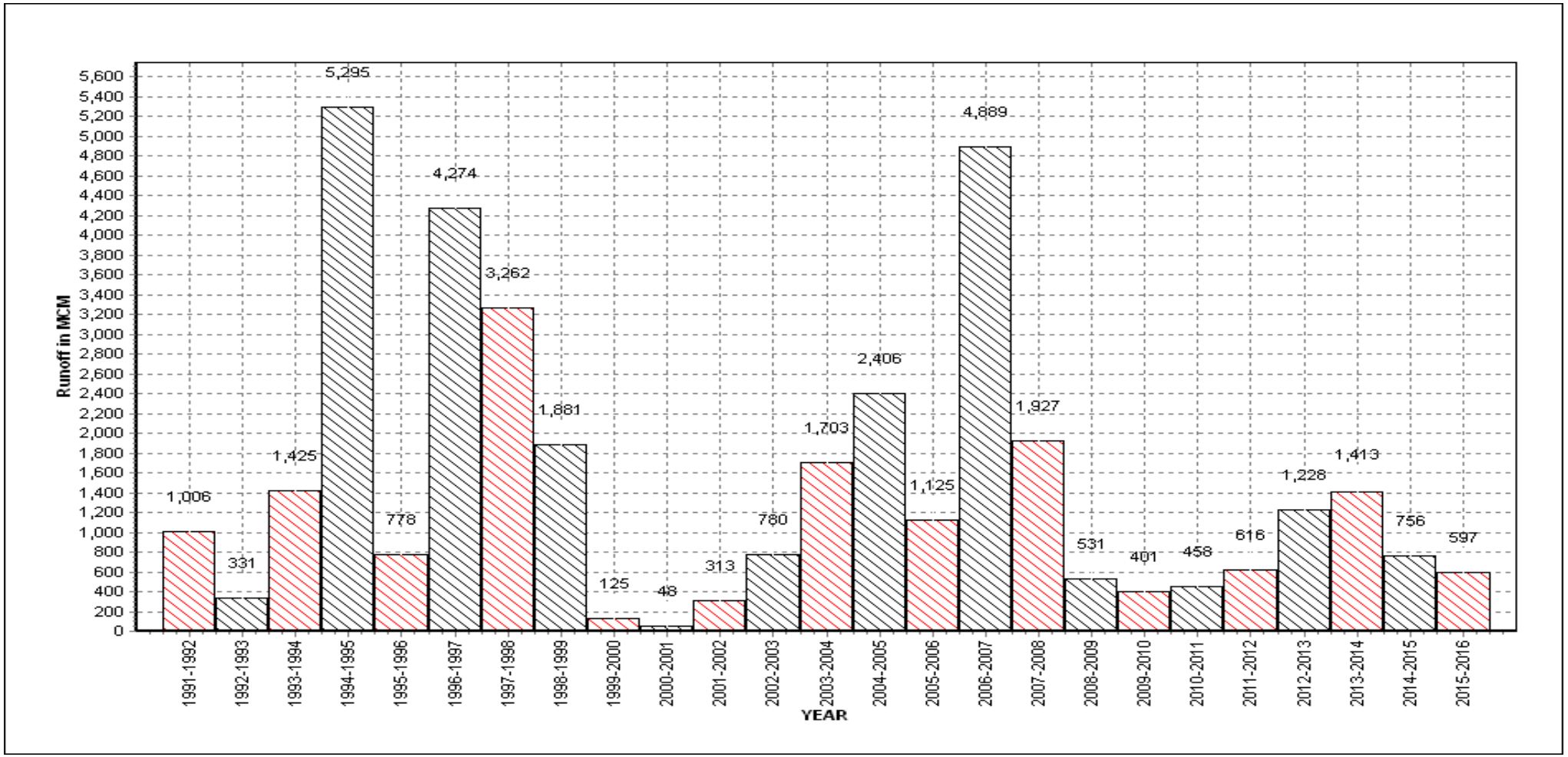
Cross section al survey not finalised

Histroic Flood Level -230.200 m on 11.08.2006 at 1400 hrs Maximum Water Level -223.790 dt 25/07/2015 at 1600hrs during the Water Year 2015-16

Annual Runoff Values for the period: 1991 - 2016

Station Name : Anas at Chakaliya (01 02 13 007) **Division : Mahi Division, Gandhinagar**

Local River : Anas **Sub-Division : Mahi Sub Divn., Kadana**



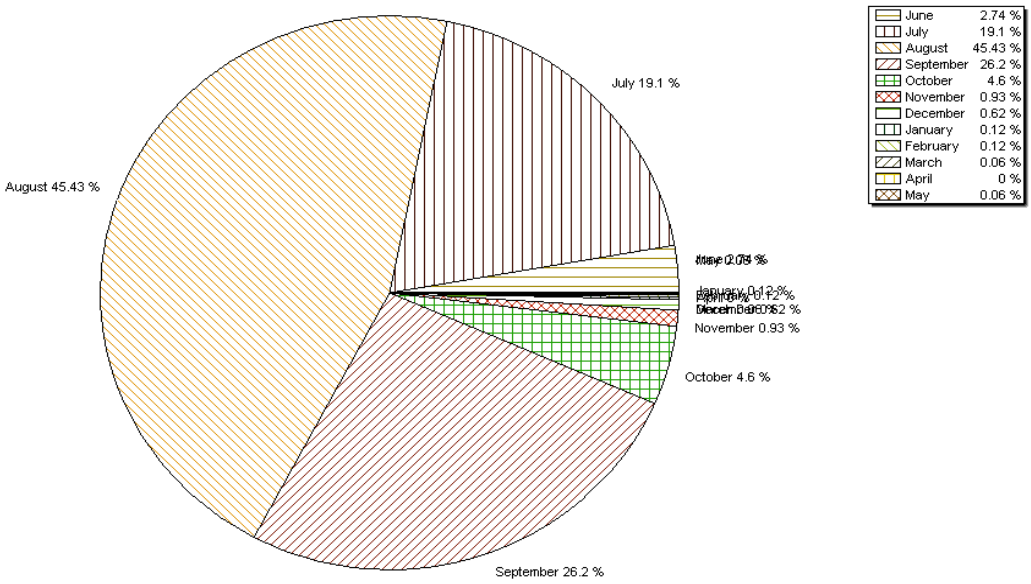
Note: Missing values have not been considered while arriving at Annual Runoff

Monthly Average Runoff based on period : 1991-2015

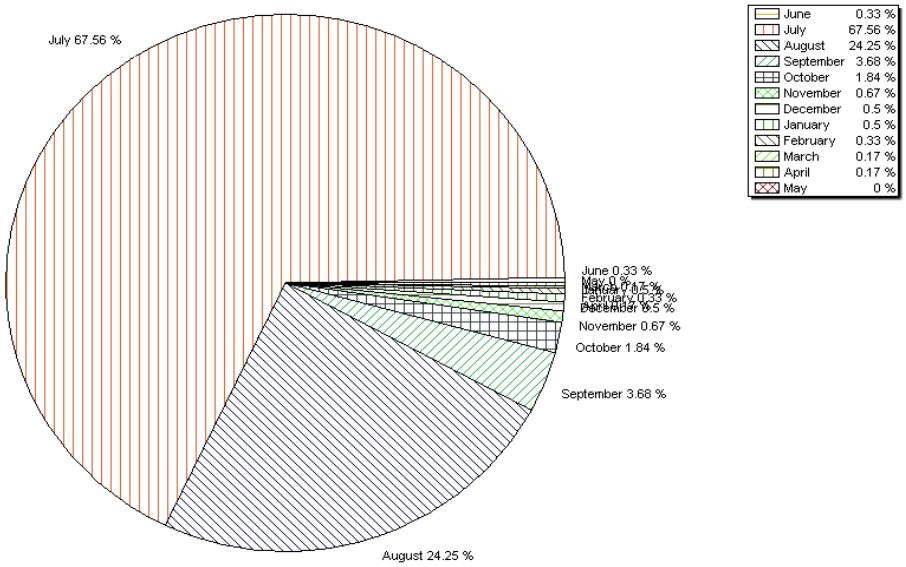
Station Name : Anas at Chakaliya (01 02 13 007) **Division : Mahi Division, Gandhinagar**

Local River : Anas **Sub-Division : Mahi Sub Divn., Kadana**

Monthly Average Runoff based on period : 1991-2015



Monthly Runoff for the Year : 2015-2016

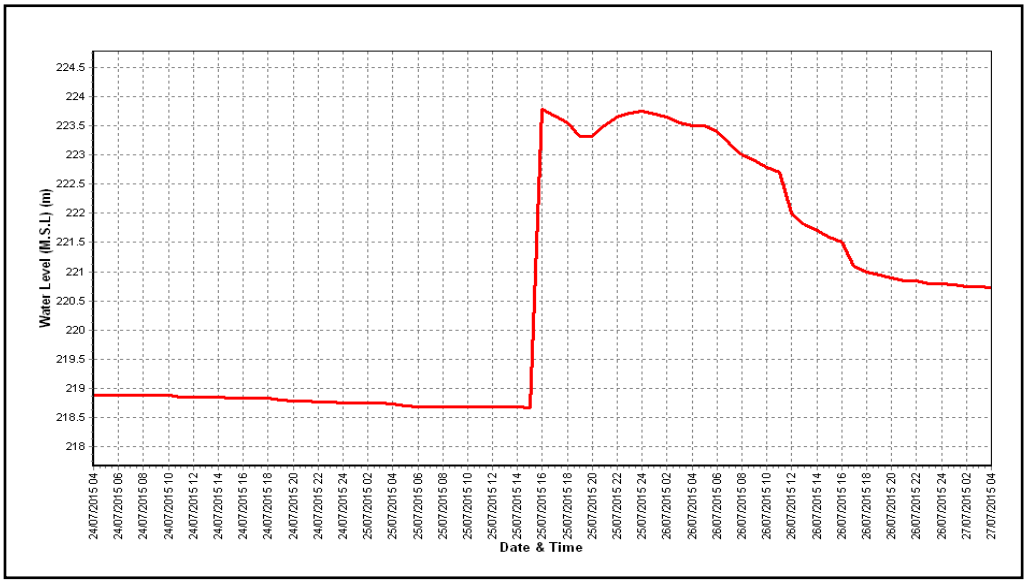


Water Level vs. Time - Graph of Highest Flood Peak during the Year : 2015-2016

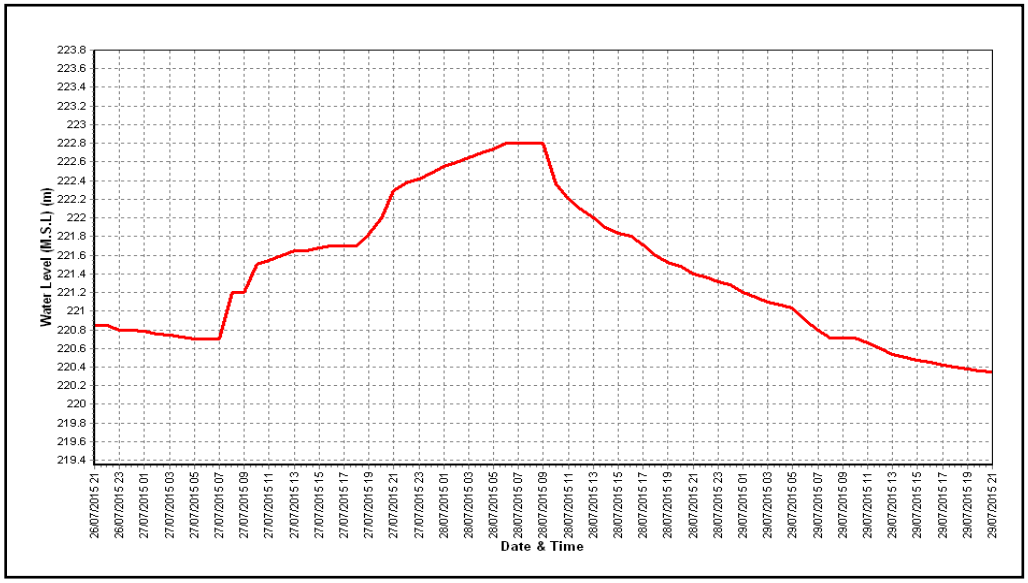
Station Name : Anas at Chakaliya (01 02 13 007) **Division : Mahi Division, Gandhinagar**

Local River : Anas **Sub-Division : Mahi Sub Divn., Kadana**

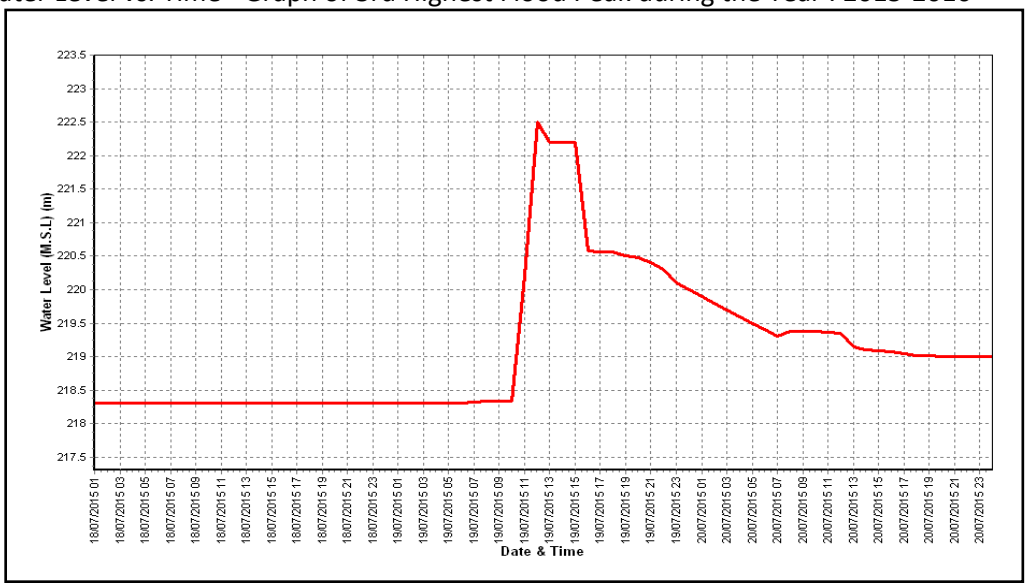
Water Level vs. Time - Graph of Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 2nd Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 3rd Highest Flood Peak during the Year : 2015-2016



Time Span: 72 Hrs

HISTORY SHEET

			Water Year	**:**	**2015-16**
Site	**:**	**Mahi at Paderdibadi**	**Code**	**:**	**01 02 13 006**
State	:	Rajasthan	District		Dungarpur
Basin	:	Mahi	Independent Ri	:	Mahi
Tributary	:	Mahi	Sub Tributary	:	
Sub Sub Tributary:			Local River	:	Mahi
Division	:	Mahi Division, Gandhinagar	Sub-Division	:	Mahi Sub Divn., Kadana
Drianage Area :		16247 Sq. Km.	Bank	:	Right
Latitude	:	23°46'02" N	Longitude	:	74°08'12" E
Zero of Gauge(m):		131 (m.s.l)	17/09/77	-	
		Opening Date	Closing Date		
Gauge	:	17/09/77			
Discharge	:	24/06/78			
Sediment	:	21/07/80			
Water Quality	:	01/07/78			

Annual Maximum / Minimum discharge with corresponding Water Level (m.s.l)

	Maximum			Minimum		
Year	**Q (cumecs)**	**WL (m)**	**Date**	**Q (cumecs)**	**WL (m)**	**Date**
1978-1979	4615	141.355	17/08/78	0.000	River Dry	31/05/79
1979-1980	6206	141.390	10/08/79	0.000	River Dry	12/05/80
1980-1981	3886	140.050	31/08/80	0.000	River Dry	02/05/81
1981-1982	5720	142.100	17/08/81	0.000	River Dry	15/06/81
1982-1983	1725	137.700	19/08/82	0.000	132.775	17/06/82
1983-1984	1090	137.130	16/08/83	0.100	132.970	06/06/83
1984-1985	9343	143.080	20/08/84	0.000	River Dry	13/05/85
1985-1986	523.5	135.785	25/09/85	0.000	132.840	08/07/85
1986-1987	6818	141.800	16/08/86	0.000	132.945	31/05/87
1987-1988	2154	139.110	26/08/87	0.000	132.970	09/08/87
1988-1989	1320	137.450	06/08/88	0.000	132.945	27/05/89
1989-1990	584.7	135.970	02/09/89	0.000	132.925	07/06/89
1990-1991	4760	141.600	24/08/90	2.000	133.150	30/05/91
1991-1992	3037	139.897	24/08/91	0.125	133.105	30/06/91
1992-1993	328.6	135.088	09/09/92	0.000	133.015	20/06/92
1993-1994	1580	137.125	17/07/93	0.000	133.090	07/06/93
1994-1995	6684	142.250	02/08/94	0.000	133.115	07/06/94
1995-1996	303.4	134.983	26/07/95	0.000	133.110	30/06/95
1996-1997	3143	139.310	08/08/96	0.000	132.795	13/06/96
1997-1998	2440	138.250	24/08/97	0.000	133.015	16/06/97
1998-1999	6699	141.700	17/09/98	0.000	133.070	29/04/99
1999-2000	531.5	135.250	19/07/99	0.000	132.890	13/05/00
2000-2001	158.0	134.410	13/07/00	0.000	132.350	22/12/00
2001-2002	204.0	134.625	12/07/01	0.000	River Dry	02/06/01

	Maximum			Minimum		
Year	**Q (cumecs)**	**WL (m)**	**Date**	**Q (cumecs)**	**WL (m)**	**Date**
2002-2003	243.9	134.880	04/09/02	0.000	132.580	18/01/03
2003-2004	1777	137.140	26/09/03	0.000	133.075	21/06/03
2004-2005	2888	139.990	24/08/04	0.000	133.115	02/07/04
2005-2006	3637	141.525	28/07/05	0.558	133.180	17/05/06
2006-2007	16153	147.525	19/08/06	0.000	132.550	01/06/06
2007-2008	3802	140.080	09/08/07	0.000	133.130	02/05/08
2008-2009	262.7	135.150	12/08/08	0.000	132.930	27/05/09
2009-2010	438.9	135.850	05/09/09	0.000	133.180	17/03/10
2010-2011	204.9	134.180	09/09/10	1.619	133.190	12/04/11
2011-2012	2382.2	140.520	12/09/11	0.000	133.000	16/05/12
2012-2013	2034.0	140.200	07/09/12	0.000	132.750	01/06/12
2013-2014	1788	139.75	02/08/13	0.000	133.11	01/06/13
2014-2015	519.6	135.57	10/09/14	0.000	133.15	01/06/14
2015-2016	2250	139.1	28/07/15	1.71	133	12/12/15

Stage-Discharge Data for the period 2015 - 2016

Station Name : Mahi at Paderdibadi (01 02 13 006) **Division : Mahi Division, Gandhinagar**

Local River : Mahi **Sub-Division : Mahi Sub Divn., Kadana**

Day	Jun		Jul		Aug		Sep		Oct		Nov	
	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q
1	133.010	1.744	133.340	6.077	135.300	391.5	133.830	113.5	133.380	17.00	133.160	6.630 *
2	133.000	1.590 *	133.310	5.538	135.270	352.3 *	133.830	60.64 *	133.350	16.53 *	133.140	5.699
3	133.000	1.590 *	133.300	5.357	135.300	391.4	133.810	108.7	133.330	16.21	133.140	5.604
4	133.000	1.590 *	133.200	4.173	134.650	197.8 *	133.580	27.29	133.320	14.68 *	133.160	6.365
5	132.990	1.510 *	133.160	3.180 *	134.600	187.2 *	133.570	26.38	133.310	15.17	133.170	6.465
6	132.990	1.510 *	133.140	3.125	139.000	2180 *	133.550	31.62 *	133.300	15.18	133.180	6.921
7	132.980	1.430 *	133.120	2.748	135.750	501.5 *	133.520	23.01	133.300	15.01	133.160	6.662
8	132.980	1.430 *	133.110	2.635	134.800	231.2 *	133.500	22.29	133.300	13.51 *	133.170	7.050 *
9	132.970	1.360 *	133.090	2.495	134.730	215.3 *	133.480	21.44	133.290	14.60	133.190	7.957
10	132.960	1.280 *	133.080	2.350	135.050	325.3	133.470	20.97	133.280	14.42	133.200	8.133
11	132.950	1.210 *	133.070	2.214	134.690	206.5 *	133.470	25.01 *	133.280	12.38 *	133.200	8.360 *
12	132.950	1.210 *	133.060	2.130 *	134.270	124.7 *	133.470	25.01 *	133.260	13.88	133.200	8.360 *
13	132.940	1.140 *	133.050	1.940	136.270	650.3	133.470	25.01 *	133.250	13.26	133.160	6.630 *
14	132.940	1.140 *	133.040	1.783	135.340	397.7	133.470	19.91	133.240	12.18	133.130	5.470 *
15	132.930	1.070 *	133.000	1.590 *	135.150	319.0 *	133.470	19.99	133.240	11.69	133.130	5.470 *
16	132.930	1.070 *	133.000	1.590 *	135.560	439.4 *	133.490	20.78	133.230	11.12	133.130	5.446
17	132.920	1.000 *	132.980	1.430 *	135.110	362.4	133.490	26.59 *	133.230	10.75	133.130	5.370
18	132.920	1.000 *	132.960	1.280 *	134.970	320.2	133.500	21.63	133.230	9.770 *	133.150	5.796
19	132.920	1.000 *	132.950	1.210 *	134.730	264.4	133.500	21.64	133.220	10.05	133.150	5.897
20	133.000	1.590 *	132.950	1.210 *	134.550	177.0 *	133.560	32.49 *	133.210	9.434	133.150	5.934
21	133.210	3.780 *	132.950	1.210 *	134.330	201.7	133.900	125.5	133.210	9.147	133.160	6.097
22	133.390	5.639	133.070	2.334	134.560	240.5	133.640	39.94 #	133.210	8.820 *	133.170	7.050 *
23	133.260	3.889	133.000	1.590 *	134.310	131.6 *	133.650	40.93 #	133.190	8.432	133.170	6.372
24	133.210	3.244	133.000	1.590 *	134.120	100.3 *	134.160	188.0	133.190	7.910 *	133.200	7.467
25	133.250	3.925	133.530	18.57	134.240	119.6 *	133.930	73.23 *	133.180	7.470 *	133.200	8.360 *
26	133.450	7.049	134.000	109.0 *	134.030	86.97 *	133.700	46.03 *	133.180	7.909	133.200	7.564
27	133.700	51.03	135.500	430.8	133.870	65.54 *	133.700	46.03 *	133.180	7.712	133.240	10.81
28	133.590	30.21 *	139.100	2250 #	133.710	47.08 *	133.530	23.03	133.170	7.349	133.250	11.23
29	133.460	7.799	137.225	949.2	133.810	58.27 #	133.430	19.04	133.170	6.997	133.180	7.470 *
30	133.400	6.835	137.800	1426 *	133.890	68.05 *	133.400	17.29	133.160	6.576	133.150	5.991
31			136.300	704.1 *	133.840	61.85 #			133.160	6.646		
Ten-Daily Mean												
I Ten-Daily	132.988	1.503	133.185	3.768	135.445	497.4	133.614	45.59	133.316	15.23	133.167	6.749
II Ten-Daily	132.940	1.143	133.006	1.638	135.064	326.1	133.489	23.81	133.239	11.45	133.153	6.273
III Ten-Daily	133.392	12.34	135.043	535.8	134.065	107.4	133.704	61.90	133.182	7.724	133.192	7.842
Monthly												
Min.	132.920	1.000	132.950	1.210	133.710	47.08	133.400	17.29	133.160	6.576	133.130	5.370
Max.	133.700	51.03	139.100	2250	139.000	2180	134.160	188.0	133.380	17.00	133.250	11.23
Mean	133.107	4.995	133.787	191.9	134.832	303.8	133.602	43.76	133.244	11.35	133.171	6.955

Annual Runoff in MCM = 1678 Annual Runoff in mm = 103

Peak Observed Discharge = 2250 cumecs on 28/07/2015 Corres. Water Level :139.1 m

Lowest Observed Discharge = 1.710 cumecs on 12/12/2015 Corres. Water Level :133 m

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff

Stage-Discharge Data for the period 2015 - 2016

Station Name : Mahi at Paderdibadi (01 02 13 006) **Division : Mahi Division, Gandhinagar**

Local River : Mahi **Sub-Division : Mahi Sub Divn., Kadana**

Day	Dec		Jan		Feb		Mar		Apr		May	
	W.L	Q	WL	Q	WL	Q	WL	Q	WL	Q	WL	Q
1	133.010	3.351	133.410	16.73	133.390	16.14	133.470	19.59	133.190	9.312	133.160	6.630 *
2	133.010	3.667	133.400	16.30	133.350	15.32	133.280	12.50	133.190	9.102	133.150	6.583
3	133.010	3.800	133.390	19.17 *	133.410	17.29	133.260	11.74	133.190	7.910 *	133.140	6.259
4	133.000	3.655	133.380	16.11	133.380	16.53	133.440	22.73 *	133.180	7.470 *	133.150	6.552
5	133.100	5.276	133.410	17.12	133.340	15.04	133.340	15.90 *	133.180	8.734	133.160	6.750
6	133.100	4.420 *	133.410	17.12	133.350	15.37	133.330	15.29 *	133.180	7.470 *	133.140	6.147
7	133.100	5.151	133.410	17.09	133.400	19.86 *	133.320	14.68 *	133.180	8.523	133.120	5.445
8	133.100	5.103	133.410	16.97	133.420	17.70	133.310	13.19	133.170	8.149	133.120	5.110 *
9	133.010	1.920 #	133.400	19.86 *	133.420	17.69	133.310	14.09 *	133.160	7.585	133.130	5.592
10	133.010	1.920 #	133.390	19.17 *	133.360	15.88	133.320	14.68 *	133.150	6.230 *	133.140	5.851
11	133.010	1.920 #	133.390	16.01	133.340	14.17	133.420	15.60	133.150	6.280	133.130	5.573
12	133.000	1.710 #	133.290	13.04	133.290	13.09	133.350	14.42	133.150	6.114	133.140	5.705
13	133.420	21.27 *	133.290	12.65	133.280	12.38 *	133.320	14.68 *	133.150	5.981	133.150	6.025
14	133.360	15.30	133.450	23.48 *	133.270	11.83 *	133.300	13.51 *	133.150	6.230 *	133.140	5.850 *
15	133.250	11.71	133.460	18.92	133.260	12.23	133.300	13.51 *	133.150	5.957	133.130	5.470 *
16	133.240	11.34	133.340	13.86	133.320	13.83	133.270	11.83 *	133.130	4.915	133.120	5.214
17	133.240	11.07	133.290	12.94 *	133.360	15.07	133.270	11.83 *	133.130	5.470 *	133.130	5.506
18	133.240	10.86	133.270	11.85	133.300	13.42	133.280	12.38 *	133.130	4.941	133.140	5.850 *
19	133.260	11.81	133.260	11.38	133.200	9.165	133.280	12.38 *	133.180	8.603	133.140	5.626
20	133.350	16.53 *	133.310	13.52	133.180	8.657	133.270	11.83 *	133.180	7.470 *	133.120	5.350
21	133.420	21.27 *	133.310	13.23	133.250	10.78 *	133.270	11.83 *	133.180	8.455	133.120	5.110 *
22	133.410	20.56 *	133.490	20.11	133.330	14.94	133.260	11.30 *	133.160	7.569	133.120	5.110 *
23	133.390	19.17 *	133.430	17.85	133.320	14.45	133.250	10.78 *	133.140	5.749	133.110	4.942
24	133.360	17.17 *	133.350	16.53 *	133.220	10.70	133.240	10.27 *	133.150	6.230 *	133.100	4.704
25	133.360	17.17 *	133.250	11.60	133.230	11.15	133.230	9.770 *	133.180	8.432	133.090	4.498
26	133.360	17.17 *	133.300	13.51 *	133.240	11.48	133.220	9.290 *	133.180	8.081	133.090	4.344
27	133.360	17.17 *	133.470	19.71	133.230	10.99	133.210	8.820 *	133.170	7.869	133.090	4.284
28	133.350	16.53 *	133.460	19.30	133.230	9.770 *	133.210	10.20	133.170	7.869	133.080	3.780 #
29	133.350	16.53 *	133.420	21.27 *	133.230	9.770 *	133.210	8.820 *	133.170	7.038	133.060	3.180 *
30	133.430	16.85	133.400	19.86 *			133.200	9.775	133.170	6.720	133.010	1.920 #
31	133.420	17.10	133.400	19.86 *			133.200	8.360 *			133.010	1.920 *
Ten-Daily Mean												
I Ten-Daily	133.045	3.826	133.401	17.56	133.382	16.68	133.338	15.44	133.177	8.048	133.141	6.092
II Ten-Daily	133.237	11.35	133.335	14.76	133.280	12.38	133.306	13.20	133.150	6.196	133.134	5.617
III Ten-Daily	133.383	17.88	133.389	17.53	133.253	11.56	133.227	9.929	133.167	7.401	133.080	3.981
Monthly												
Min.	133.000	1.710	133.250	11.38	133.180	8.657	133.200	8.360	133.130	4.915	133.010	1.920
Max.	133.430	21.27	133.490	23.48	133.420	19.86	133.470	22.73	133.190	9.312	133.160	6.750
Mean	133.227	11.24	133.375	16.65	133.307	13.61	133.288	12.76	133.165	7.215	133.117	5.19

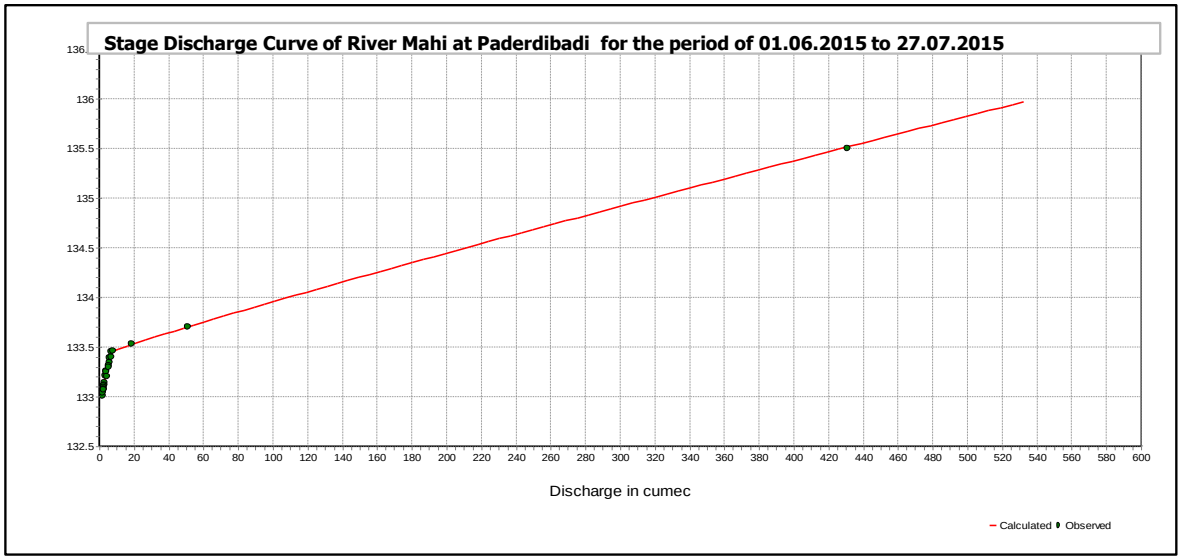
Peak Computed Discharge = 2180 cumecs on 06/08/2015 Corres. Water Level :139 m

Lowest Computed Discharge = 1.000 cumecs on 17/06/2015 Corres. Water Level :132.92 m

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

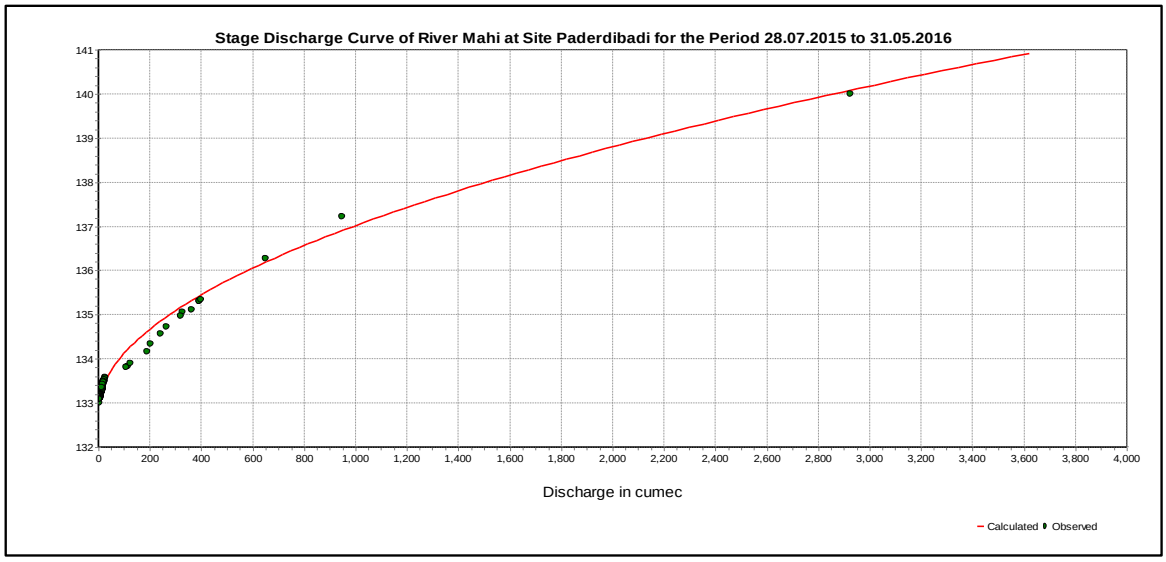
Note:Missing values ignored while arriving at Annual Runoff



Procedure - Standard

Equation Type - Power $Q=c*(h+a)^b$

LB	UB	a	b	c
133	133.46	-132.63	1.918	10.735
133.46	136	-133.41	1.081	192.85



Procedure - Standard

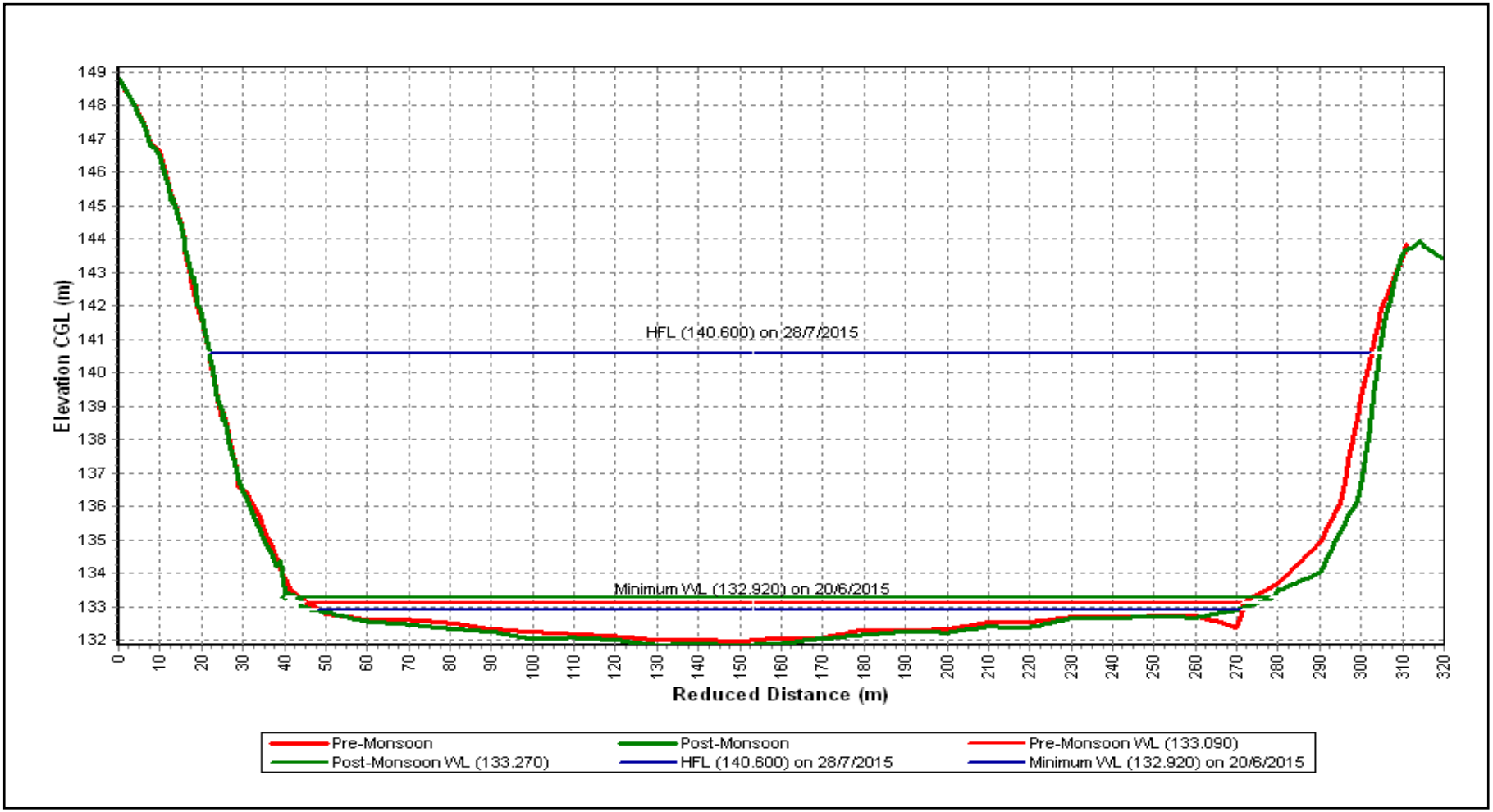
Equation Type - Power $Q=c*(h+a)^b$

LB	UB	a	b	c
133	141	-132.84	1.9594	61.85

Pre-Monsoon & Post-Monsoon X-Section for Water Year : 2015-2016

Station Name : Mahi at Paderdibadi (01 02 13 006) **Division : Mahi Division, Gandhinagar**

Local River : Mahi **Sub-Division : Mahi Sub Divn., Kadana**



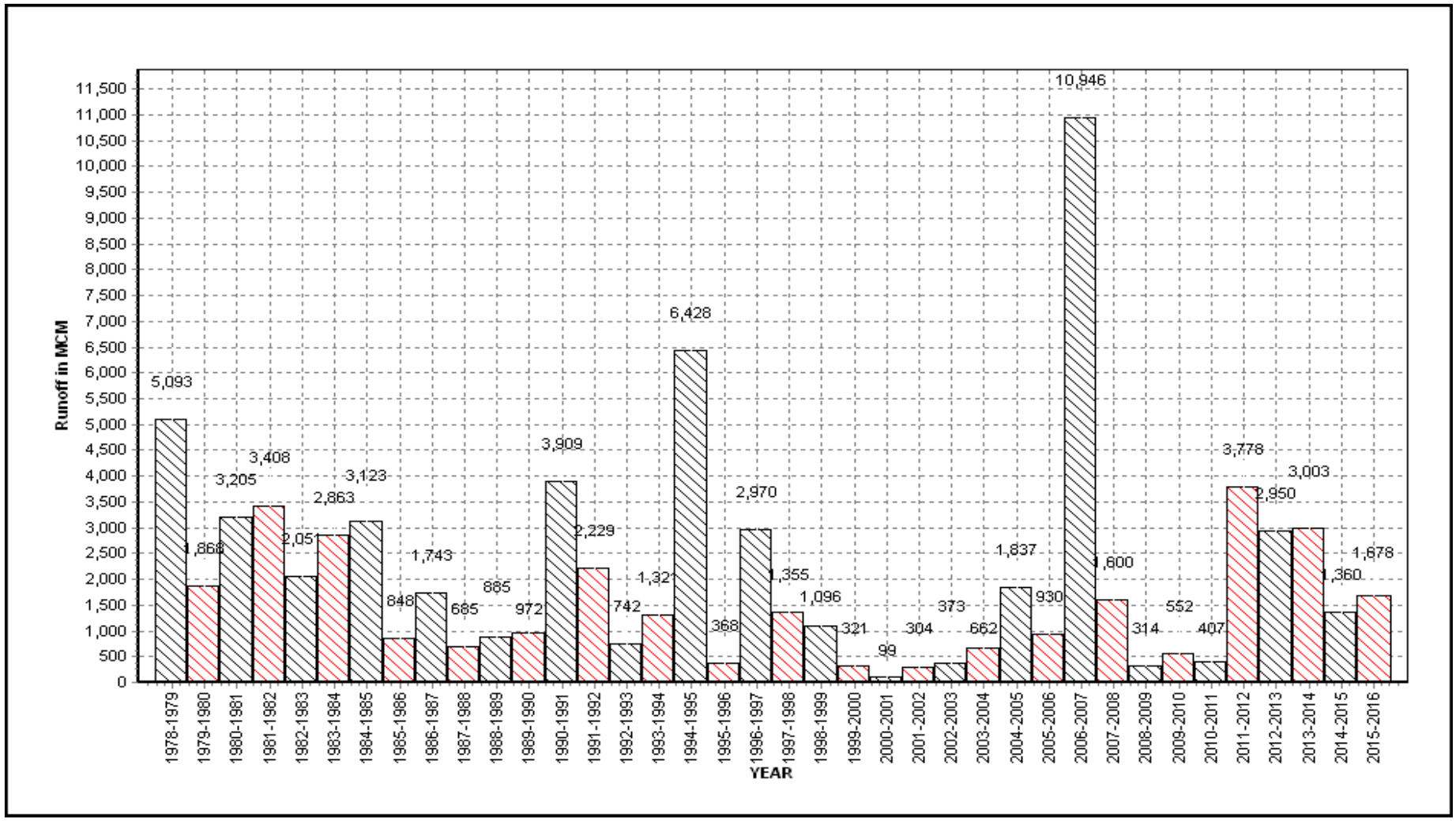
Historic Flood Level- 149.650m on 19.08.2006 at 1600 hrs

Note: HFL marked on graph denotes Max Water Level observed during the Water Year 2015-16

Annual Runoff Values for the period: 1978 - 2016

Station Name : Mahi at Paderdibadi (01 02 13 006) **Division : Mahi Division, Gandhinagar**

Local River : Mahi **Sub-Division : Mahi Sub Divn., Kadana**



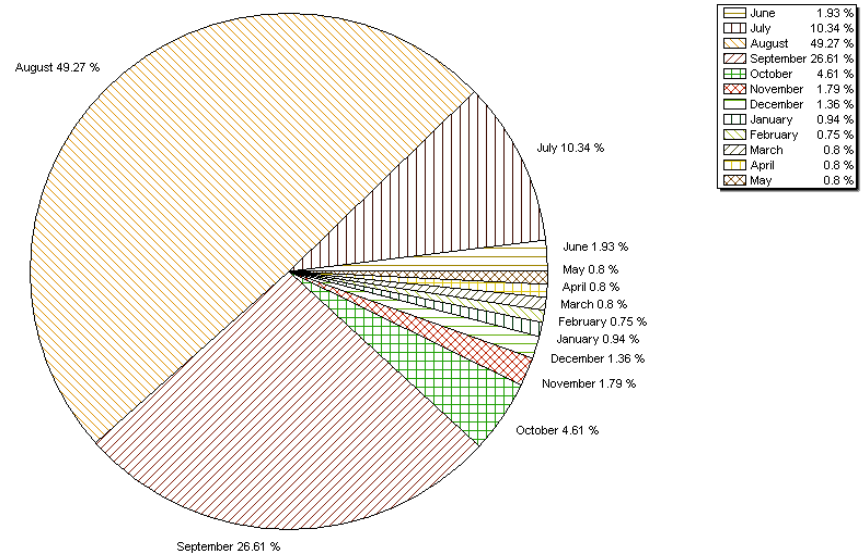
Note: Missing values have not been considered while arriving at Annual Runoff

Monthly Average Runoff based on period : 1978-2015

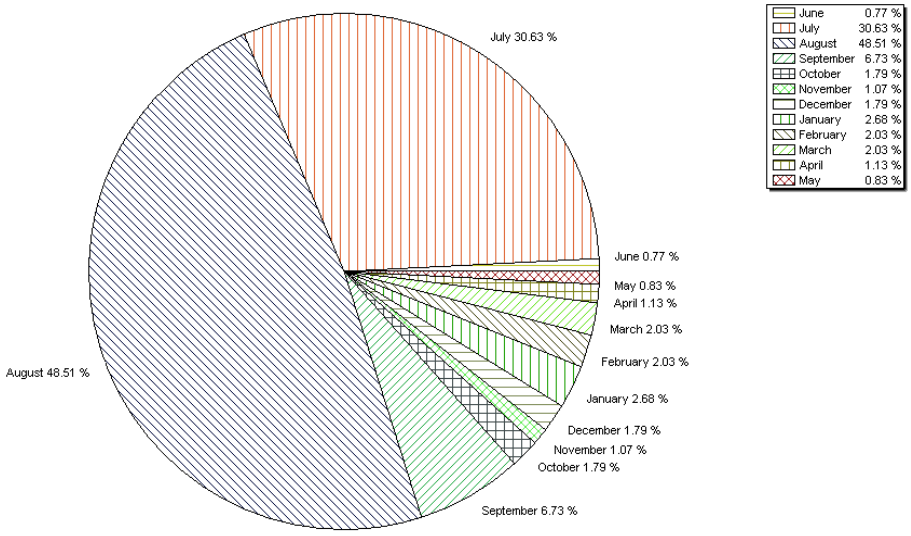
Station Name : Mahi at Paderdibadi (01 02 13 006) **Division : Mahi Division, Gandhinagar**

Local River : Mahi **Sub-Division : Mahi Sub Divn., Kadana**

Monthly Average Runoff based on period : 1978-2015



Monthly Runoff for the Year : 2015-2016

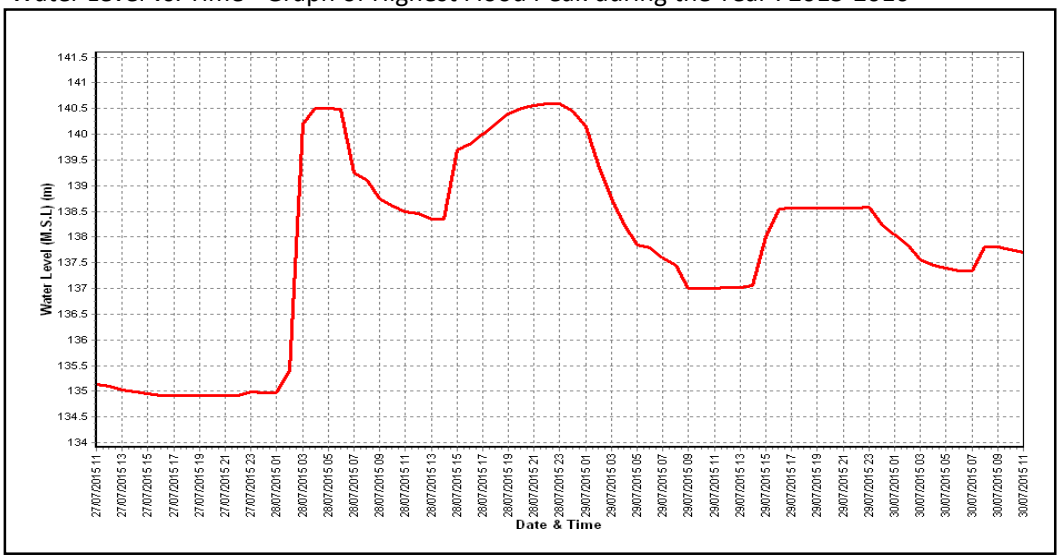


Water Level vs. Time - Graph of Highest Flood Peak during the Year : 2015-2016

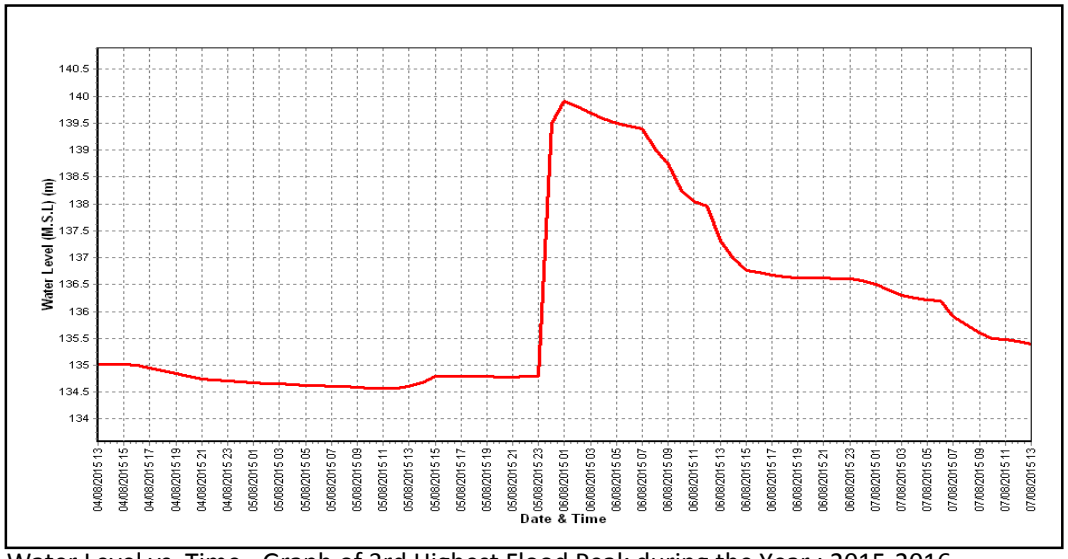
Station Name : Mahi at Paderdibadi (01 02 13 006) **Division : Mahi Division, Gandhinagar**

Local River : Mahi **Sub-Division : Mahi Sub Divn., Kadana**

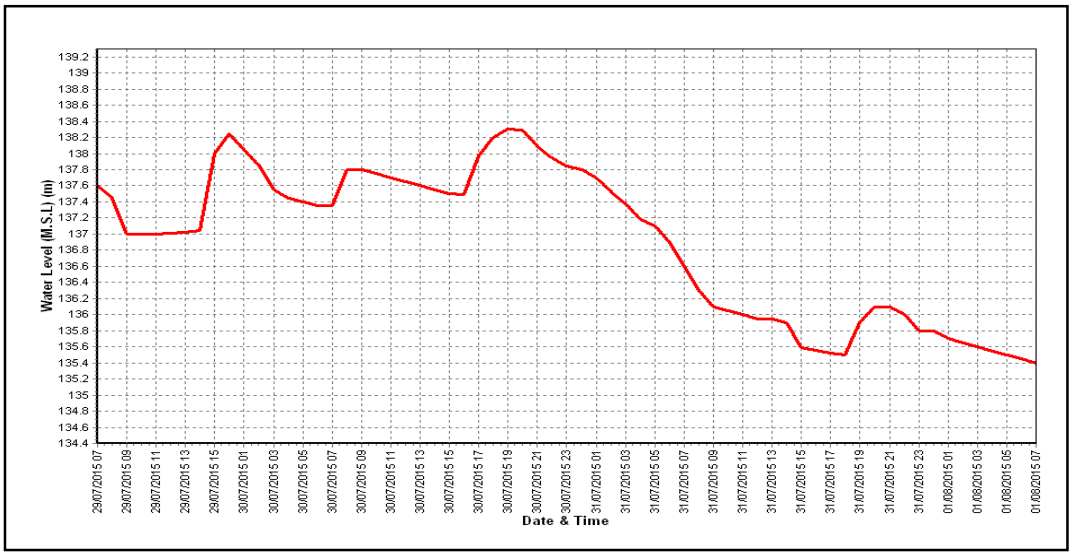
Water Level vs. Time - Graph of Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 2nd Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 3rd Highest Flood Peak during the Year : 2015-2016



Time Span: 72 Hrs

HISTORY SHEET

			Water Year	**:**	**2015-16**
Site	**:**	**Som at Rangeli**	**Code**	**:**	**01 02 13 005**
State	:	Rajasthan	District		Dungarpur
Basin	:	Mahi	Independent River	:	Mahi
Tributary	:	Som	Sub Tributary	:	
Sub-Sub Tributary	:		Local River	:	Som
Division	:	Mahi Division, Gandhinagar	Sub-Division	:	Mahi Sub Divn., Kadana
Drainage Area	:	8329 Sq. Km.	Bank	:	Right
Latitude	:	23°52'22" N	Longitude	:	74°13'25" E
Zero of Gauge (m)	:	150 (m.s.l)	01/01/78		-

		Opening Date	Closing Date
Gauge	:	15/07/78	
Discharge	:	15/07/78	
Sediment	:	-	
Water Quality	:	01/07/88	

Annual Maximum / Minimum discharge with corresponding Water Level (m.s.l)

	Maximum			Minimum		
Year	**Q (cumecs)**	**WL (m)**	**Date**	**Q (cumecs)**	**WL (m)**	**Date**
1979-1980	205.0	152.650	11/08/79	0.000	River Dry	27/05/80
1980-1981	707.1	154.350	24/06/80	0.000	River Dry	13/06/80
1981-1982	560.0	154.310	10/07/81	0.000	River Dry	24/06/81
1982-1983	664.4	153.990	23/08/82	0.000	151.545	05/06/82
1983-1984	715.0	154.550	16/08/83	0.000	River Dry	08/06/83
1984-1985	1020	155.405	20/08/84	0.000	151.510	06/06/84
1985-1986	444.3	154.075	05/08/85	0.000	151.375	13/04/86
1986-1987	958.6	155.190	16/08/86	0.000	River Dry	16/06/86
1987-1988	720.0	153.900	26/08/87	0.000	151.510	14/08/87
1988-1989	1261	155.400	06/08/88	0.100	151.460	31/05/89
1989-1990	401.3	153.945	29/08/89	0.063	151.435	13/06/89
1990-1991	920.3	155.095	24/08/90	2.040	151.715	25/05/91
1991-1992	1984	155.609	31/07/91	1.025	151.551	11/07/91
1992-1993	233.0	153.475	09/09/92	1.065	151.515	10/07/92
1993-1994	978.9	154.910	18/07/93	0.288	151.490	14/06/93
1994-1995	3072	156.800	02/08/94	1.000	151.550	09/06/94
1995-1996	83.50	152.490	26/07/95	0.000	151.050	30/05/96

1996-1997	269.0	153.925	08/09/96	0.000	River Dry	19/06/96
1997-1998	147.0	152.945	08/09/97	0.000	150.970	23/06/97
1998-1999	77.72	152.105	24/09/98	0.000	151.070	17/05/99
1999-2000	268.6	153.360	19/07/99	0.000	151.065	25/04/00
2000-2001	58.50	152.230	13/07/00	0.000	River Dry	19/06/00
2001-2002	118.0	152.125	12/07/01	0.000	River Dry	09/06/01
2002-2003	215.2	152.420	04/09/02	0.000	River Dry	25/12/02
2003-2004	98.71	152.240	20/09/03	0.000	151.030	26/03/04
2004-2005	412.8	154.250	24/08/04	0.000	151.020	29/05/05
2005-2006	905.3	155.480	28/07/05	0.810	151.240	30/04/06
2006-2007	5179	158.240	19/08/06	0.000	River Dry	01/06/06
2007-2008	187.5	153.315	30/08/07	0.000	151.110	01/06/07
2008-2009	228.7	153.370	11/07/08	0.000	151.100	16/05/09
2009-2010	331.3	153.725	23/07/09	0.476	151.270	09/07/09
2010-2011	284.6	153.750	10/09/10	0.083	151.250	30/04/11
2011-2012	1195.0	156.650	11/09/11	0.000	River Dry	22/06/12
2012-2013	344.8	153.900	08/09/12	0.000	151.080	01/06/12
2013-2014	1128	153.805	30/09/13	0.241	151.26	01/06/13
2014-2015	1717	154.76	10/09/14	0.000	151.21	01/06/14
2015-2016	473.1	154.1	30/07/15	0.000	151.09	27/04/16

Stage-Discharge Data for the period 2015 - 2016

Station Name : Som at Rangeli (01 02 13 005) **Division : Mahi Division, Gandhinagar**

Local River : Som **Sub-Division : Mahi Sub Divn., Kadana**

Day	Jun		Jul		Aug		Sep		Oct		Nov	
	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q
1	151.230	0.555	151.340	2.882	152.760	145.0	152.110	73.73	151.500	9.839	151.400	6.790 *
2	151.230	0.575	151.220	0.479	152.700	138.2 *	152.110	74.28	151.450	8.970 *	151.400	8.296
3	151.230	0.535	151.220	0.476	152.540	130.5	151.900	40.65 #	151.450	9.666	151.400	8.296
4	151.230	0.524	151.300	1.793	152.560	131.7	151.850	36.10 #	151.430	8.060 *	151.400	8.379
5	151.220	0.483	151.230	0.540 *	152.920	169.2	151.720	25.45 #	151.430	9.318	151.390	8.048
6	151.220	0.489	151.300	2.323	152.720	142.7	151.700	23.96 *	151.420	9.125	151.390	6.380 *
7	151.220	0.420 *	151.280	1.844	152.550	124.7	151.680	11.27	151.420	9.092	151.390	8.018
8	151.220	0.452	151.280	1.793	152.440	113.7	151.650	11.03	151.420	9.092	151.390	6.380 *
9	151.220	0.449	151.250	0.688	152.330	83.02 *	151.650	11.01	151.410	8.839	151.390	8.013
10	151.210	0.364	151.250	0.688	152.280	94.83	151.660	11.37	151.410	8.811	151.390	8.337
11	151.210	0.364	151.240	0.674	152.470	116.8	151.650	11.35	151.410	7.200 *	151.390	6.380 *
12	151.210	0.364	151.240	0.680 *	152.390	104.9	151.650	11.28	151.410	8.746	151.390	6.380 *
13	151.200	0.227	151.240	0.585	153.160	204.7	151.660	21.12 *	151.410	8.727	151.390	6.380 *
14	151.200	0.230 *	151.240	0.551	152.820	173.0	151.660	11.03	151.400	8.468	151.390	8.013
15	151.200	0.212	151.240	0.573	152.910	183.8 *	151.650	10.76	151.400	8.438	151.390	6.380 *
16	151.200	0.205	151.230	0.517	152.970	195.3 *	151.510	10.11	151.400	8.468	151.390	7.897
17	151.400	4.720	151.250	0.582	152.590	132.0	151.650	20.43 *	151.400	8.406	151.390	8.065
18	151.500	6.541	151.250	0.820 *	152.750	154.9 #	151.640	10.69	151.400	6.790 *	151.380	7.396
19	151.450	5.748	151.210	0.320 *	152.760	158.1	151.670	11.56	151.400	8.331	151.380	5.990 *
20	151.400	4.701	151.210	0.320 *	152.650	137.8	151.660	21.12 *	151.400	8.306	151.380	5.990 *
21	151.380	3.910 *	151.220	0.420	152.580	108.0	151.880	38.80 #	151.400	8.308	151.380	7.352
22	151.380	4.380	151.290	2.245	152.450	114.5	151.800	31.80 #	151.400	6.790 *	151.380	5.990 *
23	151.350	3.133	151.700	10.61	152.410	121.0 *	151.680	11.35	151.400	8.367	151.380	5.990 *
24	151.400	4.683	151.640	9.554	152.390	105.9	152.400	99.60 #	151.400	6.790 *	151.390	6.380 *
25	151.400	4.669	152.300	97.01	152.200	81.01	152.200	73.14 *	151.400	6.790 *	151.390	6.380 *
26	151.650	10.17	152.620	125.2 *	152.100	72.86	151.950	45.45 #	151.400	8.320	151.400	7.872
27	151.630	9.556	152.540	137.5	152.080	69.98	151.950	45.45 *	151.400	8.379	151.390	6.380 *
28	151.500	8.570 *	152.860	185.6	152.020	66.08	151.830	34.35 #	151.400	8.377	151.390	7.869
29	151.460	6.058	152.790	164.8	152.210	81.39	151.630	10.69	151.400	8.320	151.400	6.790 *
30	151.430	4.820	154.100	473.1	152.140	65.94 *	151.510	10.11	151.400	8.285	151.400	8.376
31			153.280	259.2	152.100	72.75			151.400	8.285		
Ten-Daily Mean												
I Ten-Daily	151.223	0.485	151.267	1.351	152.580	127.4	151.803	31.89	151.434	9.081	151.394	7.694
II Ten-Daily	151.297	2.331	151.235	0.562	152.747	156.1	151.640	13.94	151.403	8.188	151.387	6.887
III Ten-Daily	151.458	5.995	152.395	133.2	152.244	87.22	151.883	40.07	151.400	7.910	151.390	6.938
Monthly												
Min.	151.200	0.205	151.210	0.320	152.020	65.94	151.510	10.11	151.400	6.790	151.380	5.990
Max.	151.650	10.17	154.100	473.1	153.160	204.7	152.400	99.60	151.500	9.839	151.400	8.379
Mean	151.326	2.937	151.657	47.88	152.515	122.4	151.775	28.63	151.412	8.378	151.390	7.173

Annual Runoff in MCM = 671 Annual Runoff in mm = 81

Peak Observed Discharge = 473.1 cumecs on 30/07/2015 Corres. Water Level :154.1 m

Lowest Observed Discharge = 0.000 cumecs on 28/04/2016 Corres. Water Level :151.08 m

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff

Stage-Discharge Data for the period 2015 - 2016

Station Name : Som at Rangeli (01 02 13 005) **Division : Mahi Division, Gandhinagar**

Local River : Som **Sub-Division : Mahi Sub Divn., Kadana**

Day	Dec		Jan		Feb		Mar		Apr		May	
	W.L	Q	WL	Q	WL	Q	WL	Q	WL	Q	WL	Q
1	151.400	8.404	151.400	8.617	151.470	9.021	151.460	8.069	151.370	7.752	151.070	0.000
2	151.400	6.790 *	151.400	8.617	151.490	10.91 *	151.460	8.407	151.300	3.280 *	151.070	0.000
3	151.400	8.373	151.400	6.790 *	151.490	10.91 *	151.450	8.970 *	151.300	3.280 *	151.080	0.000
4	151.400	6.790 *	151.400	8.559	151.490	10.91 *	151.450	8.292	151.290	3.000 *	151.080	0.000
5	151.400	8.373	151.400	8.519	151.500	9.158	151.450	8.292	151.280	2.730	151.080	0.000
6	151.400	6.790 *	151.420	8.587	151.500	9.162	151.450	8.970 *	151.270	2.484	151.070	0.000
7	151.400	7.872	151.420	7.620 *	151.490	10.91 *	151.460	8.410	151.250	1.980 *	151.060	0.000
8	151.390	7.891	151.430	8.736	151.490	9.066	151.460	8.377	151.250	1.791	151.060	0.000
9	151.390	7.881	151.430	8.704	151.490	10.91 #	151.460	8.352	151.230	1.833	151.060	0.000
10	151.390	7.869	151.430	8.060 *	151.480	9.091	151.460	9.440 *	151.230	1.540 *	151.050	0.000
11	151.390	6.380 *	151.440	8.879	151.480	10.41 *	151.460	8.303	151.230	1.529	151.050	0.000
12	151.390	7.887	151.440	8.835	151.500	9.175	151.460	7.235	151.220	1.574	151.050	0.000
13	151.390	6.380 *	151.440	8.782	151.500	9.187	151.460	9.440 *	151.220	1.564	151.040	0.000
14	151.390	7.767	151.450	8.970 *	151.500	11.43 *	151.450	8.292	151.220	1.340 *	151.040	0.000
15	151.380	7.352	151.450	8.914	151.470	9.031	151.450	8.292	151.220	1.340 *	151.040	0.000
16	151.380	7.352	151.440	8.835	151.470	8.998	151.450	8.272	151.210	1.160 *	151.030	0.000
17	151.380	7.192	151.430	8.060 *	151.470	8.948	151.450	8.970 *	151.200	0.980 *	151.030	0.000
18	151.380	5.990 *	151.430	8.747	151.470	9.920 *	151.450	8.165	151.170	0.100	151.030	0.000
19	151.380	5.990 *	151.420	7.620 *	151.470	8.958	151.450	8.165	151.160	0.420 *	151.030	0.000
20	151.380	5.990 *	151.420	7.620 *	151.470	8.937	151.450	8.970 *	151.150	0.320 *	151.020	0.000
21	151.380	5.990 *	151.420	7.620 *	151.470	9.920 *	151.440	8.782	151.150	0.320 *	151.020	0.000
22	151.390	7.769	151.430	8.697	151.470	8.894	151.440	8.782	151.130	0.112	151.020	0.000
23	151.390	7.769	151.430	8.658	151.470	8.867	151.440	8.732	151.130	0.112	151.020	0.000
24	151.390	7.774	151.420	7.620 *	151.470	8.851	151.440	8.510 *	151.130	0.150 *	151.010	0.000
25	151.390	6.380 *	151.420	8.593	151.470	9.920 *	151.440	8.510 *	151.140	0.126	151.010	0.000
26	151.390	7.774	151.430	8.060 *	151.470	8.779	151.440	8.510 *	151.140	0.230 *	151.010	0.000
27	151.390	6.380 *	151.450	8.909	151.470	8.675	151.440	8.510 *	151.090	0.000 *	151.010	0.000
28	151.400	8.373	151.470	9.031	151.470	9.920 *	151.420	7.620 *	151.080	0.000	151.010	0.000
29	151.400	6.790 *	151.470	8.982	151.470	8.688 #	151.400	6.790 *	151.070	0.000	151.010	0.000
30	151.400	6.790 *	151.470	8.959			151.380	8.173	151.060	0.000	151.010	0.000
31	151.400	6.790 *	151.460	9.440 *			151.380	5.990 *			151.010	0.000
Ten-Daily Mean												
I Ten-Daily	151.397	7.703	151.413	8.281	151.489	10.00	151.456	8.558	151.277	2.967	151.068	0.000
II Ten-Daily	151.384	6.828	151.436	8.526	151.480	9.499	151.453	8.411	151.200	1.033	151.036	0.000
III Ten-Daily	151.393	7.143	151.443	8.597	151.470	9.168	151.424	8.083	151.112	0.105	151.013	0.000
Monthly												
Min.	151.380	5.990	151.400	6.790	151.470	8.675	151.380	5.990	151.060	0.000	151.010	0.000
Max.	151.400	8.404	151.470	9.440	151.500	11.43	151.460	9.440	151.370	7.752	151.080	0.000
Mean	151.391	7.222	151.431	8.472	151.480	9.571	151.444	8.342	151.196	1.368	151.038	0.000

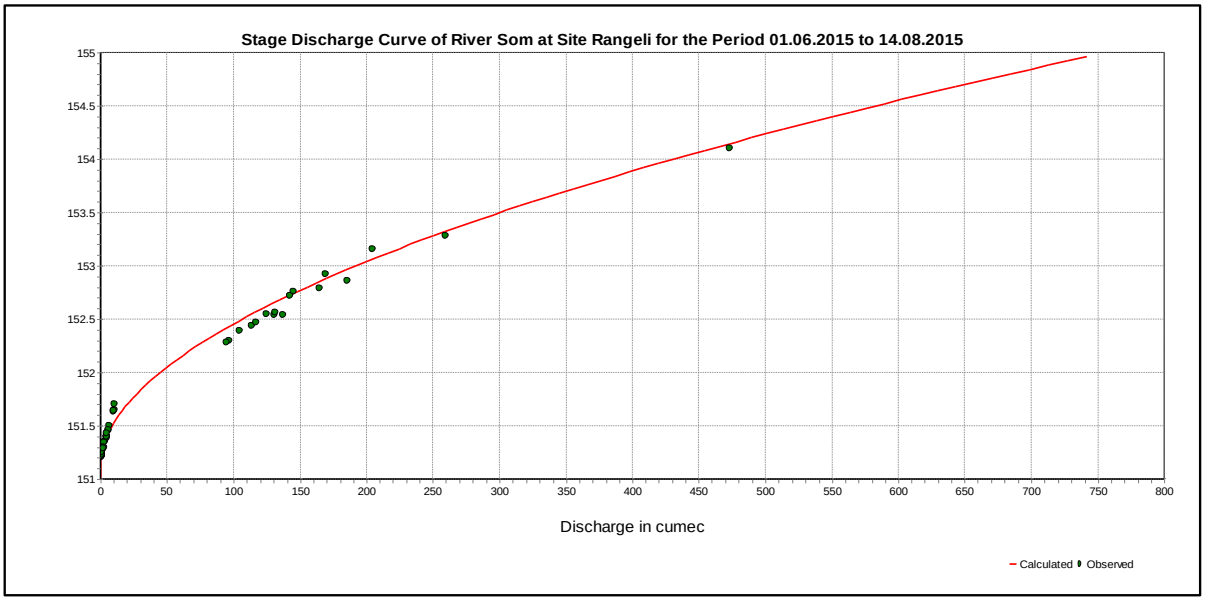
Peak Computed Discharge = 195.3 cumecs on 16/08/2015 Corres. Water Level :152.97 m

Lowest Computed Discharge = 0.000 cumecs on 27/04/2016 Corres. Water Level :151.09 m

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

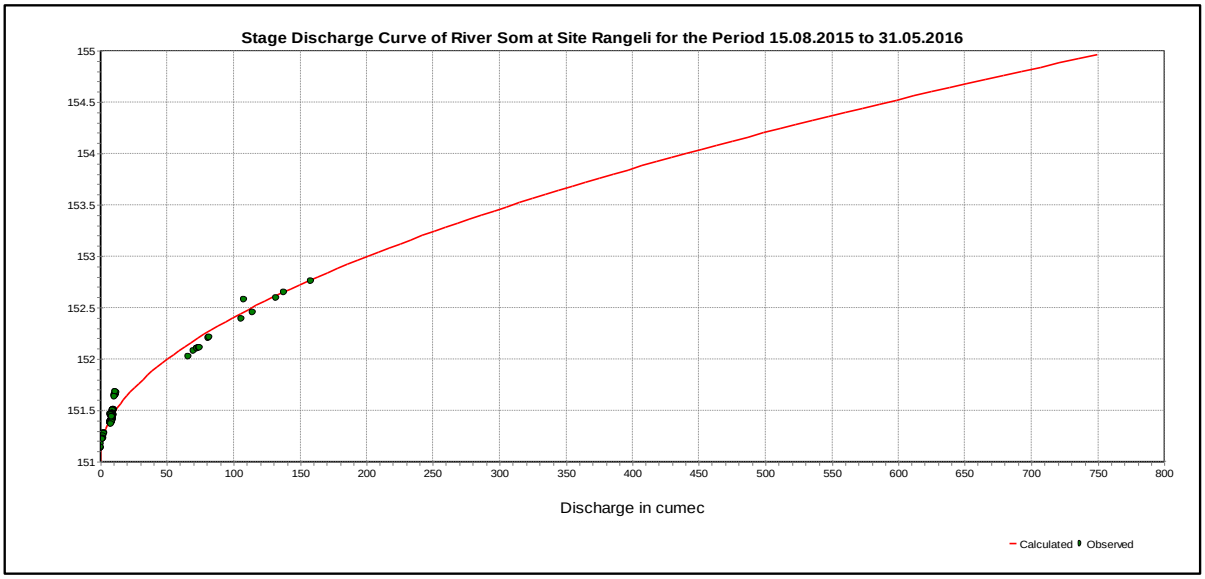
Note:Missing values ignored while arriving at Annual Runoff



Procedure - Standard

Equation Type - Power $Q=c*(h+a)^b$

LB	UB	a	b	c
151	155	-151.15	1.8686	60.937



Procedure - Standard

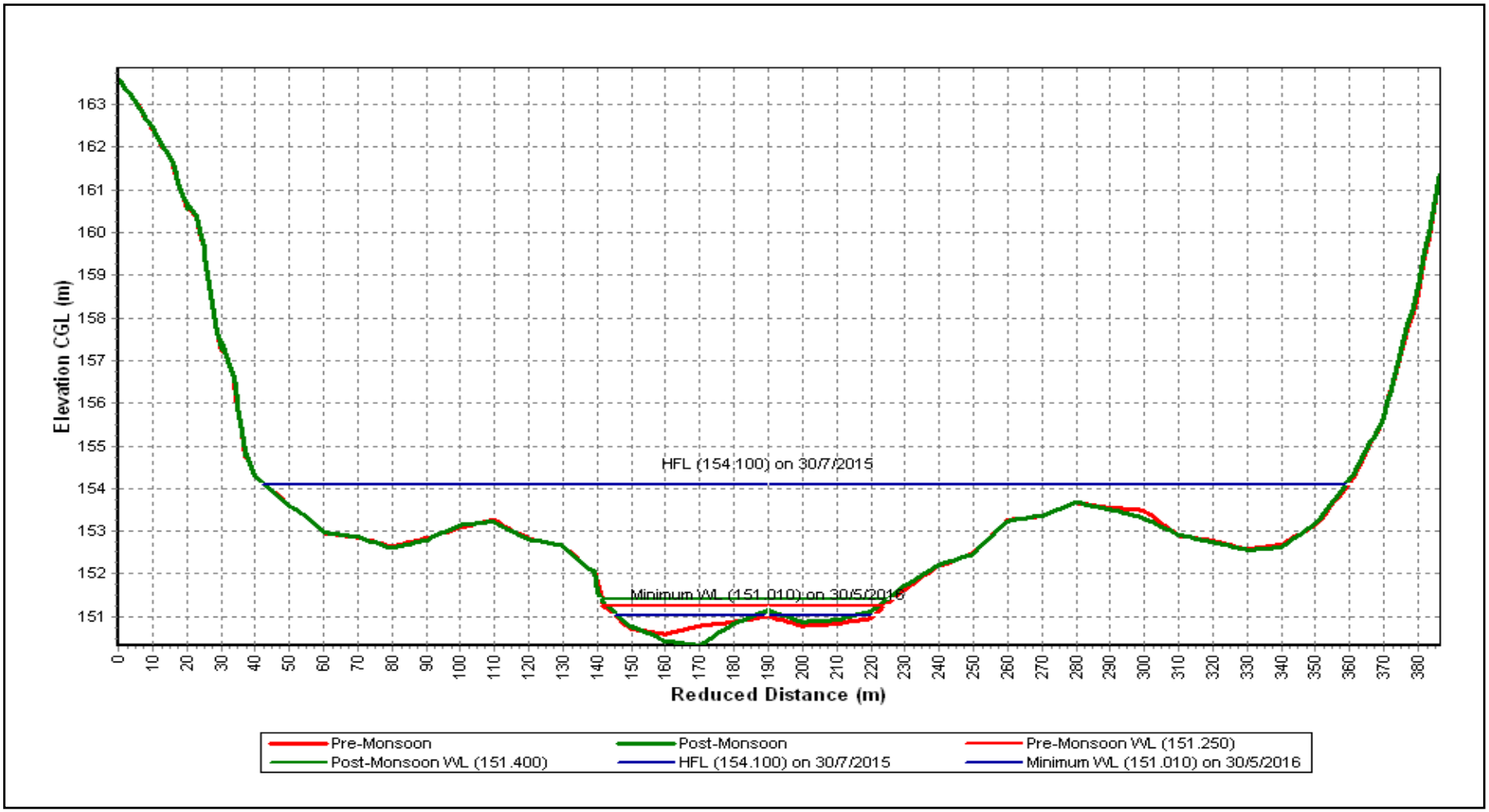
Equation Type - Power $Q=c*(h+a)^b$

LB	UB	a	b	c
151	155	-151.09	1.8639	60.21

Pre-Monsoon & Post-Monsoon X-Section for Water Year : 2015-2016

Station Name : Som at Rangeli (01 02 13 005) **Division : Mahi Division, Gandhinagar**

Local River : Som **Sub-Division : Mahi Sub Divn., Kadana**



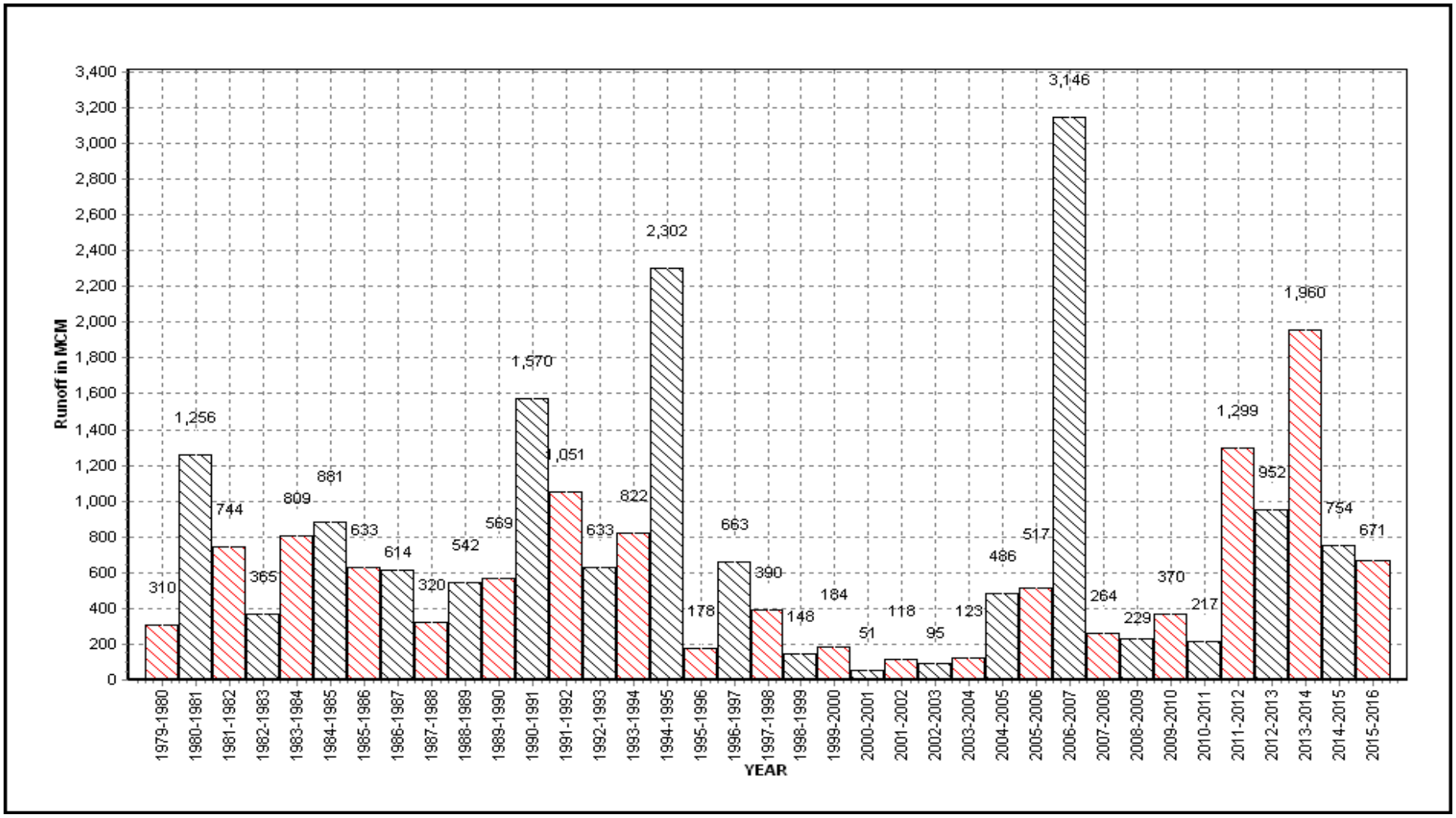
Historical Flood level - 160.86 m on 19.08.2006 at 1700 hrs

Note: HFL marked on graph denotes Max Water Level observed during the Water Year 2015-16

Annual Runoff Values for the period: 1979 - 2016

Station Name : Som at Rangeli (01 02 13 005) **Division : Mahi Division, Gandhinagar**

Local River : Som **Sub-Division : Mahi Sub Divn., Kadana**



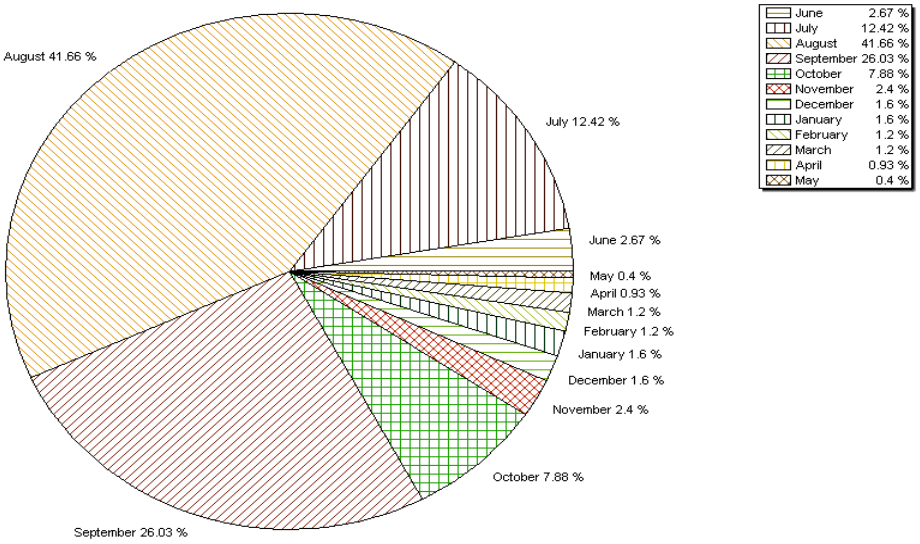
Note: Missing values have not been considered while arriving at Annual Runoff

Monthly Average Runoff based on period : 1979-2015

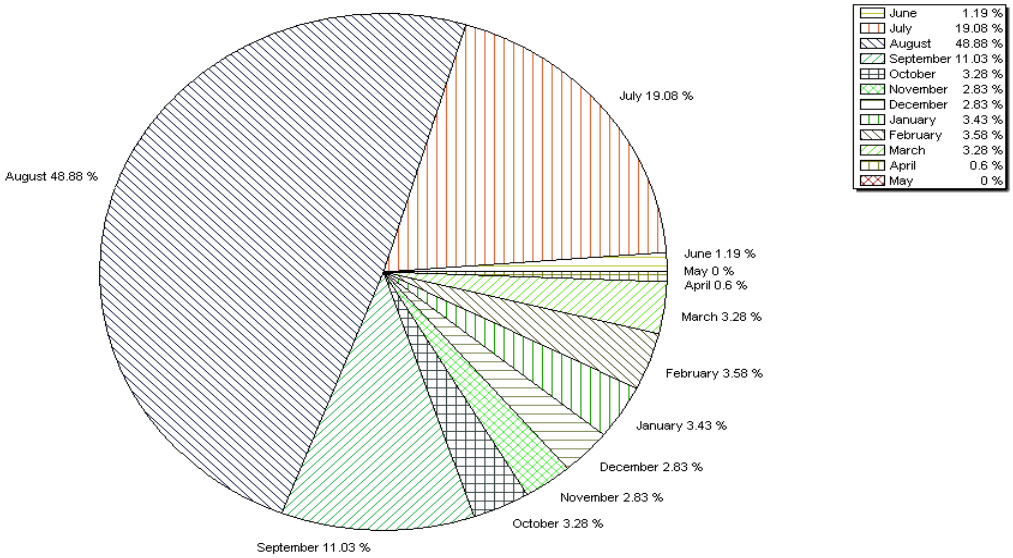
Station Name : Som at Rangeli (01 02 13 005) **Division : Mahi Division, Gandhinagar**

Local River : Som **Sub-Division : Mahi Sub Divn., Kadana**

Monthly Average Runoff based on period : 1979-2015



Monthly Runoff for the Year : 2015-2016

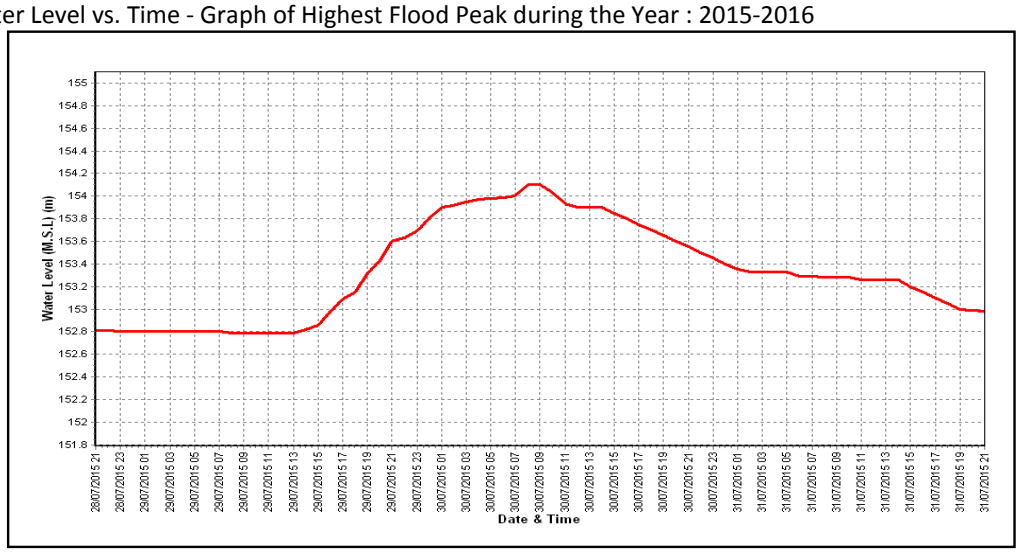


Water Level vs. Time - Graph of Highest Flood Peak during the Year : 2015-2016

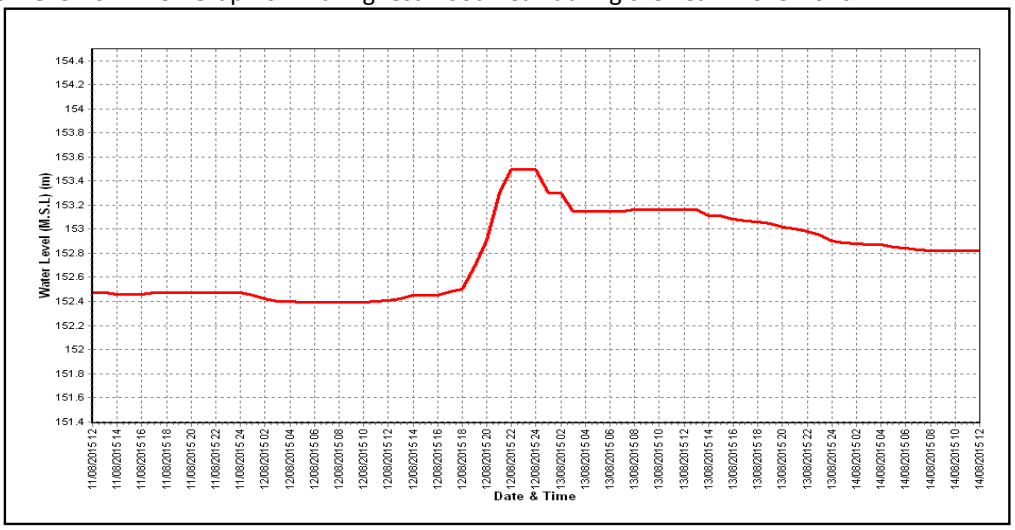
Station Name : Som at Rangeli (01 02 13 005) **Division : Mahi Division, Gandhinagar**

Local River : Som **Sub-Division : Mahi Sub Divn., Kadana**

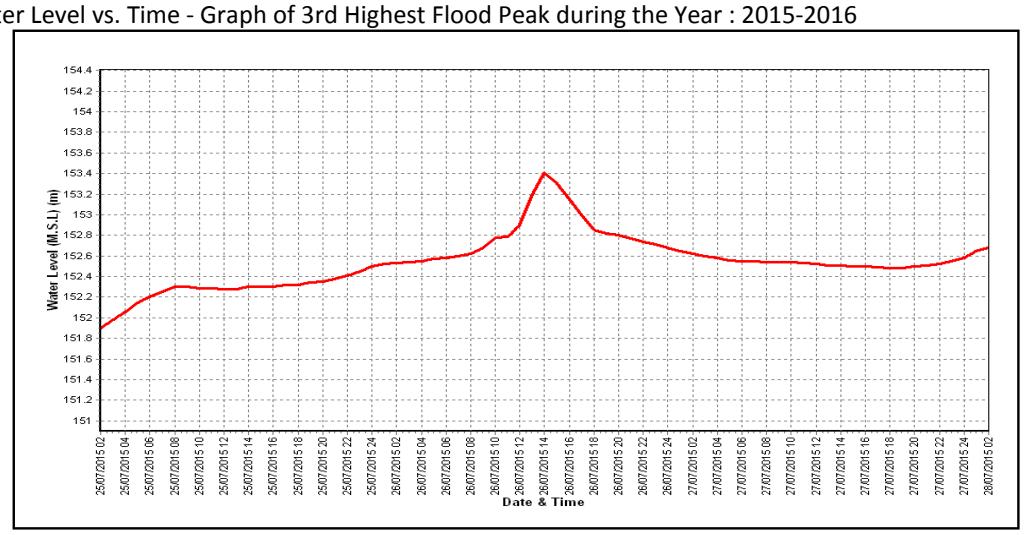
Water Level vs. Time - Graph of Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 2nd Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 3rd Highest Flood Peak during the Year : 2015-2016



Time Span: 72 Hrs

HISTORY SHEET

Water Year : 2015-16

Site	**:**	**Jakham at Dhariawad**	**Code**	**:**	**01 02 13 004**
State	:	Rajasthan	District		Udaipur
			Independent		
Basin	:	Mahi	River	:	Mahi
Tributary	:	Jakham	Sub Tributary	:	
Sub-Sub Tributary	:		Local River	:	Jakham
Division	:	Mahi Division, Gandhinagar	Sub-Division	:	Mahi Sub Divn., Kadana
Drainage Area	:	1510 Sq. Km.	Bank	:	Right
Latitude	:	24°04'43" N	Longitude	:	74°28'02" E
Zero of Gauge (m)	:	203 (m.s.l)	17/07/84		-
		Opening Date	Closing Date		
Gauge	:	17/07/84			
Discharge	:	01/06/88			
Sediment	:	-			
Water Quality	:	-			

Annual Maximum / Minimum discharge with corresponding Water Level (m.s.l)

	Maximum			Minimum		
Year	**Q (cumecs)**	**WL (m)**	**Date**	**Q (cumecs)**	**WL (m)**	**Date**
1988-1989	219.3	204.080	05/08/88	0.000	River Dry	01/04/89
1989-1990	Data not published					
1990-1991	484.2	206.300	07/09/90	0.000	River Dry	23/05/91
1991-1992	278.9	205.460	25/08/91	0.000	203.170	11/12/91
1992-1993	25.47	204.650	17/08/92	0.060	203.120	08/06/92
1993-1994	210.2	203.890	16/08/93	0.040	203.120	06/06/93
1994-1995	281.7	206.600	03/09/94	0.000	203.250	11/06/94
1995-1996	21.58	204.250	25/07/95	0.000	203.270	25/02/96
1996-1997	295.1	205.980	16/09/96	0.000	203.100	16/06/96
1997-1998	41.00	204.525	10/09/97	0.000	203.190	05/07/97
1998-1999	12.37	204.030	18/10/98	0.000	203.240	07/04/99
1999-2000	51.60	204.440	31/07/99	0.000	203.140	17/05/00
2000-2001	265.4	205.780	21/07/00	0.000	203.180	25/01/01
2001-2002	16.10	204.100	08/07/01	0.000	River Dry	06/06/01
2002-2003	64.41	204.560	06/09/02	0.000	203.200	24/12/02
2003-2004	17.25	204.400	25/09/03	0.000	203.190	07/04/04
2004-2005	682.4	207.350	24/08/04	0.000	203.300	02/04/05
2005-2006	939.8	207.600	28/07/05	0.582	203.360	05/09/05
2006-2007	1980	209.350	11/08/06	0.285	203.360	12/12/06
2007-2008	198.1	205.450	21/08/07	0.000	203.280	01/06/07
2008-2009	533.5	206.590	11/07/08	0.410	203.380	12/06/08
2009-2010	396.7	206.500	23/07/09	0.498	203.370	20/10/09
2010-2011	397.8	206.450	10/09/10	0.658	203.390	03/03/11
2011-2012	1296.7	208.000	12/09/11	0.000	203.350	15/04/12
2012-2013	211.1	205.500	16/08/12	0.000	River Dry	01/06/12
2013-2014	331.7	206.3	14/08/13	0.000	203.29	01/06/13
2014-2015	24.37	204.16	12/09/14	0.000	203.34	01/06/14
2015-2016	491.3	206.8	26/07/15	0.000	203.35	16/06/15

Stage-Discharge Data for the period 2015 - 2016

Station Name : Jakham at Dhariawad (01 02 13 004) **Division : Mahi Division, Gandhinagar**

Local River : Jakham **Sub-Division : Mahi Sub Divn., Kadana**

Day	Jun		Jul		Aug		Sep		Oct		Nov	
	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q
1	203.310	0.000	203.495	0.928	204.310	48.83	203.900	9.130 #	203.700	2.115	203.630	1.520 *
2	203.300	0.000	203.490	0.924	204.450	68.32 *	203.760	2.508	203.700	2.066 *	203.630	1.129
3	203.300	0.000	203.490	0.910	204.430	64.76	203.750	2.263	203.690	2.092	203.630	1.136
4	203.300	0.000	203.480	0.856	204.450	68.68	203.750	2.531	203.690	1.978 *	203.630	1.117
5	203.300	0.000	203.480	0.767 *	204.920	135.7 #	203.700	2.241	203.690	2.129	203.630	1.168
6	203.300	0.000	203.460	0.747	204.600	90.23	203.700	2.066 *	203.680	2.095	203.620	1.101
7	203.300	0.000	203.450	0.745	204.560	82.53	203.720	2.031	203.680	2.094	203.620	1.114
8	203.300	0.000	203.450	0.711	204.680	105.3	203.820	3.337	203.670	2.043	203.610	1.391 *
9	203.300	0.000	203.450	0.728	204.600	88.51 *	203.800	3.182	203.670	2.034	203.600	1.089
10	203.290	0.000	203.450	0.703	204.570	85.09	203.800	3.206	203.670	2.062	203.600	1.098
11	203.290	0.000	203.450	0.675	204.600	91.45	203.830	3.623	203.670	2.005	203.600	1.330 *
12	203.290	0.000	203.430	0.605 *	204.710	108.0	203.820	3.385	203.670	2.005	203.600	1.082
13	203.290	0.000	203.410	0.610	204.700	106.2	203.820	3.436 *	203.670	1.992	203.590	1.271 *
14	203.290	0.000	203.390	0.491	204.700	106.5	203.930	11.52 #	203.660	1.938	203.590	1.271 *
15	203.290	0.000	203.370	0.453 #	204.680	99.80 *	203.920	10.71 #	203.660	1.931	203.580	1.215 *
16	203.350	0.000	203.360	0.431 *	204.660	96.95 *	203.900	9.130 #	203.650	1.862	203.580	1.061
17	203.400	0.524 #	203.360	0.431 *	204.600	90.32	203.900	0.000 *	203.650	1.848	203.580	1.021
18	203.500	1.000	203.360	0.431 *	204.700	106.5	203.880	7.630 #	203.650	1.661 *	203.580	1.016
19	203.400	0.593	203.360	0.431 *	204.680	103.4	203.880	7.630 #	203.640	1.209	203.580	1.017
20	203.390	0.497	203.650	2.028	204.650	97.69	203.870	6.900 *	203.640	1.174	203.700	2.245
21	203.390	0.499 *	203.620	2.000	204.650	97.57	203.810	3.581	203.640	1.197	203.700	2.242
22	203.380	0.475 #	203.980	15.35	204.630	93.39	203.750	2.384	203.640	1.589 *	203.700	2.066 *
23	203.500	1.058	203.910	9.910 #	204.620	91.30 *	203.710	2.136	203.630	0.887	203.700	2.235
24	203.690	2.648	203.740	2.369	204.600	92.46	203.660	1.829	203.630	1.520 *	203.700	2.230
25	203.590	1.704	204.000	15.46	204.590	92.98	203.660	1.735 *	203.630	1.520 *	203.710	2.157 *
26	203.550	1.527	206.800	491.3 #	204.580	84.63	203.680	2.085	203.630	1.125	203.710	2.292
27	203.530	1.427	204.700	102.1	204.580	85.27	203.680	1.894 *	203.630	1.095	203.710	2.263
28	203.520	0.924 *	204.580	83.14	204.580	85.67	203.680	2.107	203.630	1.085	203.710	2.263
29	203.500	1.033	205.155	165.1	204.200	37.75	203.700	2.217	203.630	1.121	203.710	2.157 *
30	203.500	1.037	204.540	77.80	204.130	30.42 *	203.700	2.101	203.630	1.109	203.710	2.282
31			204.360	56.90 #	204.015	19.84			203.630	1.097		
Ten-Daily Mean												
I Ten-Daily	203.300	0.000	203.469	0.802	204.557	83.79	203.770	3.250	203.684	2.071	203.620	1.186
II Ten-Daily	203.349	0.261	203.414	0.659	204.668	100.7	203.875	6.396	203.656	1.763	203.598	1.253
III Ten-Daily	203.515	1.233	204.490	92.85	204.470	73.75	203.703	2.207	203.632	1.213	203.706	2.219
Monthly												
Min.	203.290	0.000	203.360	0.431	204.015	19.84	203.660	0.000	203.630	0.887	203.580	1.016
Max.	203.690	2.648	206.800	491.3	204.920	135.7	203.930	11.52	203.700	2.129	203.710	2.292
Mean	203.388	0.498	203.814	33.42	204.562	85.67	203.783	3.951	203.656	1.667	203.641	1.553

Annual Runoff in MCM = 359 Annual Runoff in mm = 237

Peak Observed Discharge = 491.3 cumecs on 26/07/2015 Corres. Water Level :206.8 m

Lowest Observed Discharge = 0.000 cumecs on 01/06/2015 Corres. Water Level :203.31 m

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff

Stage-Discharge Data for the period 2015 - 2016

Station Name : Jakham at Dhariawad (01 02 13 004) **Division : Mahi Division, Gandhinagar**

Local River : Jakham **Sub-Division : Mahi Sub Divn., Kadana**

Day	Dec		Jan		Feb		Mar		Apr		May	
	W.L	Q	WL	Q	WL	Q	WL	Q	WL	Q	WL	Q
1	203.700	2.210	203.730	2.438	203.720	2.415	203.730	2.450	203.480	0.737	203.400	0.520 *
2	203.700	2.192	203.730	2.452	203.720	2.405	203.720	2.281	203.450	0.538	203.400	0.520 *
3	203.700	2.244	203.720	2.252 *	203.720	2.386	203.700	2.234	203.440	0.650 *	203.400	0.520 *
4	203.650	1.857	203.720	2.252 *	203.730	2.454	203.700	2.228	203.430	0.600 *	203.400	0.520 *
5	203.550	1.003	203.710	2.285	203.730	2.427	203.680	2.083	203.420	0.580 *	203.400	0.520 *
6	203.540	1.014 *	203.680	2.085	203.730	2.351 *	203.660	1.735 *	203.420	0.580 *	203.400	0.520 *
7	203.540	0.979	203.650	1.661 *	203.680	1.894 *	203.640	1.847	203.420	0.580 *	203.400	0.520 *
8	203.540	0.968	203.600	1.243	203.580	1.215 *	203.600	1.097	203.420	0.580 *	203.400	0.520 *
9	203.520	0.922	203.570	1.049	203.560	1.110 *	203.570	1.095	203.420	0.580 *	203.400	0.520 *
10	203.520	0.916	203.560	1.110 *	203.550	1.029	203.550	1.026	203.420	0.580 *	203.390	0.500 *
11	203.540	0.990	203.560	1.110 *	203.550	1.036	203.520	0.915	203.410	0.550 *	203.390	0.500 *
12	203.550	0.886	203.550	1.060 *	203.540	1.013	203.520	0.907	203.410	0.550 *	203.390	0.500 *
13	203.570	1.162 *	203.540	1.013 *	203.540	1.007	203.520	0.924 *	203.410	0.550 *	203.390	0.500 *
14	203.600	1.227	203.560	1.110 *	203.540	1.013 *	203.520	0.967	203.410	0.550 *	203.390	0.500 *
15	203.620	1.318	203.560	1.110 *	203.550	1.035	203.520	0.968	203.410	0.550 *	203.390	0.500 *
16	203.620	1.328	203.580	1.215 *	203.550	1.025	203.520	0.964	203.410	0.550 *	203.390	0.500 *
17	203.660	1.941	203.590	1.271 *	203.570	1.028	203.510	0.925	203.410	0.550 *	203.390	0.500 *
18	203.680	2.118	203.600	1.330 *	203.600	1.091	203.510	0.878	203.410	0.550 *	203.380	0.480 *
19	203.680	1.894 *	203.600	1.330 *	203.620	1.454 *	203.510	0.921	203.410	0.550 *	203.380	0.480 *
20	203.690	1.978 *	203.610	1.308	203.640	1.589 *	203.510	0.882 *	203.410	0.550 *	203.380	0.480 *
21	203.700	2.066 *	203.620	1.454 *	203.670	1.813 *	203.510	0.918	203.410	0.550 *	203.380	0.480 *
22	203.700	2.066 *	203.680	2.118	203.700	2.242	203.510	0.926	203.400	0.520 *	203.380	0.480 *
23	203.700	2.066 *	203.680	2.117	203.720	2.438	203.510	0.883 *	203.400	0.520 *	203.380	0.480 *
24	203.700	2.066 *	203.690	1.978 *	203.720	2.385	203.510	0.883 *	203.400	0.520 *	203.370	0.460 *
25	203.710	2.157 *	203.690	1.978 *	203.730	2.452	203.510	0.883 *	203.400	0.520 *	203.370	0.460 *
26	203.710	2.157 *	203.690	1.978 *	203.730	2.448	203.500	0.855	203.400	0.520 *	203.370	0.460 *
27	203.720	2.252 *	203.700	2.066 *	203.730	2.440	203.500	0.842 *	203.400	0.520 *	203.370	0.460 *
28	203.730	2.351 *	203.700	2.066 *	203.730	2.351 *	203.500	0.853	203.400	0.520 *	203.370	0.460
29	203.730	2.351 *	203.710	2.157 *	203.730	2.402	203.490	0.809	203.400	0.520	203.370	0.460 *
30	203.730	2.351 *	203.710	2.157 *			203.490	0.806	203.400	0.520 *	203.360	0.430 *
31	203.730	2.351 *	203.710	2.157 *			203.480	0.744			203.360	0.430 *
Ten-Daily Mean												
I Ten-Daily	203.596	1.430	203.667	1.883	203.672	1.969	203.655	1.808	203.432	0.601	203.399	0.518
II Ten-Daily	203.621	1.484	203.575	1.186	203.570	1.129	203.516	0.925	203.410	0.550	203.387	0.494
III Ten-Daily	203.715	2.203	203.689	2.021	203.718	2.330	203.501	0.855	203.401	0.523	203.371	0.460
Monthly												
Min.	203.520	0.886	203.540	1.013	203.540	1.007	203.480	0.744	203.400	0.520	203.360	0.430
Max.	203.730	2.351	203.730	2.452	203.730	2.454	203.730	2.450	203.480	0.737	203.400	0.520
Mean	203.646	1.722	203.645	1.707	203.651	1.791	203.555	1.185	203.414	0.558	203.385	0.49

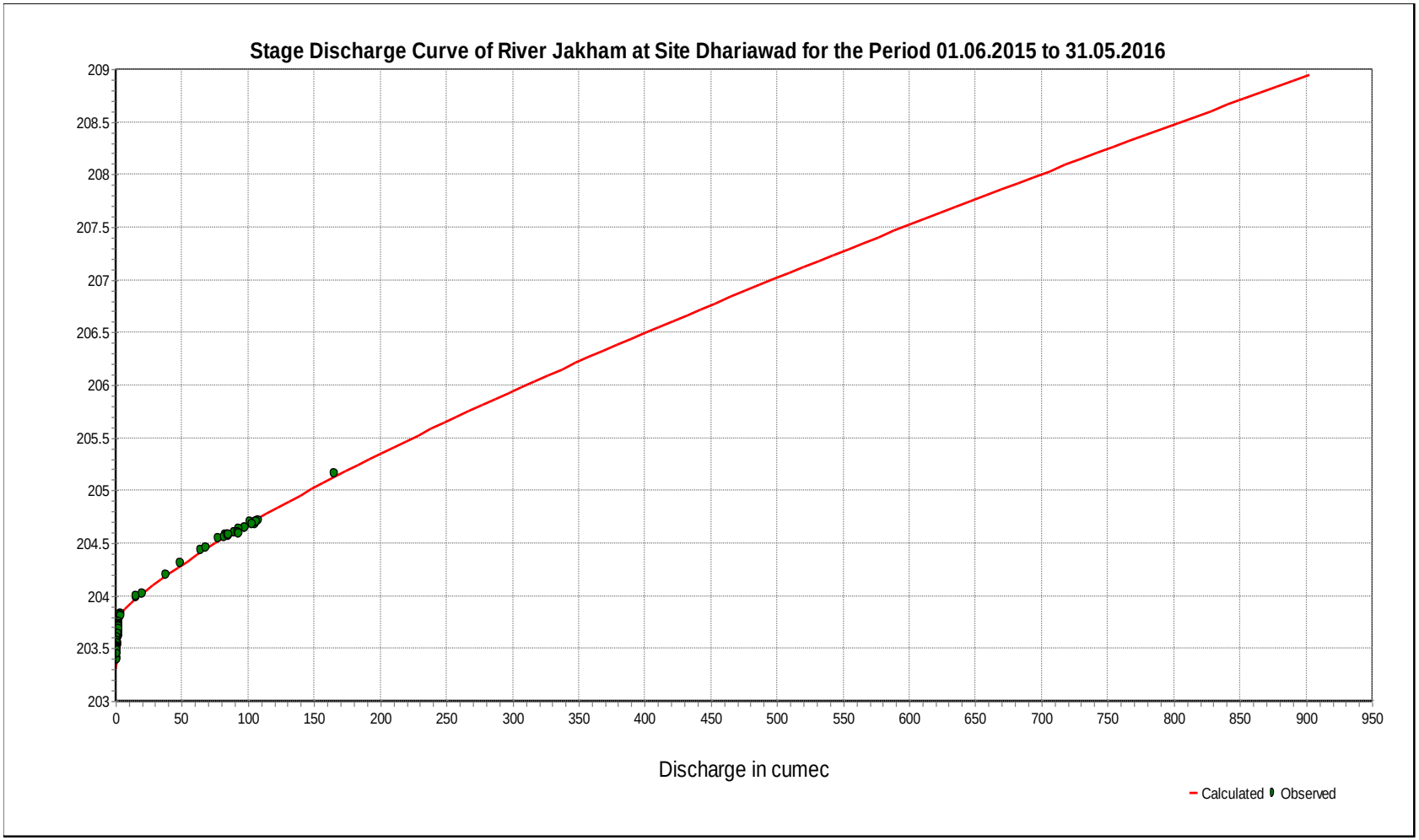
Peak Computed Discharge = 99.80 cumecs on 15/08/2015 **Corres. Water Level :204.68 m**

Lowest Computed Discharge = 0.000 cumecs on 17/09/2015 **Corres. Water Level :203.9 m**

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff



Procedure - Standard

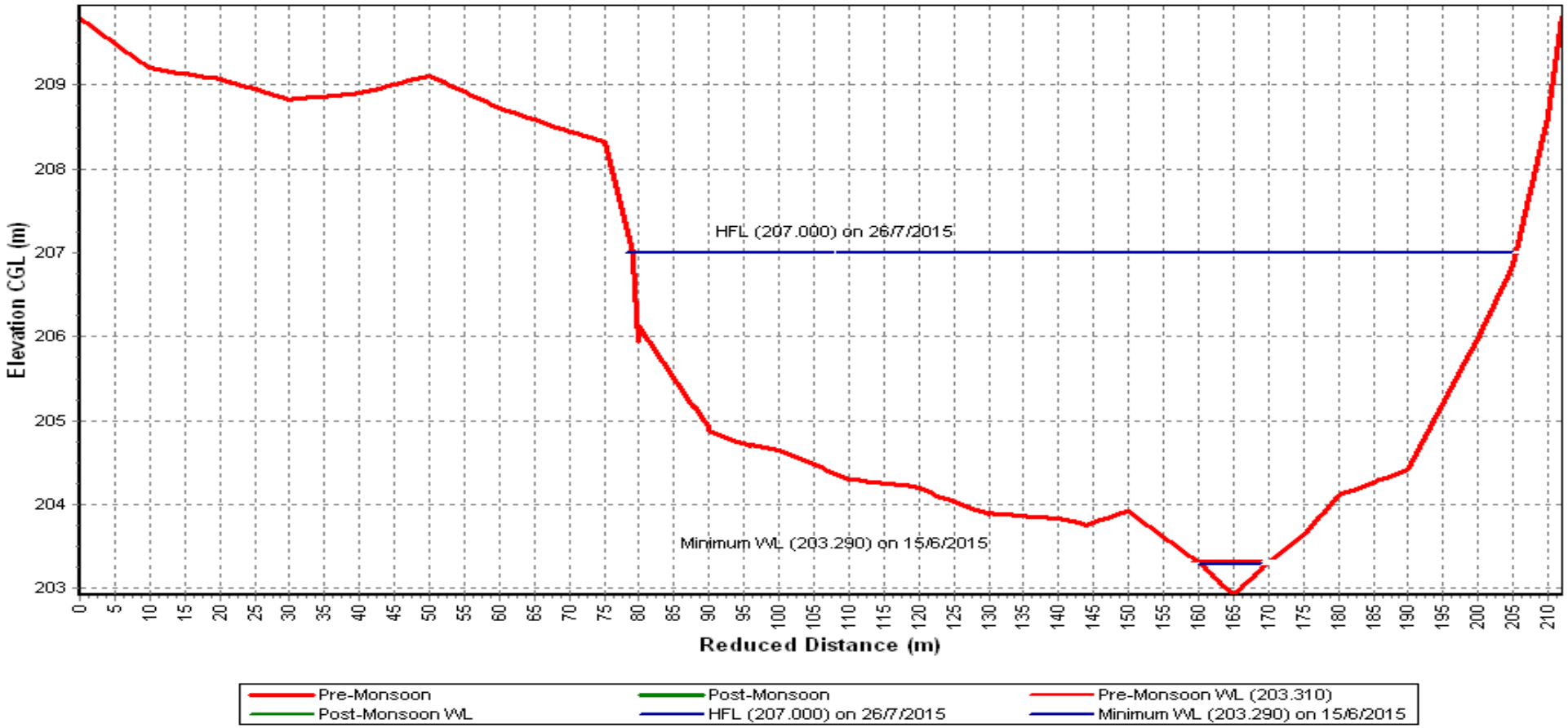
Equation Type - Power $Q=c*(h+a)^b$

LB	UB	a	b	c
203.3	203.82	-200.85	12.329	5.098-E6
203.82	209	-203.74	1.3504	108.5

Pre-Monsoon & Post-Monsoon X-Section for Water Year : 2015-2016

Station Name : Jakham at Dhariawad (01 02 13 004) **Division : Mahi Division, Gandhinagar**

Local River : Jakham **Sub-Division : Mahi Sub Divn., Kadana**



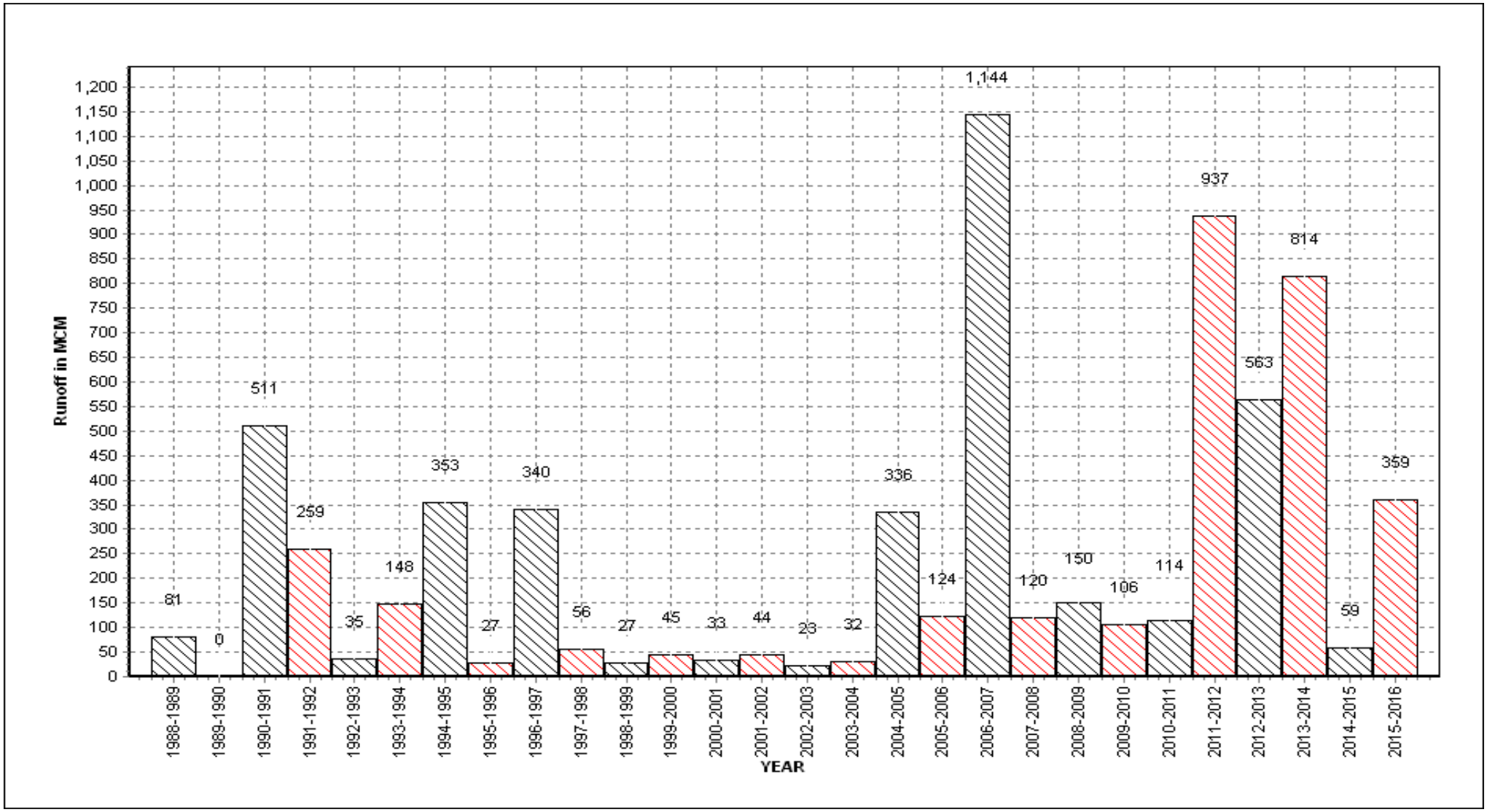
Highest flood level observed : 210.100m dt 11/08/16 at 06:00 hrs

HFL in graph shows Max Water level observed during 2015-16

Annual Runoff Values for the period: 1988 - 2016

Station Name : Jakham at Dhariawad (01 02 13 004) **Division : Mahi Division, Gandhinagar**

Local River : Jakham **Sub-Division : Mahi Sub Divn., Kadana**



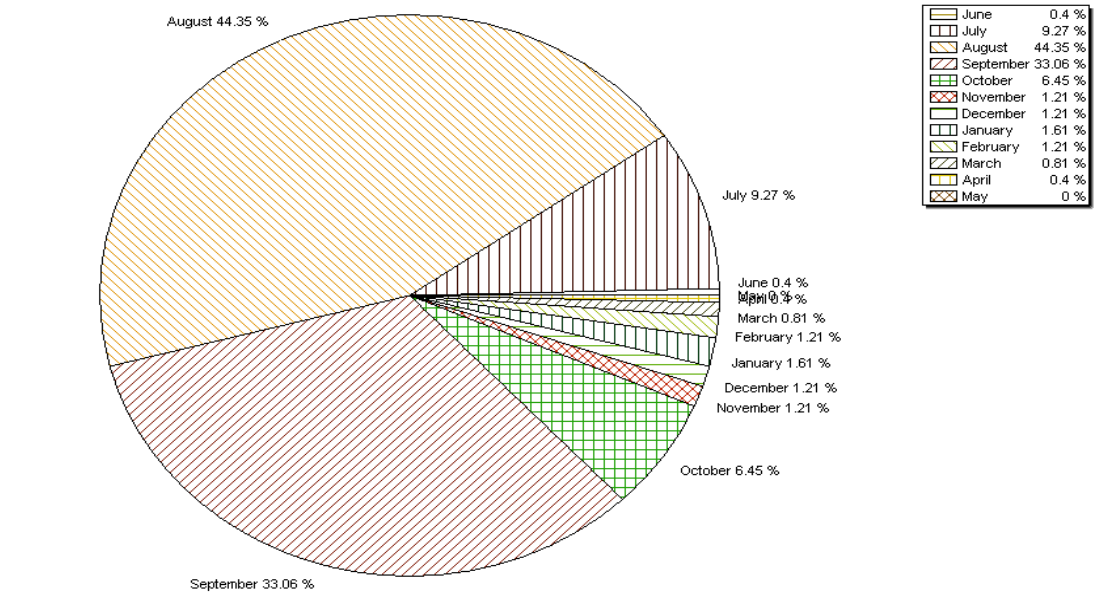
Note: Missing values have not been considered while arriving at Annual Runoff

Monthly Average Runoff based on period : 1988-2015

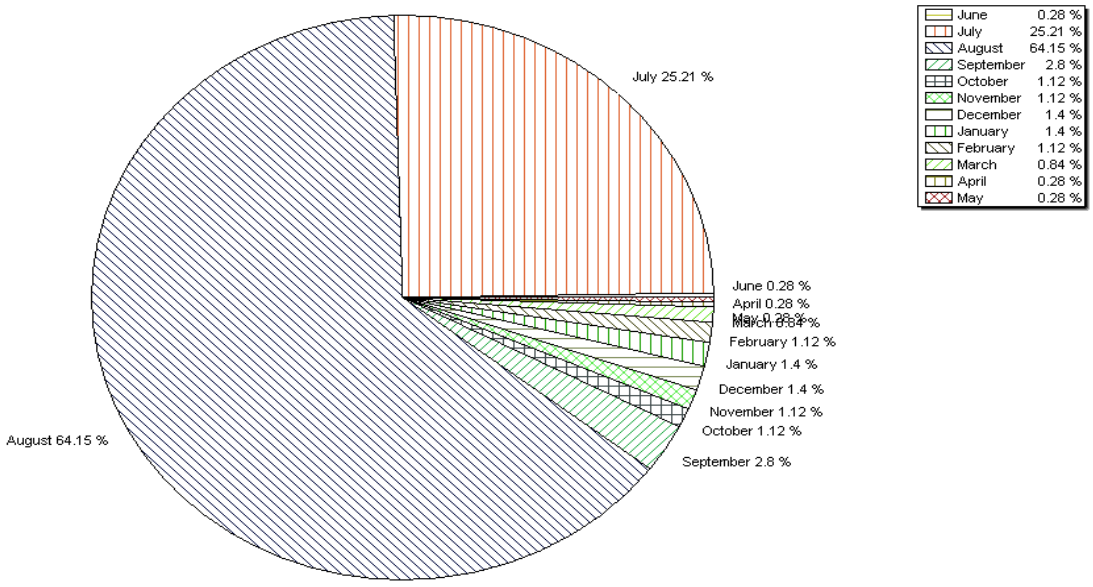
Station Name : Jakham at Dhariawad (01 02 13 004) **Division : Mahi Division, Gandhinagar**

Local River : Jakham **Sub-Division : Mahi Sub Divn., Kadana**

Monthly Average Runoff based on period : 1988-2015



Monthly Runoff for the Year : 2015-2016

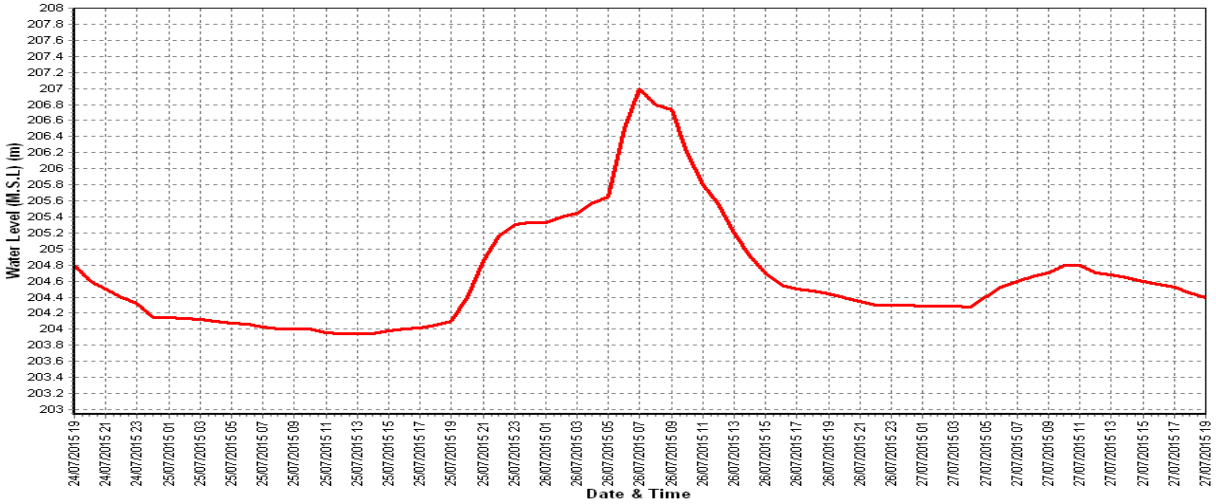


Water Level vs. Time - Graph of Highest Flood Peak during the Year : 2015-2016

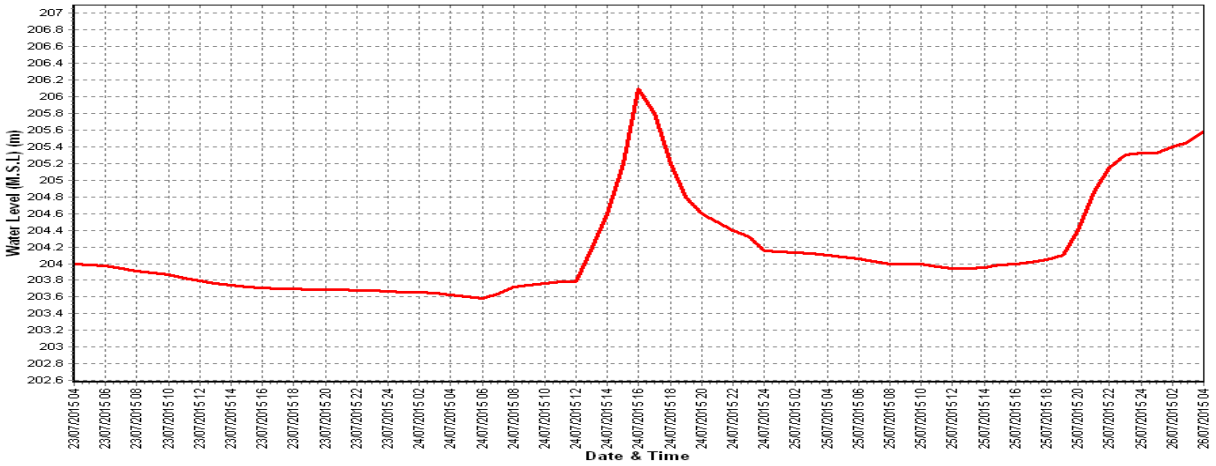
Station Name : Jakham at Dhariawad (01 02 13 004) **Division : Mahi Division, Gandhinagar**

Local River : Jakham **Sub-Division : Mahi Sub Divn., Kadana**

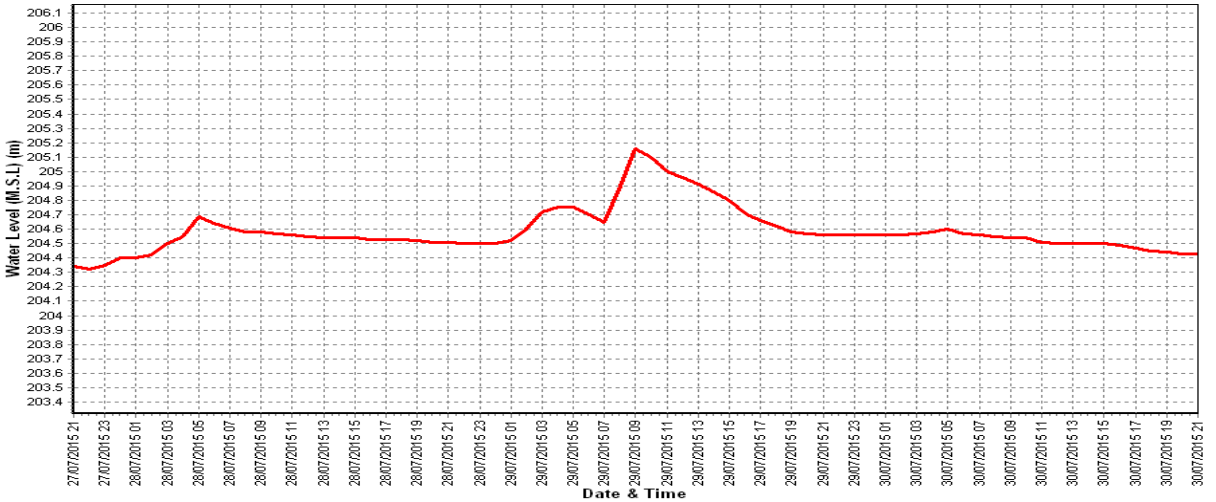
Water Level vs. Time - Graph of Highest Flood Peak during the Year : 2015-2018



Water Level vs. Time - Graph of 2nd Highest Flood Peak during the Year : 2015-2017



Water Level vs. Time - Graph of 3rd Highest Flood Peak during the Year : 2015-2016



Time Span: 72 Hrs

HISTORY SHEET

			Water Year	:	**2015-2016**
Site	:	**Mahi at Mataji**	**Code**	:	**01 02 13 001**
State	:	Madhya Pradesh	District		Ratlam
Basin	:	Mahi	Independent River	:	Mahi
Tributary	:	Mahi	Sub Tributary	:	
Sub-Sub Tributary	:		Local River	:	Mahi
Division	:	Mahi Division, Gandhinagar	Sub-Division	:	Mahi Sub Divn., Kadana
Drainage Area	:	3880 Sq. Km.	Bank	:	Left
Latitude	:	23°20'57"	Longitude	:	74°43'31"
Zero of Gauge (m)	:	295 (m.s.l) 284 (m.s.l)	01/01/82 01/01/04	-	31/12/03
		Opening Date	Closing Date		
Gauge	:	21/07/82			
Discharge	:	21/07/82			
Sediment	:	21/07/82			
Water Quality	:	21/07/82			

Annual Maximum / Minimum discharge with corresponding Water Level (m.s.l)

	Maximum			Minimum		
Year	**Q (cumecs)**	**WL (m)**	**Date**	**Q (cumecs)**	**WL (m)**	**Date**
1982-1983	2688	302.515	16/08/82	0.000	297.760	07/04/83
1983-1984	723.8	300.455	11/07/83	0.000	296.895	28/04/84
1984-1985	5636	303.895	11/08/84	0.000	296.970	05/04/85
1985-1986	165.0	298.800	04/08/85	0.000	297.015	28/03/86
1986-1987	6363	305.600	24/07/86	0.000	297.145	02/03/87
1987-1988	1080	301.200	25/08/87	0.000	297.090	30/01/88
1988-1989	8387	307.000	04/10/88	0.000	297.100	30/03/89
1989-1990	1586	297.800	02/07/89	0.000	297.100	24/01/90
1990-1991	3436	302.050	23/08/90	0.000	296.990	27/04/91
1991-1992	3154	304.800	31/07/91	0.000	296.730	22/06/91
1992-1993	475.7	299.800	07/09/92	0.000	296.940	02/05/93
1993-1994	1779	305.500	17/07/93	0.000	296.970	09/06/93
1994-1995	3453	306.550	02/08/94	0.000	296.740	03/06/94
1995-1996	1312	302.425	25/07/95	0.000	296.990	14/04/96
1996-1997	10257	306.300	28/07/96	0.000	296.910	16/04/97
1997-1998	2210	302.730	31/07/97	0.000	296.560	01/06/97
1998-1999	2430	302.150	16/09/98	0.000	296.680	13/05/99
1999-2000	284.0	299.230	26/09/99	0.000	296.990	25/01/00
2000-2001	134.0	299.050	13/08/00	0.000	296.870	25/01/01
2001-2002	166.0	299.220	17/08/01	0.000	296.525	25/01/02
2002-2003	414.1	299.750	04/09/02	0.000	River Dry	13/05/03
2003-2004	8252	306.300	28/07/03	0.000	286.440	15/04/04
2004-2005	1230	290.030	14/08/04	0.000	286.080	21/05/05
2005-2006	8075	294.480	28/07/05	0.000	286.330	01/01/06
2006-2007	7296	294.190	10/08/06	0.217	286.610	19/07/06
2007-2008	8074	294.300	09/07/07	0.000	285.650	01/06/07
2008-2009	202.3	288.890	12/09/08	0.000	285.550	31/05/09
2009-2010	6579	293.720	23/07/09	0.000	286.500	20/11/09
2010-2011	1017	290.460	30/08/10	0.000	286.630	20/01/11
2011-2012	1227.3	290.600	10/08/11	0.000	286.610	10/02/12
2012-2013	2631.0	292.120	07/09/12	0.000	286.420	01/06/12
2013-2014	1720	291.45	02/08/13	0.000	286.02	01/06/13
2014-2015	563.3	289.525	09/09/14	0.000	286.36	01/06/14
2015-2016	2643	291.225	26/07/15	0.000	286.670	19/10/15

Stage-Discharge Data for the period 2015 - 2016

Station Name : Mahi at Mataji (01 02 13 001) **Division : Mahi Division, Gandhinagar**

Local River : Mahi **Sub-Division : Mahi Sub Divn., Kadana**

Day	Jun		Jul		Aug		Sep		Oct		Nov	
	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q
1	286.930	4.867	286.960	5.007	288.435	374.0	287.130	22.17	286.900	3.828	286.520	0.000
2	286.920	4.840	286.930	5.015	288.340	269.3 *	287.140	22.86	286.890	3.440 *	286.510	0.000
3	286.900	4.683	286.870	0.723	288.280	332.9	287.120	22.08	286.880	2.968	286.510	0.000
4	286.870	0.723	286.850	0.732	288.200	312.2	287.090	21.39	286.880	3.080 *	286.510	0.000
5	286.850	0.687	286.810	1.140 *	288.230	317.2	287.070	20.77	286.870	1.025	286.500	0.000
6	286.820	0.691	286.760	0.619	289.915	1260	287.030	10.51 *	286.860	0.985	286.500	0.000
7	286.810	1.140 *	286.750	0.607	288.745	421.4	287.020	19.72	286.850	0.934	286.500	0.000
8	286.780	0.586	286.690	0.544 #	288.115	266.3	287.010	19.22	286.800	0.592	286.500	0.000
9	286.770	0.563	286.550	0.000	288.010	170.9 *	286.990	8.217	286.760	0.496	286.500	0.000
10	286.700	0.000 #	286.490	0.000	287.980	252.3	286.970	7.458	286.740	0.471	286.490	0.000
11	286.470	0.000	286.460	0.000	287.940	209.7	286.960	5.387	286.730	0.080 *	286.490	0.000
12	286.450	0.000 *	286.450	0.000	287.860	133.7 #	286.950	5.233	286.740	0.470	286.490	0.000
13	286.470	0.000 *	286.430	0.000	288.240	275.7	286.960	6.490 *	286.750	0.478	286.490	0.000
14	286.500	0.000 *	286.430	0.000	288.160	263.4	286.950	5.403	286.740	0.471	286.480	0.000
15	286.470	0.000 *	286.420	0.000	288.180	218.8 *	286.960	5.335	286.750	0.471	286.480	0.000
16	286.490	0.000 *	286.410	0.000	288.130	204.1 *	286.950	5.414	286.750	0.485	286.480	0.000
17	286.710	0.010 #	286.410	0.000	287.940	221.8	286.940	5.520 *	286.740	0.470	286.480	0.000
18	286.850	0.699	286.400	0.000	288.090	252.4	286.940	5.214	286.710	0.010 *	286.470	0.000
19	286.850	0.698	286.400	0.000	288.140	262.8	286.960	5.576	286.670	0.000 #	286.470	0.000
20	286.830	0.653	289.060	581.8 #	288.180	250.9	286.950	5.990 *	286.640	0.000 #	286.470	0.000
21	286.810	1.140 *	288.790	452.6	287.990	187.4	286.940	5.214	286.600	0.000 #	286.470	0.000
22	286.890	4.526	289.000	533.8	287.870	131.5	286.940	5.194	286.580	0.000	286.460	0.000
23	286.850	0.696	288.500	387.8	287.800	120.1 *	286.950	5.414	286.570	0.000	286.460	0.000
24	286.950	5.100	288.220	280.3	287.640	108.1	286.950	5.403	286.570	0.000	286.460	0.000
25	286.970	5.248	288.285	296.9	287.610	93.86	286.950	5.990 *	286.560	0.000	286.450	0.000
26	286.960	4.823	291.225	2643	287.580	87.90	286.940	4.764	286.550	0.000	286.450	0.000
27	286.960	4.810	290.460	1546	287.500	33.98	286.940	5.520 *	286.540	0.000	286.450	0.000
28	286.960	6.490 *	291.025	1911	287.400	32.56	286.930	5.033	286.540	0.000	286.440	0.000
29	286.980	5.050	289.640	901.5 #	287.320	28.43	286.920	4.260	286.530	0.000	286.430	0.000
30	286.980	4.921	289.240	652.5 #	287.210	25.35 *	286.910	4.224	286.520	0.000	286.430	0.000
31			288.815	455.1	287.260	26.35			286.520	0.000		
Ten-Daily Mean												
I Ten-Daily	286.835	1.878	286.766	1.439	288.425	397.6	287.057	17.44	286.843	1.782	286.504	0.000
II Ten-Daily	286.609	0.206	286.687	58.18	288.086	229.3	286.952	5.556	286.722	0.293	286.480	0.000
III Ten-Daily	286.931	4.280	289.382	914.6	287.562	79.59	286.937	5.102	286.553	0.000	286.450	0.000
Monthly												
Min.	286.450	0.000	286.400	0.000	287.210	25.35	286.910	4.224	286.520	0.000	286.430	0.000
Max.	286.980	6.490	291.225	2643	289.915	1260	287.140	22.86	286.900	3.828	286.520	0.000
Mean	286.792	2.122	287.669	343.8	288.009	230.5	286.982	9.366	286.701	0.669	286.478	0

Annual Runoff in MCM = 1570 Annual Runoff in mm = 405

Peak Observed Discharge = 2643 cumecs on 26/07/2015 Corres. Water Level :291.225 m

Lowest Observed Discharge = 0.000 cumecs on 10/06/2015 Corres. Water Level :286.7 m

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff

Stage-Discharge Data for the period 2015 - 2016

Station Name : Mahi at Mataji (01 02 13 001) **Division : Mahi Division, Gandhinagar**

Local River : Mahi **Sub-Division : Mahi Sub Divn., Kadana**

Day	Dec		Jan		Feb		Mar		Apr		May	
	W.L	Q	WL	Q	WL	Q	WL	Q	WL	Q	WL	Q
1	286.430	0.000	286.560	0.000	286.560	0.000	286.550	0.000	286.270	0.000	286.160	0.000
2	286.430	0.000	286.590	0.000	286.560	0.000	286.550	0.000	286.270	0.000	286.150	0.000
3	286.430	0.000	286.580	0.000	286.560	0.000	286.540	0.000	286.270	0.000	286.150	0.000
4	286.430	0.000	286.530	0.000	286.560	0.000	286.540	0.000	286.270	0.000	286.140	0.000
5	286.450	0.000	286.520	0.000	286.560	0.000	286.540	0.000	286.260	0.000	286.130	0.000
6	286.460	0.000	286.520	0.000	286.550	0.000	286.540	0.000	286.260	0.000	286.130	0.000
7	286.470	0.000	286.520	0.000	286.550	0.000	286.540	0.000	286.260	0.000	286.120	0.000
8	286.480	0.000	286.520	0.000	286.550	0.000	286.530	0.000	286.250	0.000	286.120	0.000
9	286.490	0.000	286.540	0.000	286.550	0.000	286.530	0.000	286.250	0.000	286.120	0.000
10	286.500	0.000	286.540	0.000	286.560	0.000	286.520	0.000	286.250	0.000	286.110	0.000
11	286.500	0.000	286.560	0.000	286.560	0.000	286.520	0.000	286.240	0.000	286.100	0.000
12	286.510	0.000	286.570	0.000	286.550	0.000	286.510	0.000	286.240	0.000	286.080	0.000
13	286.510	0.000	286.560	0.000	286.550	0.000	286.510	0.000	286.240	0.000	286.080	0.000
14	286.500	0.000	286.560	0.000	286.550	0.000	286.500	0.000	286.230	0.000	286.070	0.000
15	286.520	0.000	286.560	0.000	286.550	0.000	286.450	0.000	286.220	0.000	286.040	0.000
16	286.520	0.000	286.560	0.000	286.550	0.000	286.430	0.000	286.220	0.000	285.900	0.000
17	286.520	0.000	286.550	0.000	286.560	0.000	286.380	0.000	286.210	0.000	285.850	0.000
18	286.520	0.000	286.570	0.000	286.560	0.000	286.350	0.000	286.210	0.000	285.830	0.000
19	286.520	0.000	286.570	0.000	286.560	0.000	286.340	0.000	286.200	0.000	285.780	0.000
20	286.510	0.000	286.570	0.000	286.560	0.000	286.330	0.000	286.200	0.000	285.730	0.000
21	286.510	0.000	286.580	0.000	286.550	0.000	286.320	0.000	286.190	0.000	285.700	0.000
22	286.510	0.000	286.580	0.000	286.550	0.000	286.320	0.000	286.190	0.000	285.650	0.000
23	286.510	0.000	286.580	0.000	286.550	0.000	286.310	0.000	286.190	0.000	285.610	0.000
24	286.510	0.000	286.570	0.000	286.550	0.000	286.310	0.000	286.190	0.000	285.580	0.000
25	286.510	0.000	286.570	0.000	286.550	0.000	286.300	0.000	286.190	0.000	285.560	0.000
26	286.510	0.000	286.570	0.000	286.540	0.000	286.300	0.000	286.180	0.000	285.540	0.000
27	286.510	0.000	286.560	0.000	286.540	0.000	286.290	0.000	286.180	0.000	285.530	0.000
28	286.510	0.000	286.560	0.000	286.550	0.000	286.290	0.000	286.180	0.000	285.520	0.000
29	286.510	0.000	286.560	0.000	286.550	0.000	286.290	0.000	286.170	0.000	285.480	0.000
30	286.510	0.000	286.570	0.000			286.280	0.000	286.170	0.000	285.440	0.000
31	286.510	0.000	286.570	0.000			286.280	0.000			285.430	0.000
Ten-Daily Mean												
I Ten-Daily	286.457	0.000	286.542	0.000	286.556	0.000	286.538	0.000	286.261	0.000	286.133	0.000
II Ten-Daily	286.513	0.000	286.563	0.000	286.555	0.000	286.432	0.000	286.221	0.000	285.946	0.000
III Ten-Daily	286.510	0.000	286.570	0.000	286.548	0.000	286.299	0.000	286.183	0.000	285.549	0.000
Monthly												
Min.	286.430	0.000	286.520	0.000	286.540	0.000	286.280	0.000	286.170	0.000	285.430	0.000
Max.	286.520	0.000	286.590	0.000	286.560	0.000	286.550	0.000	286.270	0.000	286.160	0.000
Mean	286.494	0	286.559	0	286.553	0	286.419	0	286.222	0	285.865	0

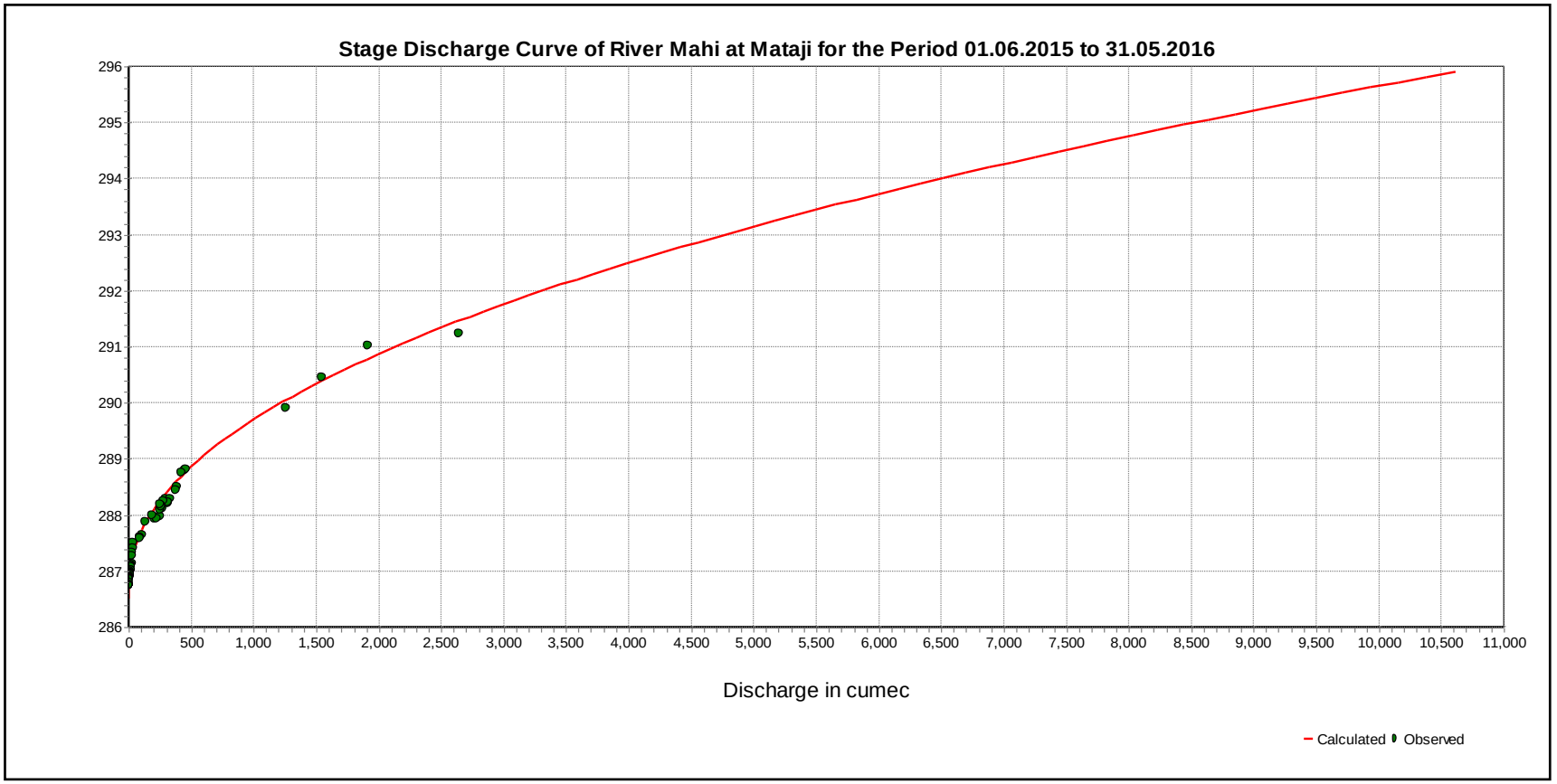
Peak Computed Discharge = 269.3 cumecs on 02/08/2015 Corres. Water Level :288.34 m

Lowest Computed Discharge = 0.000 cumecs on 12/06/2015 Corres. Water Level :286.45 m

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff



Procedure - Standard

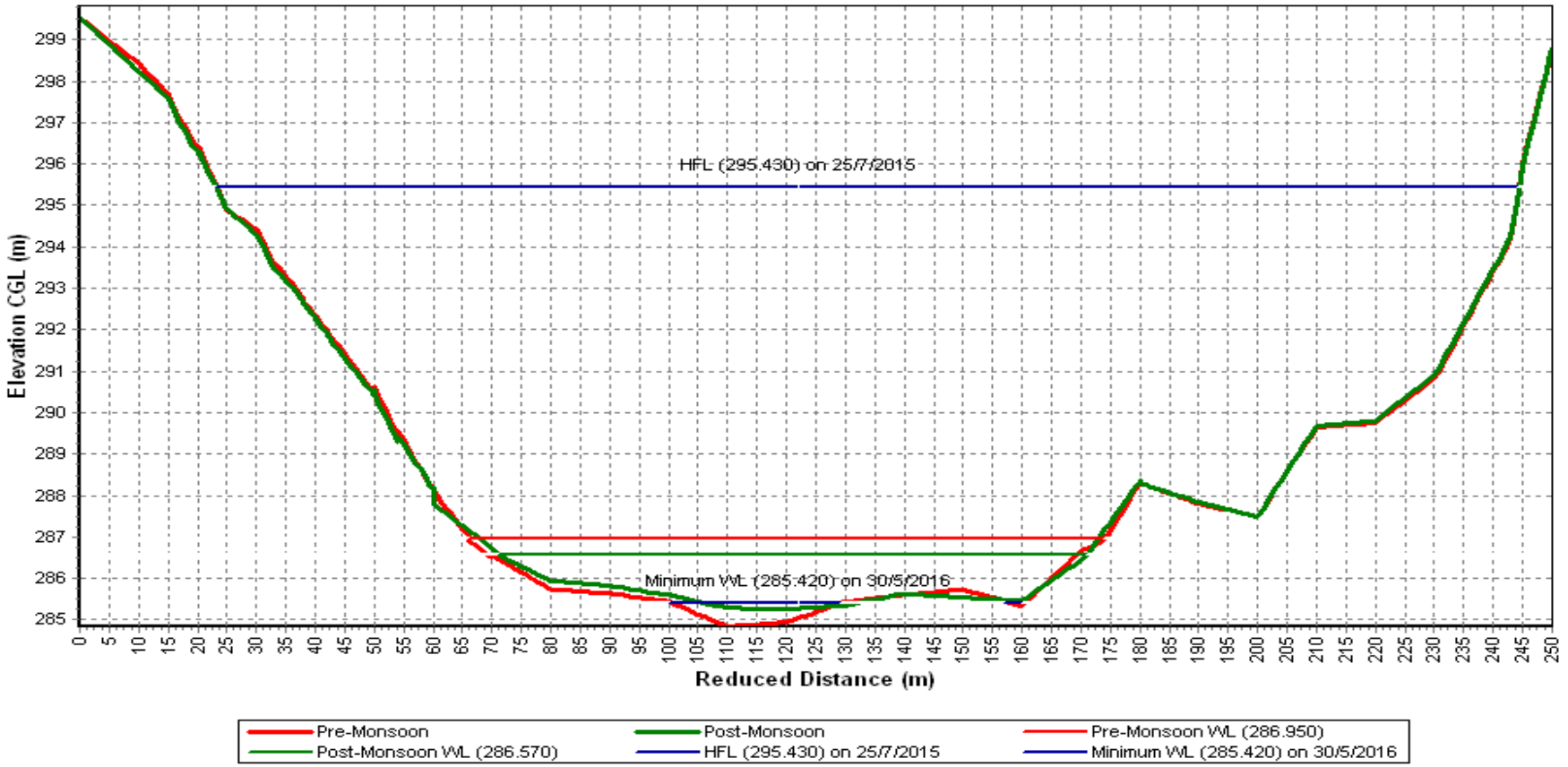
Equation Type - Power Q=c*(h+a)b

LB	UB	a	b	c
286.5	296	-286.7	2.023	98.995

Pre-Monsoon & Post-Monsoon X-Section for Water Year : 2015-2016

Station Name : Mahi at Mataji (01 02 13 001) **Division : Mahi Division, Gandhinagar**

Local River : Mahi **Sub-Division : Mahi Sub Divn., Kadana**



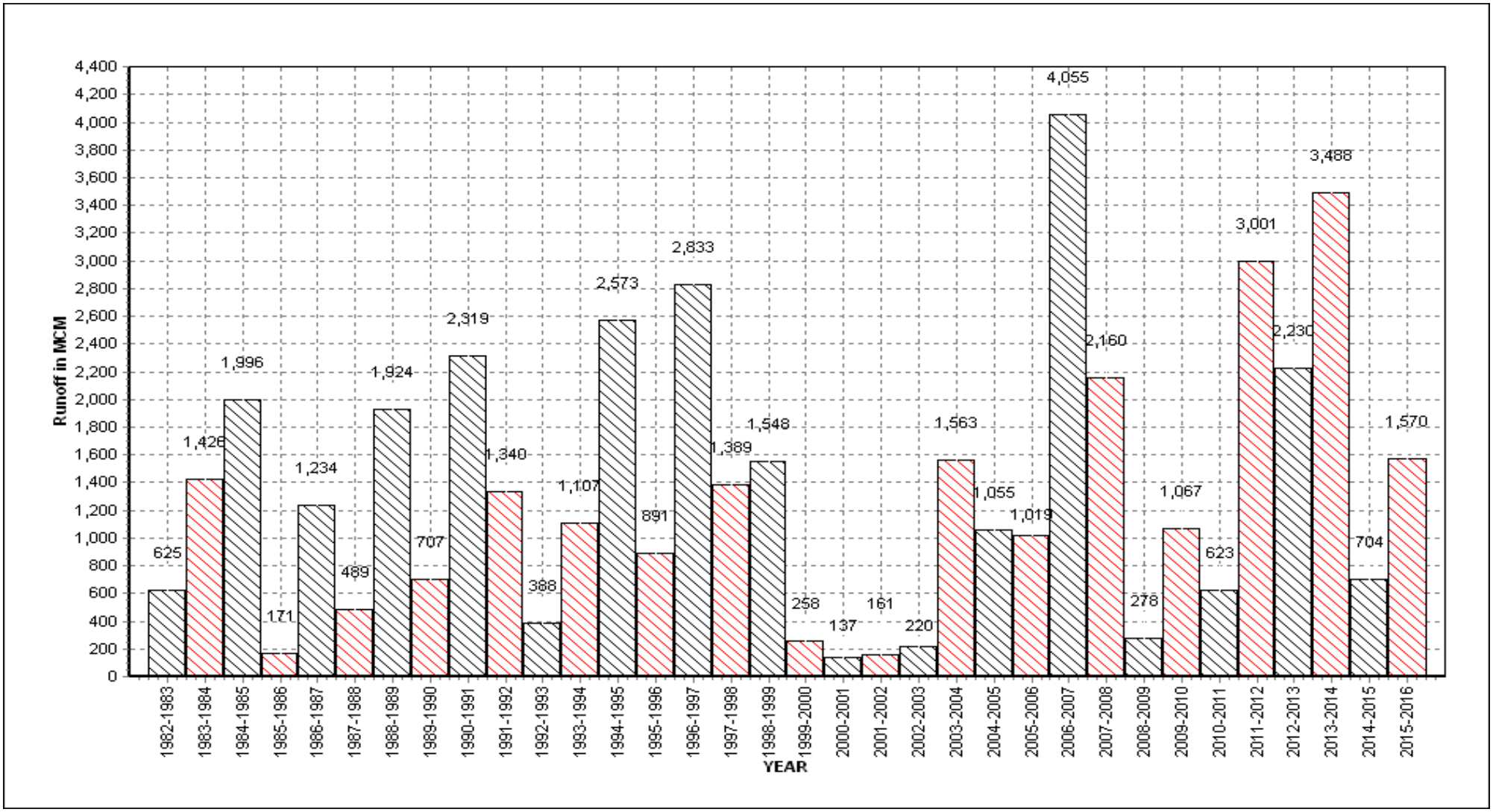
Historical flood level - 298.32 m on 06.09.2006 at 1800 hrs

Note: HFL marked on graph denotes Maxiumun Water Level observed during the Water Year 2015-16

Annual Runoff Values for the period: 1982 - 2016

Station Name : Mahi at Mataji (01 02 13 001) **Division : Mahi Division, Gandhinagar**

Local River : Mahi **Sub-Division : Mahi Sub Divn., Kadana**



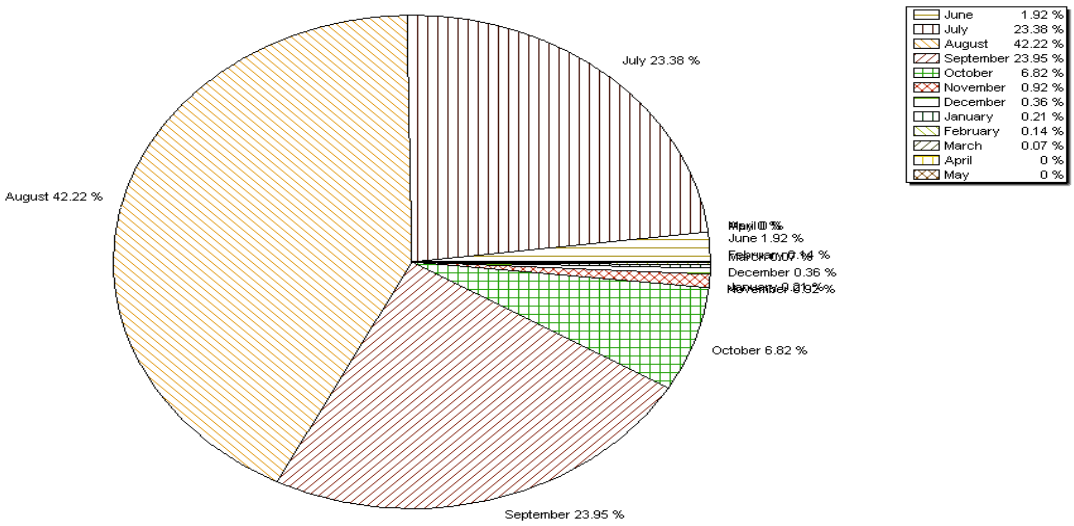
Note: Missing values have not been considered while arriving at Annual Runoff

Monthly Average Runoff based on period : 1982-2015

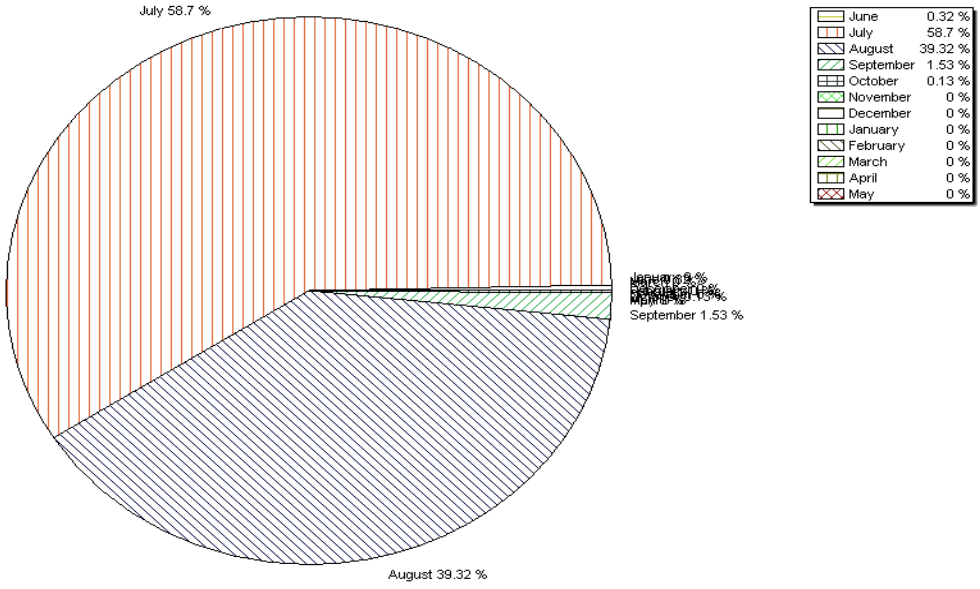
Station Name : Mahi at Mataji (01 02 13 001) **Division : Mahi Division, Gandhinagar**

Local River : Mahi **Sub-Division : Mahi Sub Divn., Kadana**

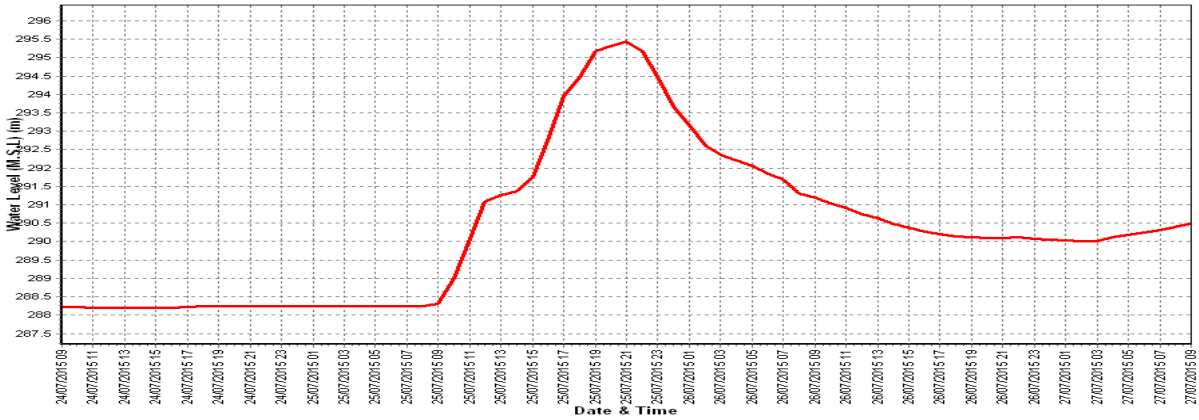
Monthly average runoff based on period 1989-2015



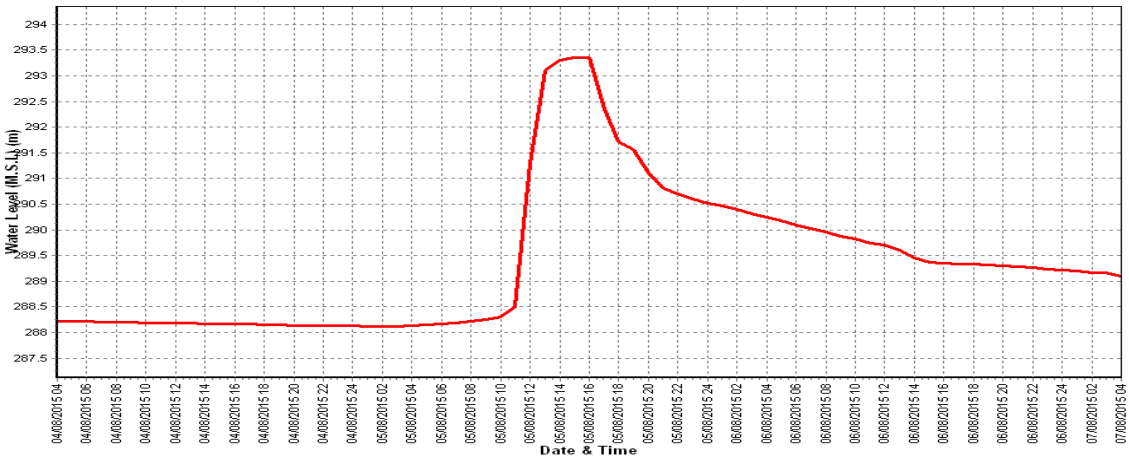
Monthly runoff for the year : 2015-16



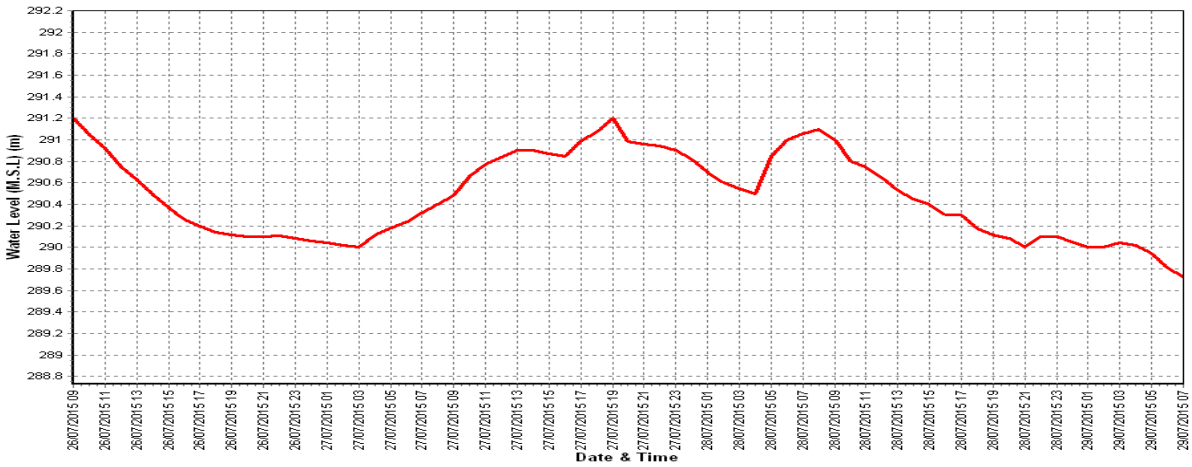
Water Level vs. Time - Graph of Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of second Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of third Highest Flood Peak during the Year : 2015-2016



HISTORY SHEET

			Water Year	:	**2015-16**
Site	:	**Sabarmati at Voutha**	**Code**	:	**01 02 12 013**
State	:	Gujarat	District	:	Ahmedabad
Basin	:	Sabarmati	Independent River	:	Sabarmati
Tributary	:	Sabarmati	Sub Tributary	:	
Sub-Sub Tributary	:		Local River	:	Sabarmati
Division	:	Mahi Division, Gandhinagar	Sub-Division	:	Sabarmati Sub Divn., Ahmedabad
Drainage Area	:	19636 Sq. Km.	Bank	:	Left
Latitude	:	22°38'59"N	Longitude	:	72°32'08"E
Zero of Gauge (m)					
	:	12 (m.s.l)	01/06/99	-	
		Opening Date	Closing Date		
Gauge	:	05/08/99			
Discharge	:	24/06/00			
Sediment	:	---			
Water Quality	:	01/01/00			

Annual Maximum / Minimum discharge with corresponding Water Level (m.s.l)

	Maximum			Minimum		
Year	**Q (cumecs)**	**WL (m)**	**Date**	**Q (cumecs)**	**WL (m)**	**Date**
2001-2002	168.0	15.198	09/08/01	0.000	River Dry	10/10/01
2002-2003	145.3	15.048	06/09/02	0.000	12.970	18/05/03
2003-2004	2220	19.025	25/08/03	0.000	13.100	01/06/03
2004-2005	1205	17.810	07/08/04	0.000	13.480	30/06/04
2005-2006	3141	19.000	01/07/05	3.857	13.250	07/06/05
2006-2007	3351	19.865	09/08/06	3.565	13.510	15/07/06
2007-2008	4958	20.660	10./07/2007	6.546	13.800	18/06/07
2008-2009	704.2	17.170	13/08/08	9.093	13.880	10/07/08
2009-2010	972.5	16.500	24/07/09	8.605	13.650	23/11/09
2010-2011	880.1	16.550	09/08/10	5.275	13.760	21/07/10
2011-2012	1744.1	18.140	13/09/11	6.296	13.710	24/06/11
2012-2013	2223.0	19.145	08/09/12	7.106	13.710	19/11/12
2013-2014	1269	17.380	04/08/13	4.500	13.360	19/09/13
2014-2015	1201	17.745	10/09/14	8.339	13.620	04/04/15
2015-2016	3137	20.320	31/07/15	10.11	13.750	05/03/16

Stage-Discharge Data for the period 2015 - 2016

Station Name : Sabarmati at Voutha (01 02 12 013) **Division : Mahi Division, Gandhinagar**

Local River : Sabarmati **Sub-Division : Sabarmati Sub Divn., Ahmedabad**

Day	Jun		Jul		Aug		Sep		Oct		Nov	
	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q
1	13.640	13.74	13.800	26.30	18.350	1717	14.030	43.10	13.850	36.20	13.900	32.40 *
2	13.630	14.58	13.760	13.14	16.200	598.8 *	14.020	40.73	13.860	33.91	13.960	44.28
3	13.640	13.21	13.750	16.33	15.560	415.8	14.030	43.62	13.820	31.60	13.860	35.25
4	13.630	11.71	13.760	13.20	15.760	517.6	14.000	39.34	13.830	25.86 *	13.860	37.66
5	13.660	16.60	13.760	20.02 *	15.450	405.6	13.960	35.60	13.830	40.13	13.820	30.92
6	13.640	13.35	13.740	16.23	15.100	366.6	13.930	35.42 *	13.810	35.70	13.890	37.95
7	13.640	11.65 *	13.740	17.64	15.090	308.3	13.910	37.69	14.000	48.05	13.810	32.98
8	13.630	14.47	13.750	19.63	14.860	272.9	13.920	42.15	14.130	60.34	13.800	23.27 *
9	13.640	15.27	13.840	25.80	14.770	168.8 *	13.880	36.99	14.080	54.18	13.780	29.82
10	13.640	13.89	13.750	22.77	14.720	219.6	13.880	36.29	13.860	33.45	13.780	29.60
11	13.660	15.92	13.730	19.12	14.500	166.5	13.870	33.45	13.840	26.75 *	13.800	23.27 *
12	13.670	17.44	13.730	17.73 *	14.460	90.81	13.870	40.92	13.820	35.87	13.820	25.89
13	13.710	18.06	13.720	19.65	14.450	117.4	13.850	27.66 *	13.990	48.08	13.900	36.87
14	13.760	20.02 *	13.710	19.46	15.720	421.4	13.870	35.03	13.890	41.92	13.800	30.15
15	13.740	26.60	13.760	19.76	16.280	643.5	13.850	34.25	13.840	34.52	13.840	26.75 *
16	13.720	18.85	13.740	22.27	15.800	453.8 *	13.800	30.26	13.840	36.96	13.760	26.53
17	13.750	23.51	13.740	16.69	15.140	255.2	13.770	32.70	13.830	35.16	13.710	24.62
18	13.720	20.60	13.740	18.32	15.080	281.2	13.850	37.94	13.820	24.98 *	13.690	23.39
19	13.720	13.96	13.720	18.32	15.060	326.9	13.920	42.10	13.820	35.51	13.720	27.07
20	13.730	16.67	13.740	19.69	15.350	397.0	14.880	211.2	13.970	41.77	13.710	25.77
21	13.700	15.57 *	13.730	18.40	15.310	346.1	14.960	211.2	14.160	60.71	13.720	25.08
22	13.680	12.19	13.720	19.68	15.190	277.6	14.720	123.5	14.100	52.57	13.740	18.48 *
23	13.680	10.67	13.950	37.68	14.720	158.3 *	14.670	99.90	14.260	69.73	13.710	23.99
24	13.700	11.16	13.750	21.39	14.700	125.6	14.880	140.7	13.950	43.80	13.760	27.19
25	14.550	127.9	13.790	24.47	14.490	91.27	14.770	128.4	13.870	29.52 *	13.740	18.48 *
26	14.800	118.3	13.890	31.43 *	14.440	100.6	14.400	81.50	13.890	39.87	13.710	24.35
27	14.790	98.69	14.310	78.64	14.390	76.68	14.330	87.35 *	13.870	40.48	13.710	23.53
28	14.380	95.34 *	15.470	272.1	14.130	50.48	14.240	65.87	13.860	36.91	13.690	23.86
29	14.240	63.63	16.900	822.2	14.070	47.80	14.080	49.44	13.880	36.14	13.690	14.88 *
30	13.920	29.65	19.050	2158 #	14.060	49.92 *	13.890	37.87	13.840	38.35	13.700	24.20
31			20.320	3137 #	14.040	42.18			13.840	38.64		
Ten-Daily Mean												
I Ten-Daily	13.639	13.85	13.765	19.11	15.586	499.1	13.956	39.09	13.907	39.94	13.846	33.41
II Ten-Daily	13.718	19.16	13.733	19.10	15.184	315.4	13.953	52.55	13.866	36.15	13.775	27.03
III Ten-Daily	14.144	58.32	15.353	601.9	14.504	124.2	14.494	102.6	13.956	44.25	13.717	22.40
Monthly												
Min.	13.630	10.67	13.710	13.14	14.040	42.18	13.770	27.66	13.810	24.98	13.690	14.88
Max.	14.800	127.9	20.320	3137	18.350	1717	14.960	211.2	14.260	69.73	13.960	44.28
Mean	13.834	30.44	14.318	225.9	15.072	306.8	14.134	64.74	13.911	40.25	13.779	27.62

Annual Runoff in MCM = 2146 Annual Runoff in mm = 109

Peak Observed Discharge = 3137 cumecs on 31/07/2015 Corres. Water Level :20.32 m

Lowest Observed Discharge = 10.11 cumecs on 05/03/2016 Corres. Water Level :13.75 m

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff

Stage-Discharge Data for the period 2015 - 2016

Station Name : Sabarmati at Voutha (01 02 12 013) **Division : Mahi Division, Gandhinagar**

Local River : Sabarmati **Sub-Division : Sabarmati Sub Divn., Ahmedabad**

Day	Dec		Jan		Feb		Mar		Apr		May	
	W.L	Q	WL	Q	WL	Q	WL	Q	WL	Q	WL	Q
1	13.690	24.85	13.770	28.42	13.770	23.22	13.720	10.60	13.800	14.32	13.740	18.48
2	13.710	26.27	13.770	20.81 *	13.770	20.81 *	13.770	20.81 *	13.810	14.34	13.740	11.78
3	13.700	25.77	13.760	20.02 *	13.780	12.60	13.720	10.67	13.790	22.44 *	13.740	12.73
4	13.710	25.85	13.760	27.58	13.770	11.93	13.740	11.04	13.760	11.90	13.720	15.66
5	13.730	27.96	13.770	29.13	13.768	11.43	13.750	10.11	13.750	12.30	13.720	16.70
6	13.740	18.48 *	13.780	27.22	13.760	11.27	13.740	18.48 *	13.750	12.81	13.730	17.45
7	13.730	27.07	13.770	26.67	13.770	20.81 *	13.740	11.23	13.750	12.27	13.760	16.55
8	13.720	25.42	13.780	25.22	13.770	12.17	13.730	11.31	13.750	19.24 *	13.760	20.02 *
9	13.710	24.91	13.770	27.59	13.760	12.15	13.730	10.60	13.740	13.12	13.770	16.76
10	13.720	25.95	13.770	20.81 *	13.760	11.79	13.780	14.00	13.730	17.73 *	13.760	18.40
11	13.710	23.19	13.760	25.92	13.740	10.72	13.760	11.89	13.730	11.31	13.750	16.94
12	13.700	24.69	13.780	26.23	13.750	23.27	13.760	11.52	13.710	10.96	13.740	16.18
13	13.720	16.99 *	13.810	29.07	13.750	11.38	13.770	20.81 *	13.710	11.59	13.740	15.68
14	13.710	24.43	13.800	23.27 *	13.770	20.81 *	13.760	11.98	13.710	16.27 *	13.750	16.73
15	13.700	27.11	13.780	27.22	13.850	35.19	13.760	11.90	13.720	11.90	13.750	19.24 *
16	13.710	24.24	13.780	21.62 *	13.860	27.85	13.780	13.62	13.720	12.41	13.750	16.45
17	13.720	24.35	13.760	20.02 *	13.790	24.34	13.780	11.88	13.730	17.73 *	13.750	16.38
18	13.700	15.57 *	13.780	27.13	13.760	25.09	13.780	13.24	13.730	11.47	13.760	17.04
19	13.700	15.57 *	13.770	23.07	13.770	12.10	13.770	12.62	13.730	11.80	13.750	16.57
20	13.710	16.27 *	13.760	25.23	13.790	24.87	13.760	20.02 *	13.720	16.99 *	13.740	16.59
21	13.740	26.81	13.750	24.81	13.810	24.12 *	13.750	11.96	13.720	11.04	13.750	16.57
22	13.750	28.63	13.740	22.45	13.780	25.34	13.760	12.63	13.710	11.13	13.750	19.24 *
23	13.720	16.99 *	13.740	23.96	13.770	24.77	13.770	13.37	13.720	11.31	13.750	16.61
24	13.720	25.89	13.740	18.48 *	13.800	25.15	13.760	20.02 *	13.730	17.73 *	13.760	19.69
25	13.740	18.48 *	13.770	23.76	13.770	24.38	13.750	19.24 *	13.730	12.43	13.760	17.68
26	13.750	19.24 *	13.750	19.24 *	13.760	24.07	13.730	11.75	13.730	11.51	13.760	17.33
27	13.750	19.24 *	13.770	19.82	13.750	23.59	13.750	19.24 *	13.740	12.73	13.780	16.90
28	13.770	20.81 *	13.740	21.25	13.740	18.48 *	13.760	13.19	13.730	12.30	13.780	16.93
29	13.760	20.02 *	13.740	22.95	13.740	22.06	13.780	13.35	13.740	11.94	13.780	21.62 *
30	13.770	23.63	13.770	20.91			13.780	13.79	13.740	11.86	13.780	17.24
31	13.770	20.81 *	13.760	20.02 *			13.790	13.45			13.790	19.88
Ten-Daily Mean												
I Ten-Daily	13.716	25.25	13.770	25.35	13.768	14.82	13.742	12.89	13.763	15.05	13.744	16.45
II Ten-Daily	13.708	21.24	13.778	24.88	13.783	21.56	13.768	13.95	13.721	13.24	13.748	16.78
III Ten-Daily	13.749	21.87	13.752	21.60	13.769	23.55	13.762	14.73	13.729	12.40	13.767	18.15
Monthly												
Min.	13.690	15.57	13.740	18.48	13.740	10.72	13.720	10.11	13.710	10.96	13.720	11.78
Max.	13.770	28.63	13.810	29.13	13.860	35.19	13.790	20.81	13.810	22.44	13.790	21.62
Mean	13.725	22.76	13.766	23.87	13.773	19.85	13.757	13.88	13.738	13.56	13.754	17.16

Annual Runoff in MC

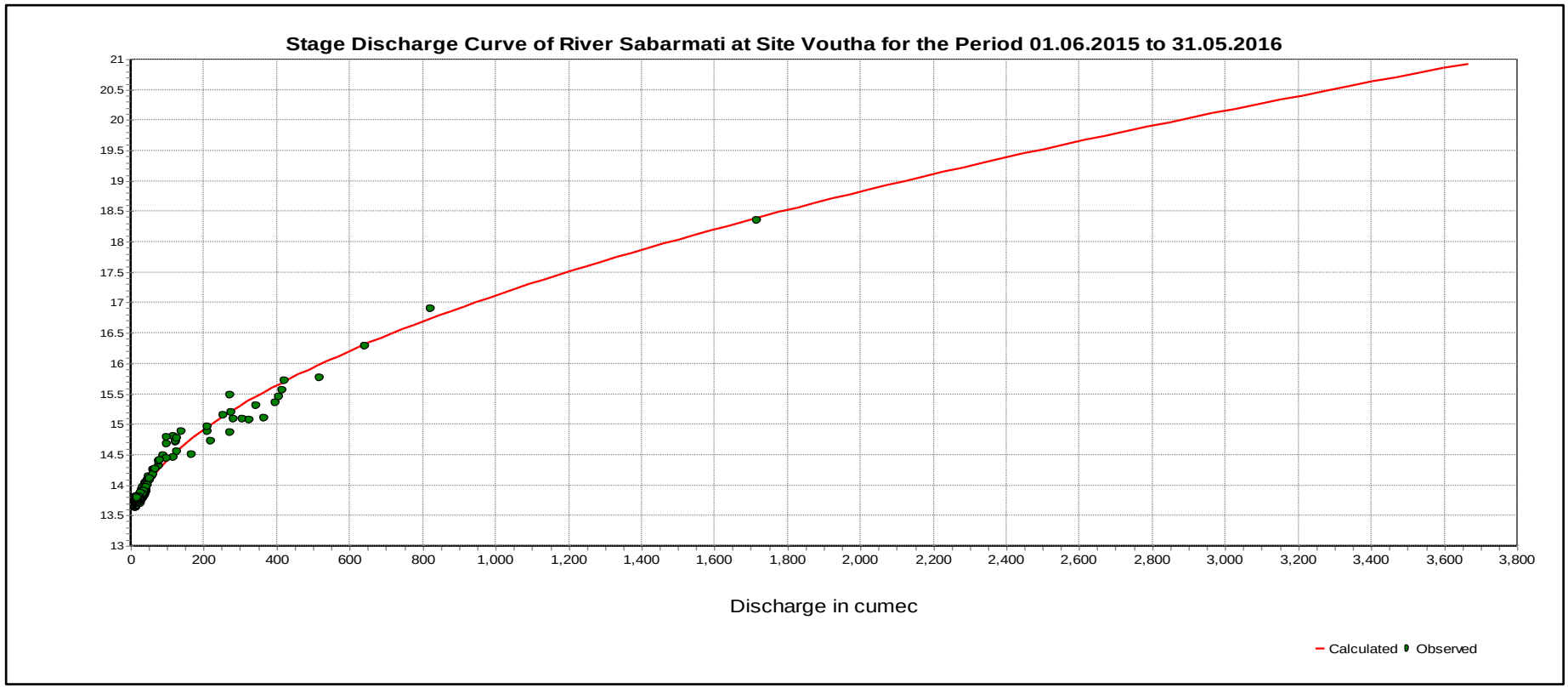
Peak Observed Disch **Peak Computed Discharge = 598.8 cumecs on 02/08/2015** **Corres. Water Level :16.2 m**

Lowest Observed Di: **Lowest Computed Discharge = 11.65 cumecs on 07/06/2015** **Corres. Water Level :13.64 m**

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff



Procedure - Standard

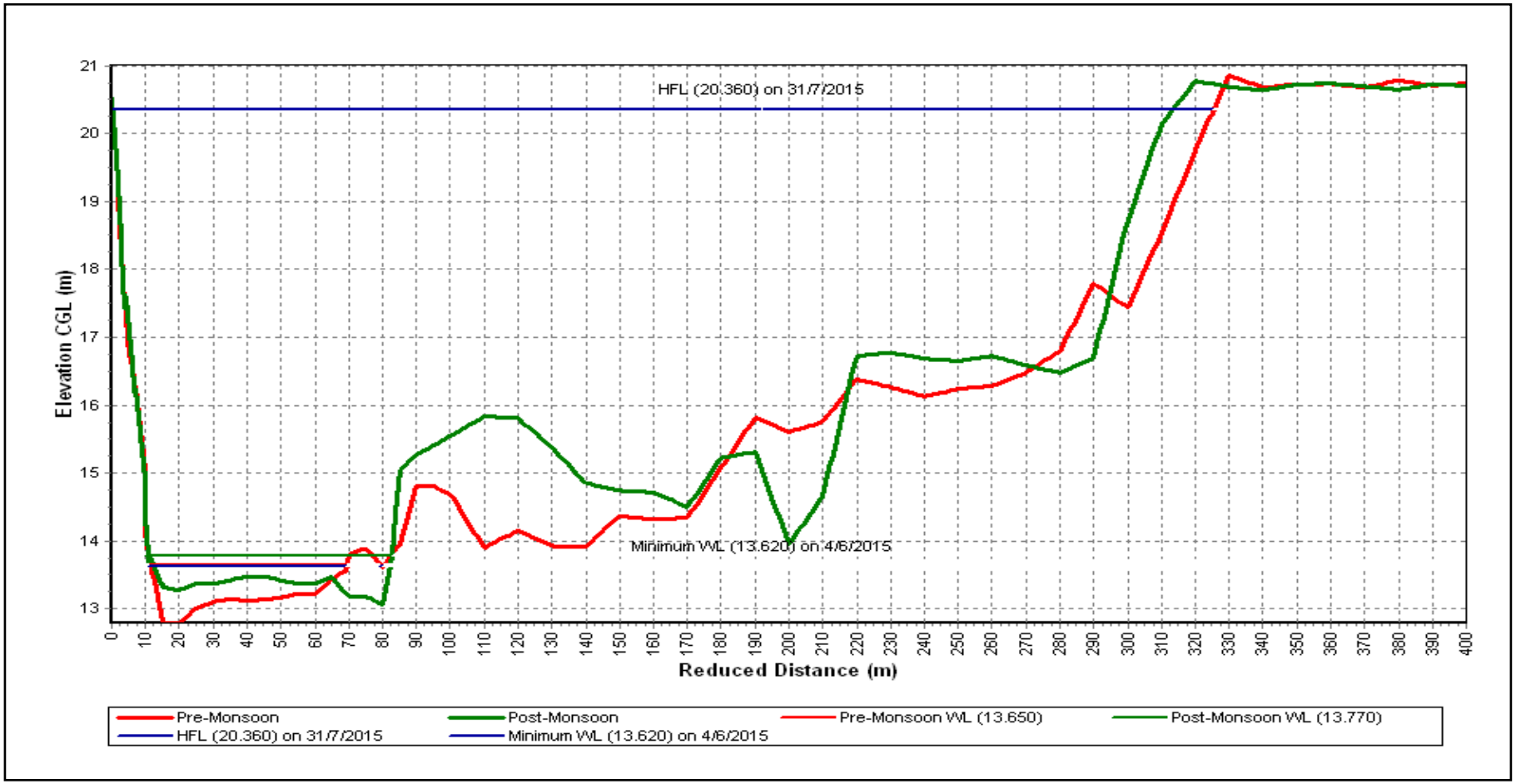
Equation Type - Power $Q=c*(h+a)^b$

LB	UB	a	b	c
13.6	21	-13.2801	1.882	79.7

Pre-Monsoon & Post-Monsoon X-Section for Water Year : 2015-2016

Station Name : Sabarmati at Voutha (01 02 12 013) **Division : Mahi Division, Gandhinagar**

Local River : Sabarmati **Sub-Division : Sabarmati Sub Divn., Ahmedabad**



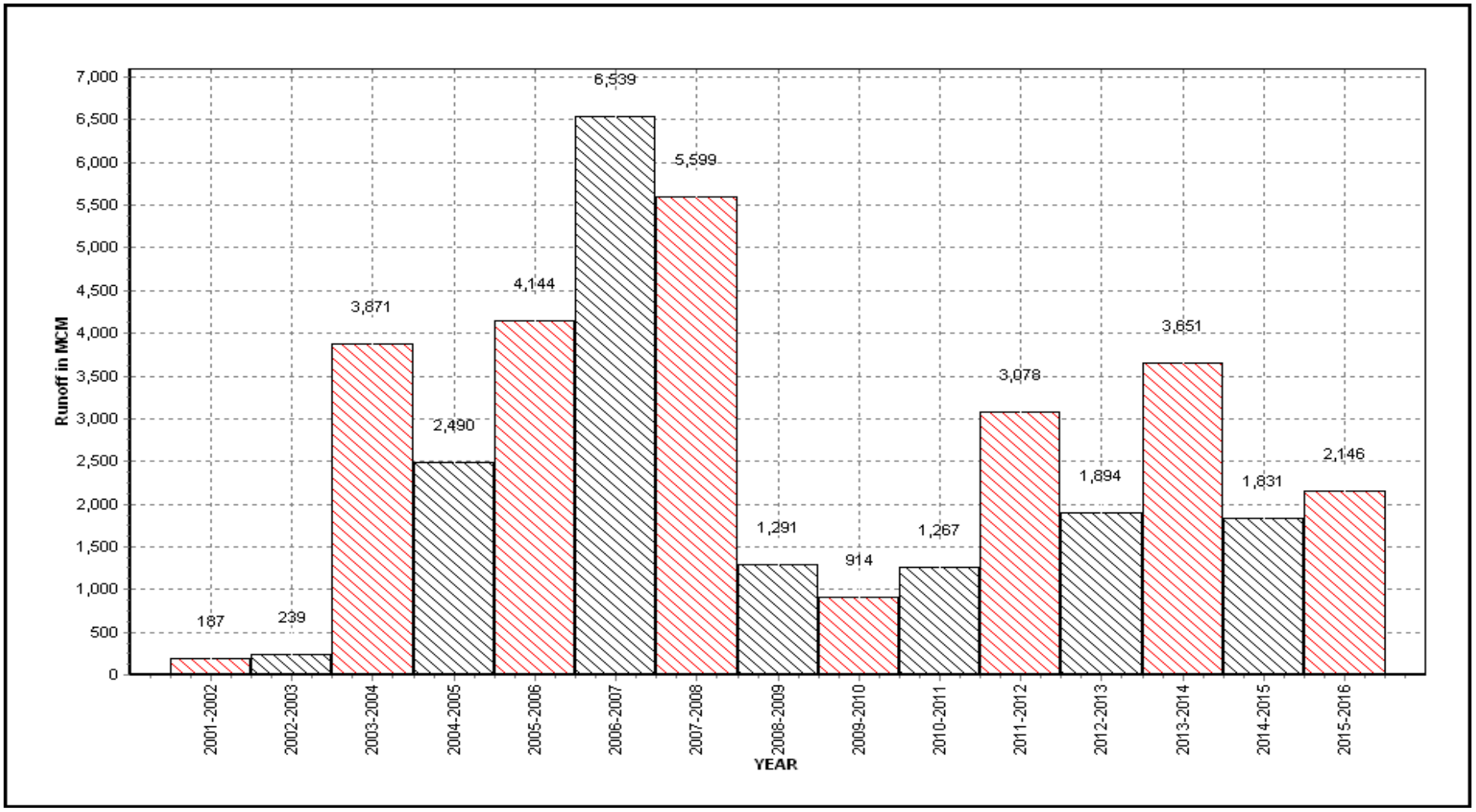
Historic Flood Level-21.090m on 20.08.2006 at 1700 hrs

Note: HFL marked on graph denotes Maximum Water Level observed during the Water Year 2015-15

Annual Runoff Values for the period: 2001 - 2016

Station Name : Sabarmati at Voutha (01 02 12 013) **Division : Mahi Division, Gandhinagar**

Local River : Sabarmati **Sub-Division : Sabarmati Sub Divn., Ahmedabad**

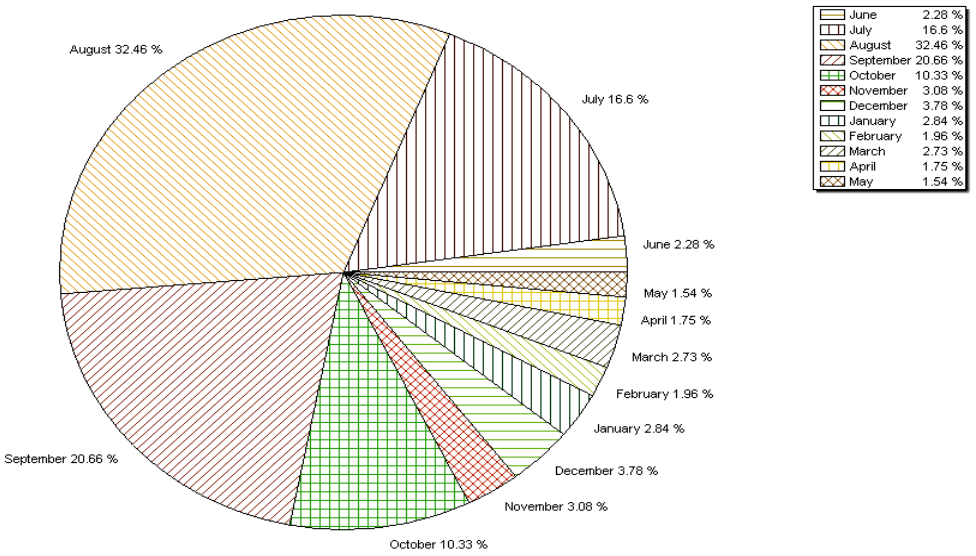


Note: Missing values have not been considered while arriving at Annual Runoff

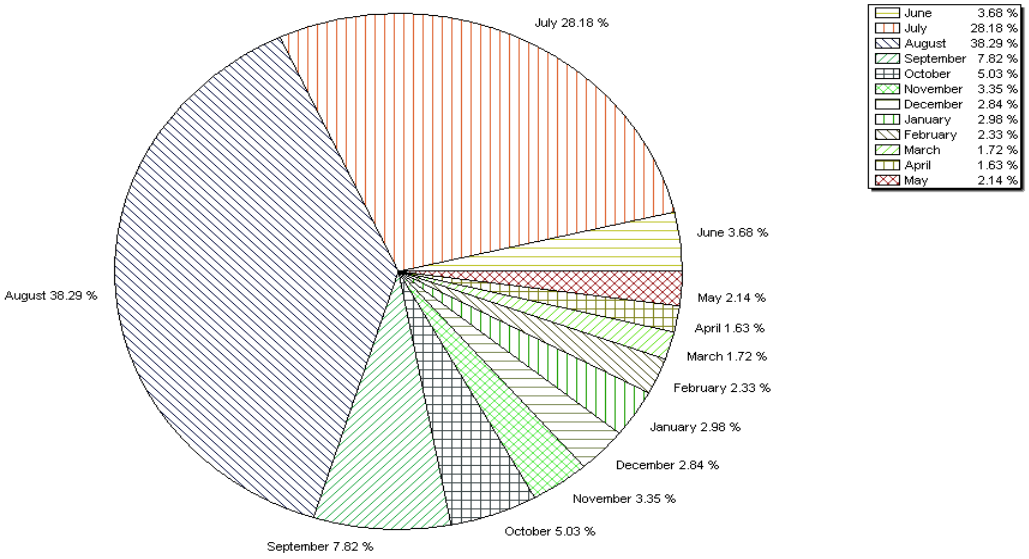
Station Name : Sabarmati at Voutha (01 02 12 013) **Division : Mahi Division, Gandhinagar**

Local River : Sabarmati **Sub-Division : Sabarmati Sub Divn., Ahmedabad**

Monthly Average Runoff based on period : 2001-2015



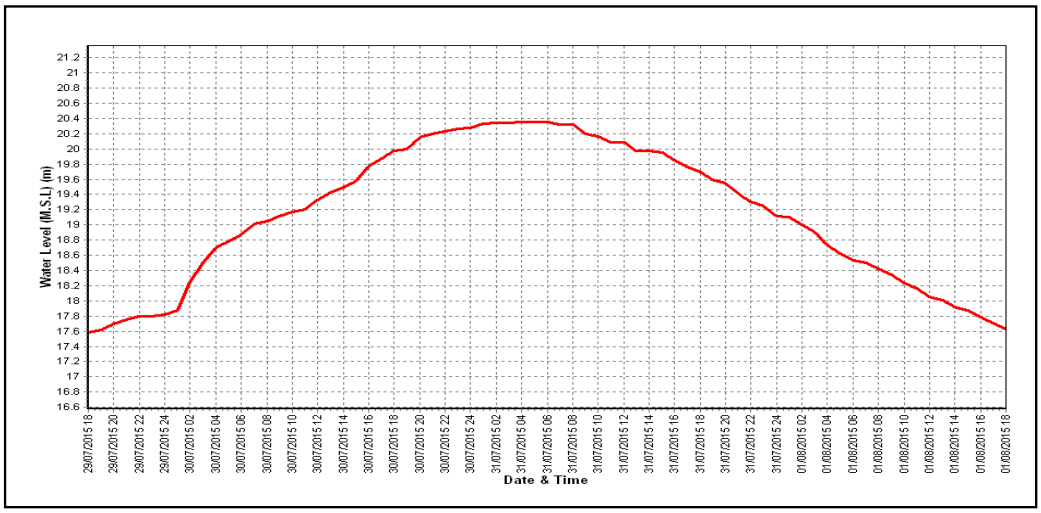
Monthly Runoff for the Year : 2015-2016



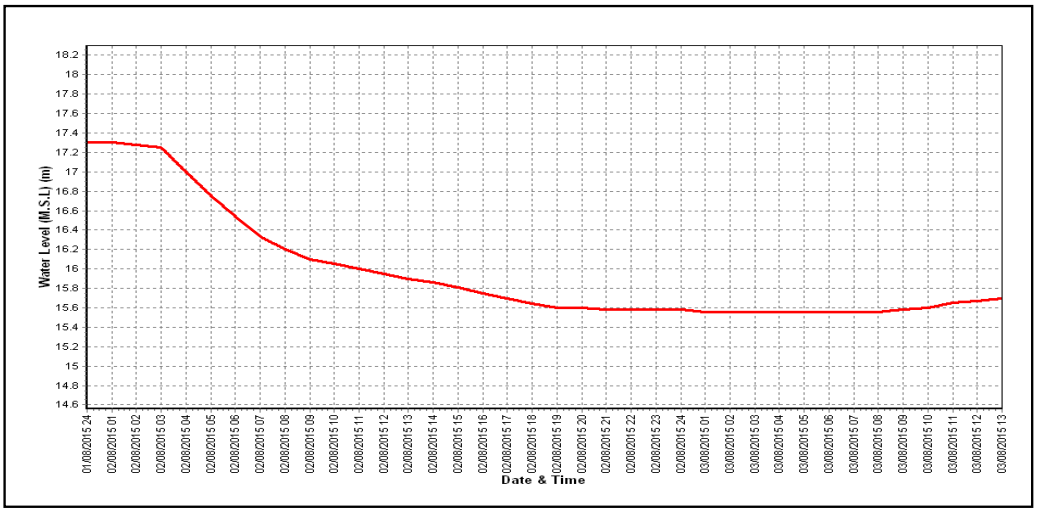
Station Name : Sabarmati at Voutha (01 02 12 013) **Division : Mahi Division, Gandhinagar**

Local River : Sabarmati **Sub-Division : Sabarmati Sub Divn., Ahmedabad**

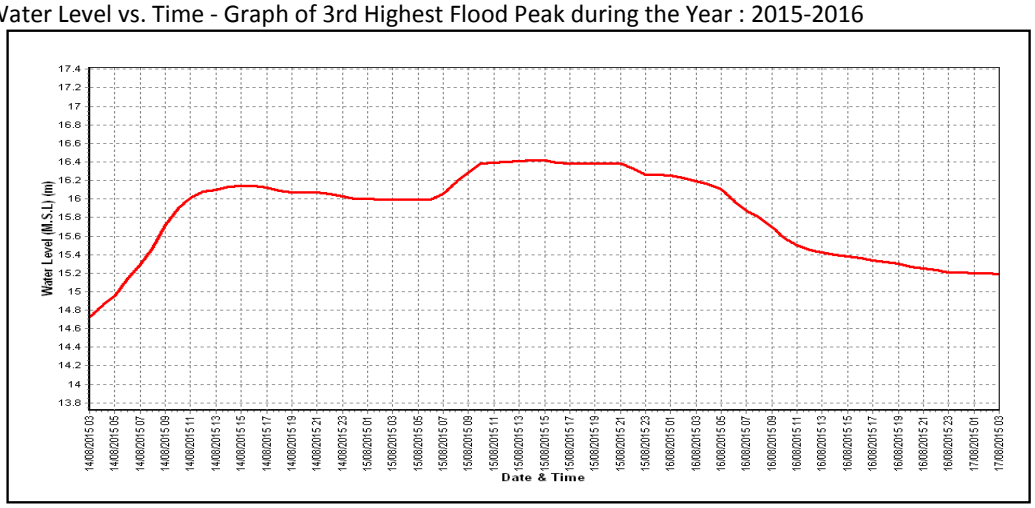
Water Level vs. Time - Graph of Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 2nd Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 3rd Highest Flood Peak during the Year : 2015-2016



Time Span: 72 Hrs

HISTORY SHEET

			Water Year	:	**2015-16**
Site	:	**Watrak at Kheda**	**Code**	:	**01 02 12 012**
State	:	Gujarat	District		Kheda
Basin	:	Sabarmati	Independent River	:	Sabarmati
Tributary	:	Watrak	Sub Tributary	:	
Sub-Sub Tributary	:		Local River	:	Watrak
Division	:	Mahi Division, Gandhinagar	Sub-Division	:	Sabarmati Sub Divn., Ahmedabad
Drainage Area	:	7550 Sq. Km.	Bank	:	Right
Latitude	:	22°44'45"N	Longitude	:	72°40'49"E
Zero of Gauge (m)	:	19.5 (m.s.l)	29/03/85	-	31/05/89
		19.75 (m.s.l)	01/06/89	-	31/05/94
		19 (m.s.l)	01/06/94	-	
		Opening Date	Closing Date		
Gauge	:	29/03/85			
Discharge	:	10/07/89			
Sediment	:	---			
Water Quality	:	---			

Annual Maximum / Minimum discharge with corresponding Water Level (m.s.l)

	Maximum			Minimum		
Year	**Q (cumecs)**	**WL (m)**	**Date**	**Q (cumecs)**	**WL (m)**	**Date**
1989-1990	239.7	22.450	21/08/89	0.000	River Dry	25/01/90
1990-1991	1626	28.200	25/08/90	0.000	River Dry	26/01/91
1991-1992	707.9	23.475	01/08/91	0.000	River Dry	26/01/92
1992-1993	57.09	20.830	08/09/92	0.000	River Dry	25/01/93
1993-1994	845.5	24.000	18/07/93	0.000	River Dry	08/11/93
1994-1995	1617	25.015	09/09/94	0.000	River Dry	25/01/95
1995-1996	31.50	20.100	31/07/95	0.000	River Dry	27/01/96
1996-1997	310.3	22.175	29/07/96	0.000	River Dry	25/01/97
1997-1998	2380	25.950	28/07/97	0.000	River Dry	25/01/98
1998-1999	1677	24.100	18/09/98	0.000	River Dry	12/03/99
1999-2000	154.2	21.480	21/07/99	0.000	River Dry	27/01/00
2000-2001	100.2	21.195	15/07/00	0.000	River Dry	04/12/00
2001-2002	0.000	19.230	04/10/01	0.000	River Dry	25/01/02
2002-2003	0.000	19.460	21/09/02	0.000	River Dry	25/01/03
2003-2004	324.6	22.985	25/08/03	0.000	River Dry	26/01/04
2004-2005	182.2	22.220	07/08/04	0.000	River Dry	29/03/05
2005-2006	872.0	26.825	07/07/05	0.000	River Dry	01/06/05
2006-2007	4508	25.326	12/08/06	0.000	River Dry	01/06/06
2007-2008	1682	26.000	10/07/07	0.000	River Dry	01/06/07
2008-2009	278.6	22.370	13/08/08	0.000	19.000	01/11/08
2009-2010	270.1	21.700	23/07/09	0.000	19.010	01/12/09
2010-2011	163.7	21.070	09/08/10	0.000	19.650	01/06/10
2011-2012	232.7	21.110	13/09/11	9.412	19.570	05/10/11
2012-2013	849.3	24.200	08/09/12	0.000	18.840	01/06/12
2013-2014	261.4	21.63	30/09/13	0.000	River dry	01/06/13
2014-2015	286	22.27	10/09/14	0.000	18.4	01/06/14
2015-2016	272.1	22.14	30/07/15	0.000	18.35	05/09/15

Stage-Discharge Data for the period 2015 - 2016

Station Name : Watrak at Kheda (01 02 12 012) **Division : Mahi Division, Gandhinagar**

Local River : Watrak **Sub-Division : Sabarmati Sub Divn., Ahmedabad**

Day	Jun		Jul		Aug		Sep		Oct		Nov	
	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q
1	18.540	0.000	18.500	0.200 *	20.360	74.79	18.610	1.448	18.550	2.031	18.150	0.000
2	18.540	0.000	18.470	0.000	19.880	43.13 *	18.600	1.165	18.440	1.548	18.290	0.420 *
3	18.540	0.000	18.460	0.000	19.630	41.36	18.570	1.120	18.400	1.439	18.300	0.450 *
4	18.570	0.000	18.450	0.000	19.340	30.64	18.430	0.925	18.380	0.860 *	18.300	0.450 *
5	18.580	0.000	18.440	0.000	19.190	25.63	18.350	0.499	18.310	0.500 *	18.300	0.450 *
6	18.580	0.000	18.430	0.000	19.060	11.01 #	18.330	0.590 *	18.340	0.640 *	18.500	2.754
7	18.580	0.000	18.430	0.000	19.230	26.13	18.310	0.500 *	18.330	0.590 *	18.550	2.970
8	18.580	0.000	18.630	3.090	19.150	13.39 #	18.300	0.450 *	18.330	0.590 *	18.450	1.330 *
9	18.570	0.000	18.610	2.860	19.100	12.03 *	18.300	0.450 *	18.320	0.550 *	18.450	2.622
10	18.570	0.000	18.470	0.000	19.000	9.570 #	18.290	0.420 *	18.310	0.500 *	18.440	2.519
11	18.570	0.000	18.440	0.000	18.875	3.188	18.280	0.400 *	18.270	0.350 *	18.440	1.260 *
12	18.570	0.000	18.430	0.000	19.180	20.72	18.260	0.300 *	18.260	0.310 *	18.430	2.343
13	18.570	0.000	18.430	0.000	19.150	20.28	18.240	0.250 *	18.340	0.640 *	18.480	2.954
14	18.580	0.000	18.420	0.000	19.030	5.109	18.230	0.220 *	18.260	0.310 *	18.480	2.882
15	18.580	0.000	18.410	0.000	19.290	17.62 #	18.220	0.210 *	18.240	0.250 *	18.460	1.410 *
16	18.580	0.000	18.410	0.000	19.100	12.03 #	18.220	0.210 *	18.200	0.150 *	18.450	2.487
17	18.570	0.000	18.410	0.000	19.090	11.77 #	18.210	0.150 *	18.190	0.130 *	18.440	2.448
18	18.570	0.000	18.400	0.000	19.130	12.83 #	18.200	0.150 *	18.180	0.110 *	18.430	2.434
19	18.560	0.000	18.400	0.000	19.080	11.51 #	18.320	0.550 *	18.170	0.000	18.425	2.264
20	18.550	0.000	18.380	0.000	19.430	30.89	18.640	3.200 *	18.170	0.000	18.300	0.450 *
21	18.540	0.000	18.380	0.000	19.300	28.80	18.900	7.410 *	18.160	0.000	18.220	0.180 *
22	18.530	0.000	18.380	0.000	19.330	31.78	19.100	12.03 #	18.160	0.000	18.180	0.110 *
23	18.530	0.000	18.370	0.000	19.090	11.77 *	19.050	10.78 #	18.150	0.000	18.170	0.000
24	18.530	0.000	18.370	0.000	19.050	10.76 #	18.830	3.210	18.150	0.000	18.160	0.000
25	18.550	0.000	18.380	0.000	18.760	3.032	18.710	2.769	18.150	0.000	18.150	0.000
26	18.550	0.000	18.800	5.569 *	18.670	2.068	18.920	7.820 #	18.150	0.000	18.150	0.000
27	18.560	0.000	18.900	7.414 *	18.660	1.927	18.780	5.240 *	18.140	0.000	18.140	0.000
28	19.130	12.83	19.540	26.88 *	18.650	1.890	18.670	2.656	18.140	0.000	18.140	0.000
29	18.830	1.876	21.480	183.6 #	18.640	1.669	18.640	2.567	18.140	0.000	18.140	0.000
30	18.570	0.652	22.140	272.1	18.640	3.220 *	18.530	2.173	18.140	0.000	18.130	0.000
31			20.880	131.0	18.620	1.423			18.130	0.000		
Ten-Daily Mean												
I Ten-Daily	18.565	0.000	18.489	0.615	19.394	28.77	18.409	0.757	18.371	0.925	18.373	1.396
II Ten-Daily	18.570	0.000	18.413	0.000	19.136	14.60	18.282	0.564	18.228	0.225	18.434	2.093
III Ten-Daily	18.632	1.536	19.420	56.95	18.855	8.940	18.813	5.665	18.146	0.000	18.158	0.029
Monthly												
Min.	18.530	0.000	18.370	0.000	18.620	1.423	18.200	0.150	18.130	0.000	18.130	0.000
Max.	19.130	12.83	22.140	272.1	20.360	74.79	19.100	12.03	18.550	2.031	18.550	2.970
Mean	18.589	0.512	18.795	20.41	19.120	17.16	18.501	2.329	18.245	0.371	18.322	1.173

Annual Runoff in MCM = 112 Annual Runoff in mm = 15

Peak Observed Discharge = 272.1 cumecs on 30/07/2015 Corres. Water Level :22.14 m

Lowest Observed Discharge = 0.000 cumecs on 01/06/2015 Corres. Water Level :18.54 m

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff

Stage-Discharge Data for the period 2015 - 2016

Station Name : Watrak at Kheda (01 02 12 012) **Division : Mahi Division, Gandhinagar**

Local River : Watrak **Sub-Division : Sabarmati Sub Divn., Ahmedabad**

Day	Dec		Jan		Feb		Mar		Apr		May	
	W.L	Q	WL	Q	WL	Q	WL	Q	WL	Q	WL	Q
1	18.130	0.000	18.110	0.000	18.100	0.000	18.190	0.000	18.100	0.000	18.070	0.000
2	18.130	0.000	18.110	0.000	18.100	0.000	18.160	0.000	18.100	0.000	18.070	0.000
3	18.130	0.000	18.110	0.000	18.100	0.000	18.135	0.000	18.100	0.000	18.070	0.000
4	18.130	0.000	18.110	0.000	18.100	0.000	18.135	0.000	18.100	0.000	18.070	0.000
5	18.130	0.000	18.110	0.000	18.100	0.000	18.120	0.000	18.095	0.000	18.070	0.000
6	18.120	0.000	18.110	0.000	18.100	0.000	18.110	0.000	18.095	0.000	18.070	0.000
7	18.120	0.000	18.110	0.000	18.100	0.000	18.100	0.000	18.095	0.000	18.070	0.000
8	18.120	0.000	18.110	0.000	18.100	0.000	18.310	0.000	18.090	0.000	18.070	0.000
9	18.120	0.000	18.100	0.000	18.170	0.000	18.330	0.000	18.090	0.000	18.070	0.000
10	18.120	0.000	18.100	0.000	18.150	0.000	18.230	0.000	18.090	0.000	18.070	0.000
11	18.120	0.000	18.100	0.000	18.130	0.000	18.150	0.000	18.090	0.000	18.070	0.000
12	18.120	0.000	18.100	0.000	18.110	0.000	18.130	0.000	18.090	0.000	18.070	0.000
13	18.120	0.000	18.100	0.000	18.100	0.000	18.120	0.000	18.090	0.000	18.070	0.000
14	18.120	0.000	18.100	0.000	18.100	0.000	18.200	0.000	18.090	0.000	18.070	0.000
15	18.120	0.000	18.100	0.000	18.100	0.000	18.200	0.000	18.090	0.000	18.070	0.000
16	18.120	0.000	18.100	0.000	18.100	0.000	18.190	0.000	18.080	0.000	18.070	0.000
17	18.120	0.000	18.100	0.000	18.100	0.000	18.180	0.000	18.080	0.000	18.070	0.000
18	18.120	0.000	18.100	0.000	18.100	0.000	18.140	0.000	18.080	0.000	18.070	0.000
19	18.120	0.000	18.100	0.000	18.160	0.000	18.150	0.000	18.080	0.000	18.070	0.000
20	18.120	0.000	18.100	0.000	18.280	0.000	18.190	0.000	18.080	0.000	18.070	0.000
21	18.120	0.000	18.100	0.000	18.340	0.000	18.180	0.000	18.080	0.000	18.070	0.000
22	18.120	0.000	18.100	0.000	18.100	0.000	18.160	0.000	18.080	0.000	18.070	0.000
23	18.120	0.000	18.100	0.000	18.310	0.000	18.140	0.000	18.070	0.000	18.070	0.000
24	18.110	0.000	18.100	0.000	18.230	0.000	18.140	0.000	18.070	0.000	18.070	0.000
25	18.110	0.000	18.100	0.000	18.180	0.000	18.130	0.000	18.070	0.000	18.070	0.000
26	18.110	0.000	18.100	0.000	18.150	0.000	18.120	0.000	18.070	0.000	18.070	0.000
27	18.110	0.000	18.100	0.000	18.130	0.000	18.120	0.000	18.070	0.000	18.070	0.000
28	18.110	0.000	18.100	0.000	18.120	0.000	18.120	0.000	18.070	0.000	18.070	0.000
29	18.110	0.000	18.100	0.000	18.120	0.000	18.120	0.000	18.070	0.000	18.070	0.000
30	18.110	0.000	18.100	0.000			18.110	0.000	18.070	0.000 *	18.070	0.000
31	18.110	0.000	18.100	0.000			18.110	0.000 *			18.060	0.000
Ten-Daily Mean												
I Ten-Daily	18.125	0.000	18.108	0.000	18.112	0.000	18.182	0.000	18.096	0.000	18.070	0.000
II Ten-Daily	18.120	0.000	18.100	0.000	18.128	0.000	18.165	0.000	18.085	0.000	18.070	0.000
III Ten-Daily	18.113	0.000	18.100	0.000	18.187	0.000	18.132	0.000	18.072	0.000	18.069	0.000
Monthly												
Min.	18.110	0.000	18.100	0.000	18.100	0.000	18.100	0.000	18.070	0.000	18.060	0.000
Max.	18.130	0.000	18.110	0.000	18.340	0.000	18.330	0.000	18.100	0.000	18.070	0.000
Mean	18.119	0.000	18.103	0	18.141	0	18.159	0	18.084	0	18.070	0

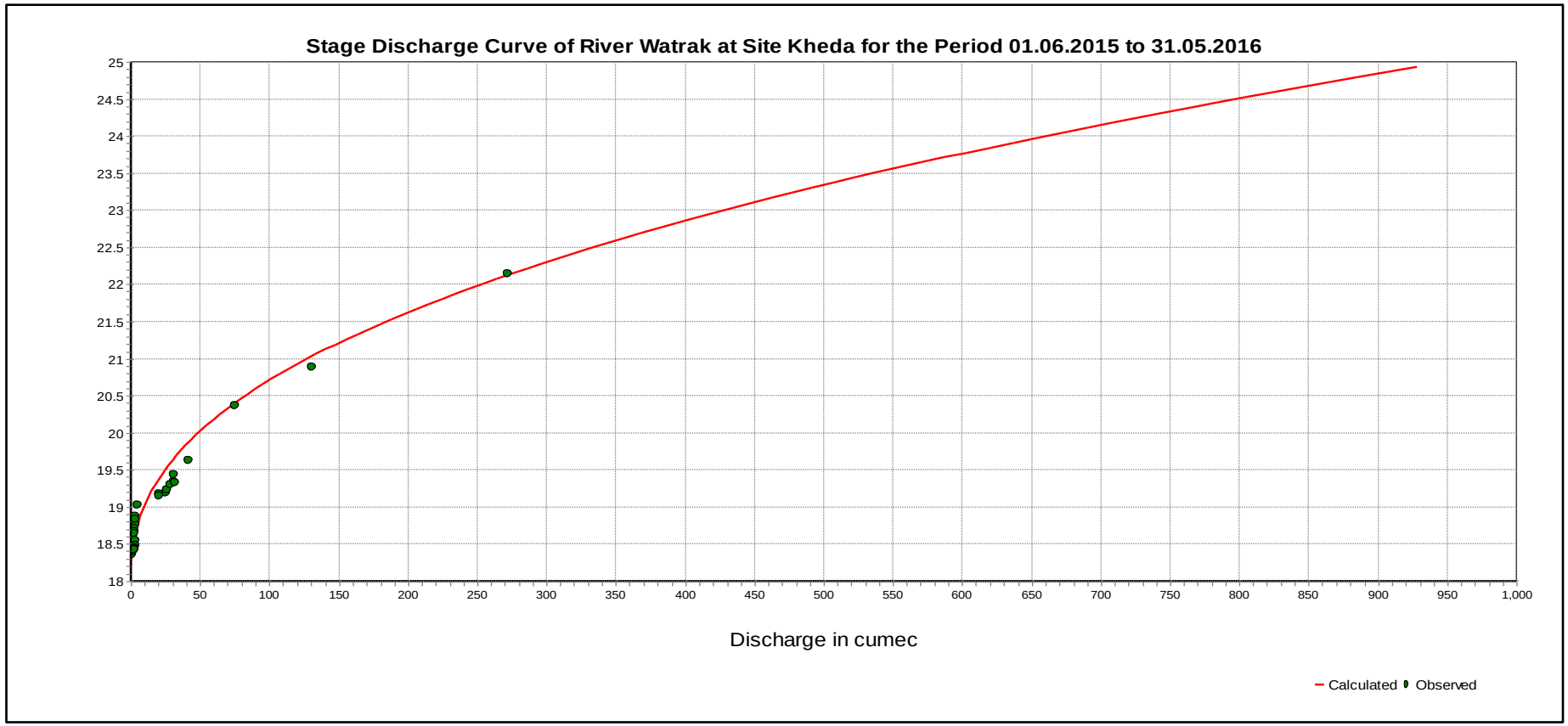
Peak Computed Discharge = 43.13 cumecs on 02/08/2015 **Corres. Water Level :19.88 m**

Lowest Computed Discharge = 0.000 cumecs on 31/03/2016 **Corres. Water Level :18.11 m**

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff



Procedure - Standard

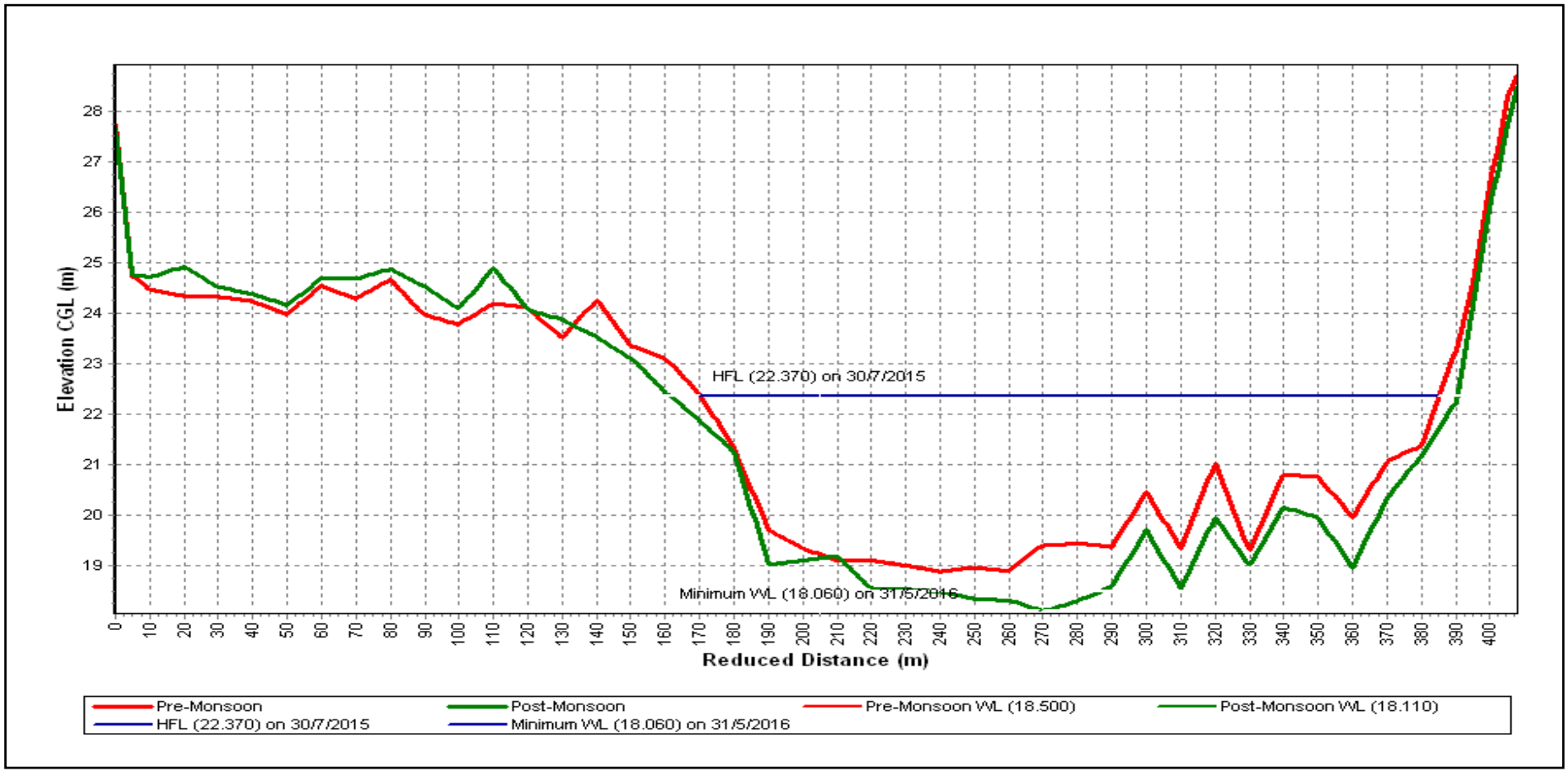
Equation Type - Power $Q=c*(h+a)^b$

LB	UB	a	b	c
18.2	25	-18.04	2.3149	10.513

Pre-Monsoon & Post-Monsoon X-Section for Water Year : 2015-2016

Station Name : Watrak at Kheda (01 02 12 012) **Division : Mahi Division, Gandhinagar**

Local River : Watrak **Sub-Division : Sabarmati Sub Divn., Ahmedabad**



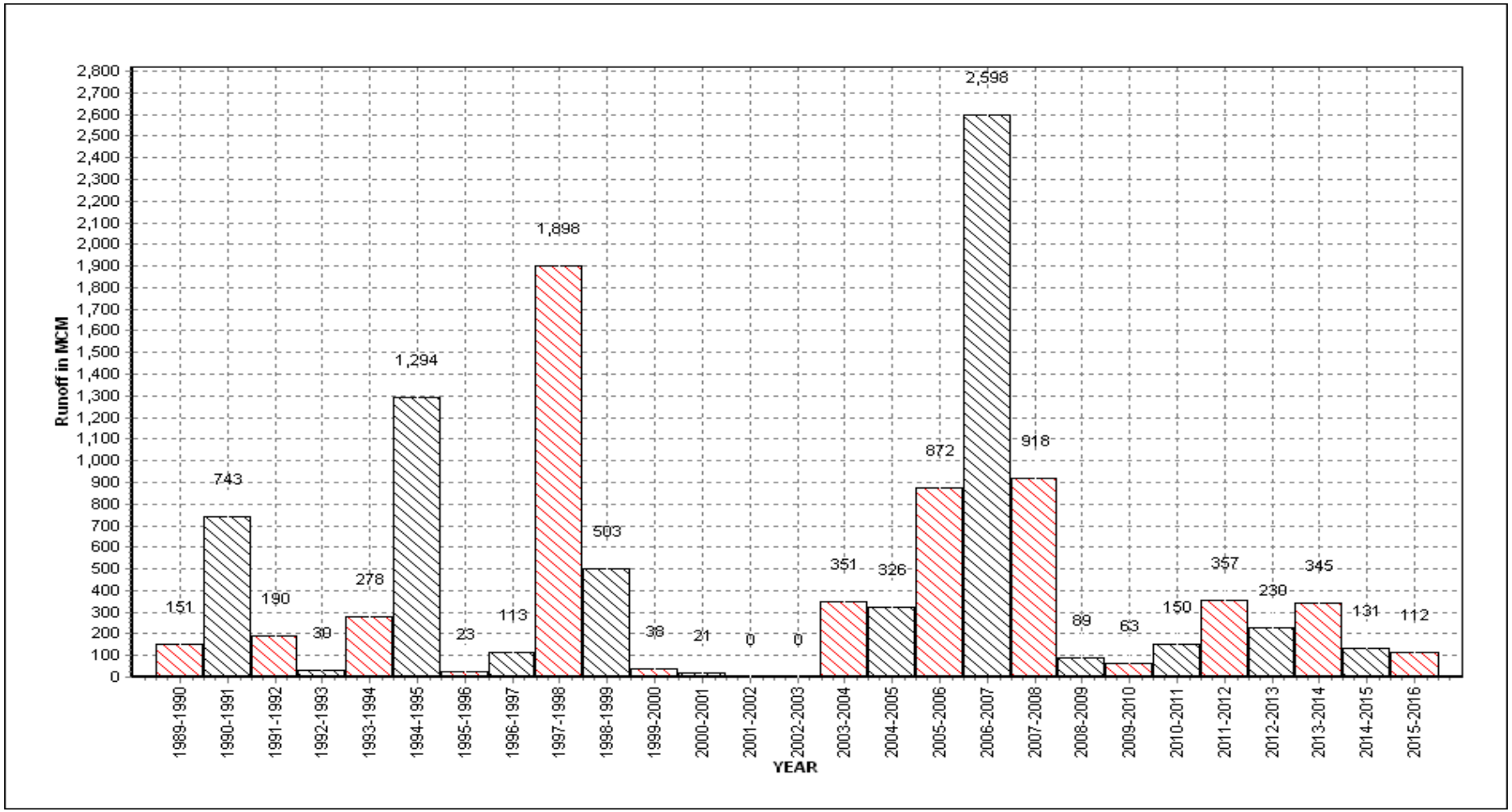
Historic Flood Level-28.2m on 25.08.1990 at 0800hrs

Note: HFL marked on graph denotes High Flood Level observed during the Water Year 2015-16

Annual Runoff Values for the period: 1989 - 2016

Station Name : Watrak at Kheda (01 02 12 012) **Division : Mahi Division, Gandhinagar**

Local River : Watrak **Sub-Division : Sabarmati Sub Divn., Ahmedabad**

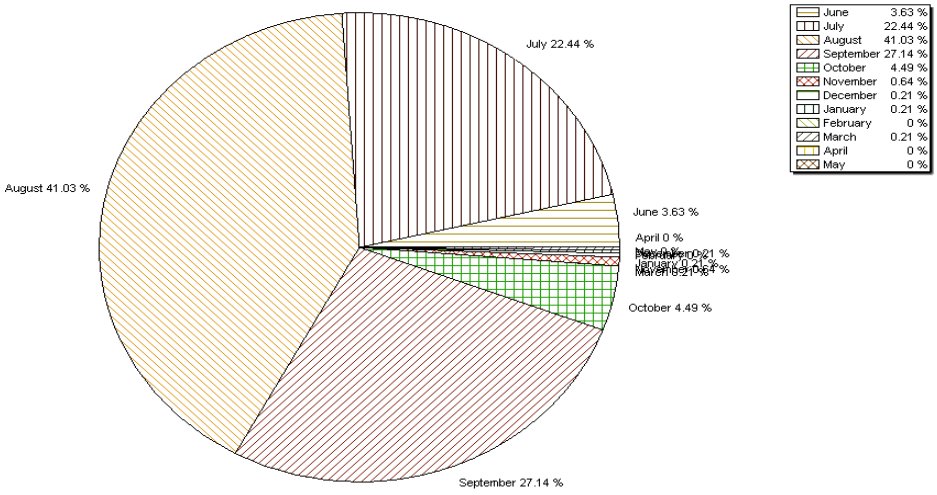


Note: Missing values have not been considered while arriving at Annual Runoff

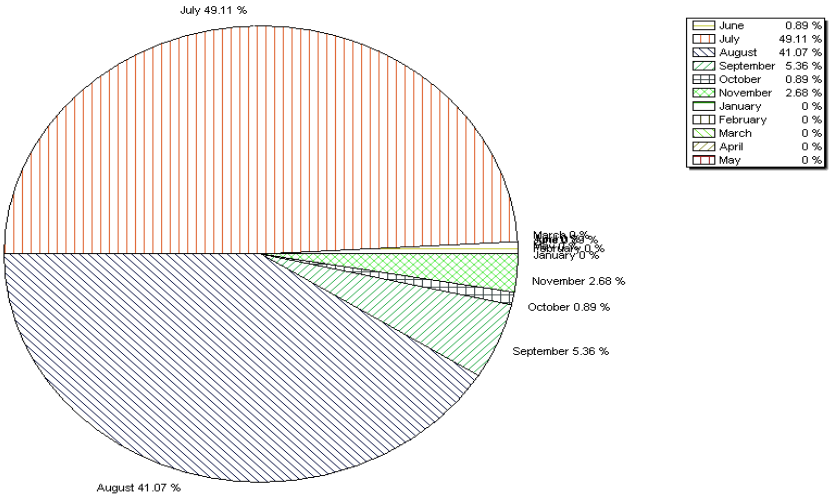
Station Name : Watrak at Kheda (01 02 12 012) **Division : Mahi Division, Gandhinagar**

Local River : Watrak **Sub-Division : Sabarmati Sub Divn., Ahmedabad**

Monthly Average Runoff based on period : 1989-2015



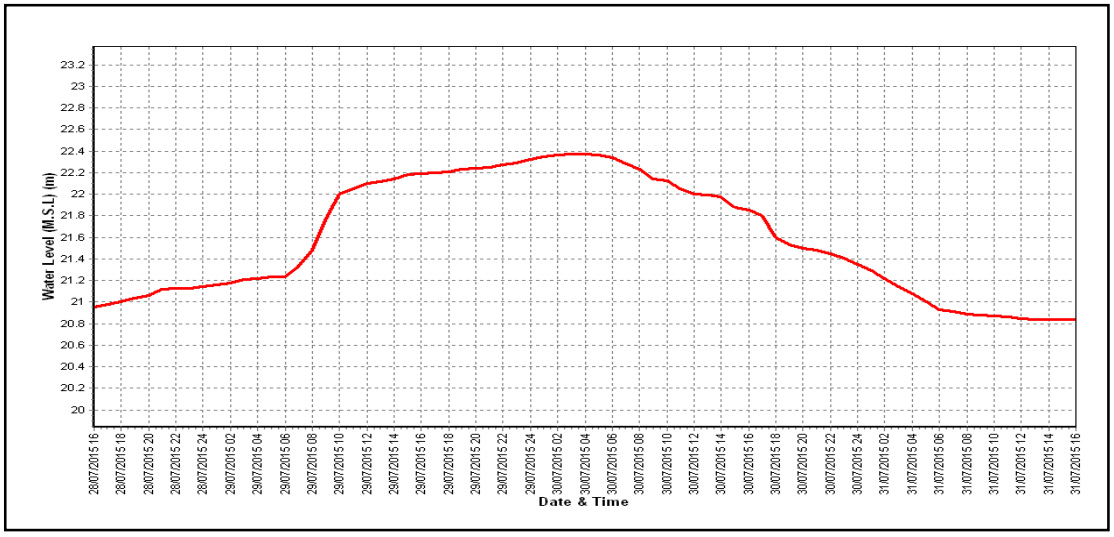
Monthly Runoff for the Year : 2015-2016



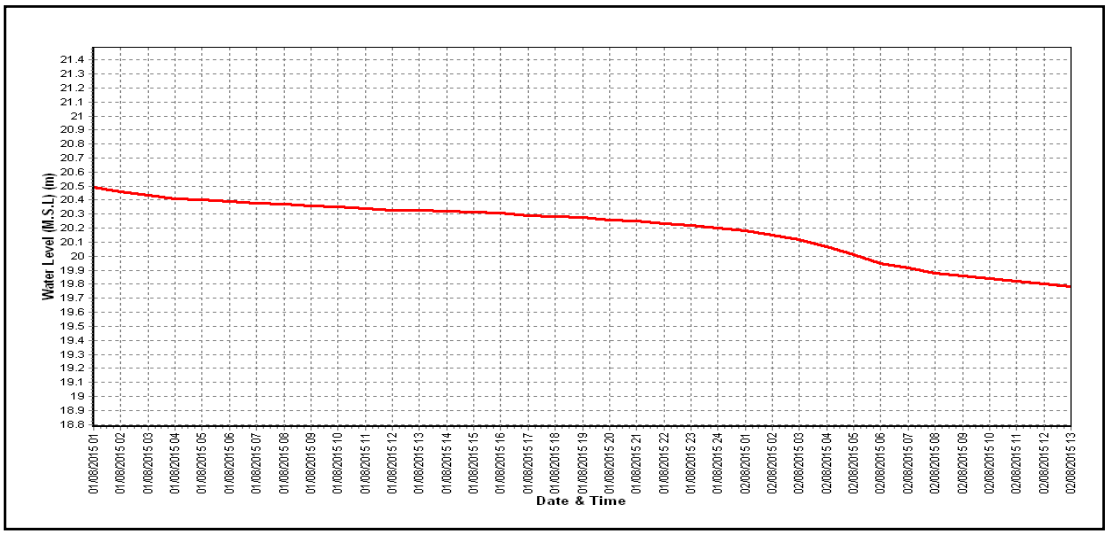
Station Name : Watrak at Kheda (01 02 12 012) **Division : Mahi Division, Gandhinagar**

Local River : Watrak **Sub-Division : Sabarmati Sub Divn., Ahmedabad**

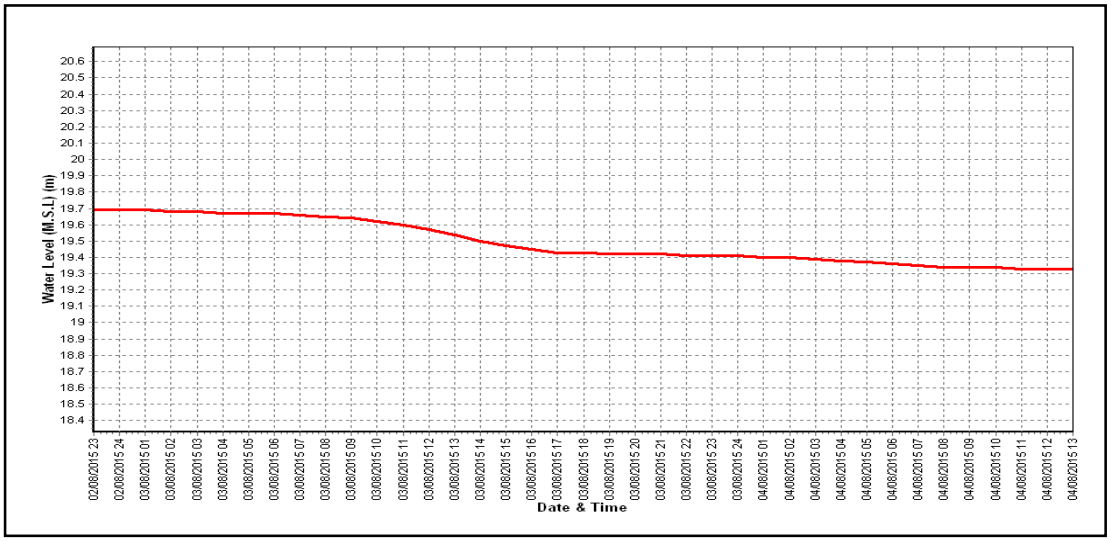
Water Level vs. Time - Graph of Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 2nd Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 3rd Highest Flood Peak during the Year : 2015-2016



Time Span: 72 Hrs

HISTORY SHEET

			Water Year	:	**2015-16**
Site	:	**Watrak at Gadvel (Ratanpur)**	**Code**	:	**01 02 12 010**
State	:	Gujarat	District		Kheda
Basin	:	Sabarmati	Independent River	:	Sabarmati
Tributary	:	Watrak	Sub Tributary	:	
Sub-Sub Tributary	:		Local River	:	Watrak
Division	:	Mahi Division, Gandhinagar	Sub-Division	:	Sabarmati Sub Divn., Ahmedabad
Drainage Area	:	2916 Sq. Km.	Bank	:	Left
Latitude	:	22°58'31"N	Longitude	:	72°53'02"E
Zero of Gauge (m)	:	39.1 (m.s.l) 37 (m.s.l)	30/03/85 16/06/90	-	15/06/90 -
		Opening Date	Closing Date		
Gauge	:	30/03/85			
Discharge	:	11/07/89			
Sediment	:	---			
Water Quality	:	---			

Annual Maximum / Minimum discharge with corresponding Water Level (m.s.l)

	Maximum			Minimum		
Year	**Q (cumecs)**	**WL (m)**	**Date**	**Q (cumecs)**	**WL (m)**	**Date**
1991-1992	467.8	41.000	01/08/91	0.000	River Dry	05/03/92
1992-1993	56.13	39.150	08/09/92	0.000	River Dry	09/05/93
1993-1994	672.0	41.400	18/07/93	0.000	River Dry	13/09/93
1994-1995	735.8	42.185	08/09/94	0.000	River Dry	09/03/95
1995-1996	39.38	38.500	20/07/95	0.000	River Dry	30/01/96
1996-1997	213.4	39.100	29/07/96	0.000	River Dry	16/03/97
1997-1998	1978	44.750	01/08/97	0.000	River Dry	27/01/98
1998-1999	365.0	40.725	18/09/98	0.000	River Dry	10/02/99
1999-2000	77.92	38.365	21/07/99	0.000	River Dry	14/02/00
2000-2001	150.0	38.815	14/07/00	0.000	River Dry	25/01/01
2001-2002	17.30	37.890	12/08/01	0.000	River Dry	25/01/02
2002-2003	60.50	38.250	05/09/02	0.000	River Dry	12/01/03
2003-2004	159.0	39.040	24/08/03	0.000	River Dry	12/07/03
2004-2005	253.0	39.400	02/08/04	0.000	River Dry	18/05/05
2005-2006	340.6	40.400	01/07/05	0.000	River Dry	01/06/05
2006-2007	3732	44.980	12/08/06	0.000	River Dry	01/06/06
2007-2008	1526	43.950	10/07/07	0.000	River Dry	01/06/07
2008-2009	98.714	40.043	13/08/10	0.000	River Dry	01/06/08
2009-2010	101	39.230	24/07/09	0.000	River Dry	01/06/09
2010-2011	102.2	39.150	19/09/10	0.000	River Dry	19/06/10
2011-2012	134.8	39.000	05/09/11	0.000	River Dry	09/04/12
2012-2013	314.9	40.735	08/09/12	0.000	River Dry	01/06/12
2013-2014	186.5	40.2	14/08/13	0.000	River Dry	01/06/13
2014-2015	142.5	39.325	11/09/14	0.000	37.1	08/06/14
2015-2016	132	39.3	29/07/15	0.000	37.030	04/01/16

Stage-Discharge Data for the period 2015 - 2016

Station Name : Watrak at Gadvel (Ratanpur) (01 02 12 010) **Division : Mahi Division, Gandhinagar**

Local River : Watrak **Sub-Division : Sabarmati Sub Divn., Ahmedabad**

Day	Jun		Jul		Aug		Sep		Oct		Nov	
	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q
1	R Dry	0.00	37.520	8.840 #	38.250	42.99 #	37.360	5.141	37.350	3.627	37.150	1.090 *
2	R Dry	0.00	37.470	7.390 #	37.830	20.41 *	37.320	2.864	37.330	3.990 *	37.150	1.187
3	R Dry	0.00	37.430	6.320 #	37.770	19.88	37.300	3.189	37.310	4.199	37.150	1.170
4	R Dry	0.00	37.400	5.570 #	37.640	13.49	37.290	3.043	37.290	3.200 *	37.150	1.150
5	R Dry	0.00	37.390	5.330 *	37.560	9.035	37.280	2.923	37.280	2.819	37.150	1.146
6	R Dry	0.00	37.370	4.860 *	37.800	20.30	37.270	2.840 *	37.260	2.525	37.150	1.148
7	R Dry	0.00	37.340	4.205 *	37.740	17.03	37.260	2.294	37.260	2.463	37.150	1.144
8	R Dry	0.00	37.210	1.869 *	37.560	8.684	37.240	2.052	37.250	2.523	37.150	1.090 *
9	R Dry	0.00	37.150	1.090 *	37.530	9.140 *	37.230	1.669	37.240	2.382	37.150	1.136
10	R Dry	0.00	37.050	0.000 #	37.450	5.915	37.230	1.649	37.230	2.026	37.140	1.096
11	R Dry	0.00	R Dry	0.00	37.820	21.85	37.220	1.556	37.230	2.170 *	37.140	0.980 *
12	R Dry	0.00	R Dry	0.00	37.680	14.26 #	37.210	1.521	37.220	1.592	37.140	1.104
13	R Dry	0.00	R Dry	0.00	37.600	11.40 #	37.210	1.870 *	37.210	1.629	37.140	1.099
14	R Dry	0.00	R Dry	0.00	37.830	22.91	37.200	1.220	37.210	1.548	37.140	1.085
15	R Dry	0.00	R Dry	0.00	37.670	13.88 *	37.200	1.217	37.200	1.581	37.140	0.980 *
16	R Dry	0.00	R Dry	0.00	37.730	16.19 *	37.190	1.459	37.200	1.543	37.140	1.072
17	R Dry	0.00	R Dry	0.00	37.720	17.04	37.190	1.192	37.190	1.499	37.150	1.265
18	R Dry	0.00	R Dry	0.00	37.620	16.06	37.180	1.167	37.190	1.590 *	37.150	1.222
19	R Dry	0.00	R Dry	0.00	38.010	27.25	37.370	3.556	37.190	1.466	37.140	1.193
20	R Dry	0.00	R Dry	0.00	37.810	18.60	37.530	9.140 *	37.180	1.430	37.140	1.113
21	R Dry	0.00	R Dry	0.00	37.890	23.70	37.600	13.47	37.180	1.422	37.130	1.059
22	R Dry	0.00	R Dry	0.00	37.700	20.07	37.550	10.11	37.180	1.460 *	37.130	0.870 *
23	R Dry	0.00	R Dry	0.00	37.650	13.15 *	37.500	7.892	37.180	1.449	37.130	1.042
24	R Dry	0.00	R Dry	0.00	37.440	6.580 #	37.510	9.851	37.180	1.460 *	37.120	0.945
25	R Dry	0.00	R Dry	0.00	37.420	7.372	37.640	12.79 *	37.170	1.330 *	37.120	0.780 *
26	38.500	60.05 *	R Dry	0.00	37.400	6.666	37.510	9.610	37.170	1.341	37.120	0.938
27	38.100	34.04 *	38.200	39.90 #	37.470	6.876	37.470	7.390 *	37.170	1.329	37.120	0.923
28	37.850	21.31 *	38.400	50.91 #	37.360	4.952	37.440	7.006	37.170	1.312	37.120	0.914
29	37.760	17.41 *	39.300	132.0 #	37.340	4.760	37.410	5.017	37.160	1.252	37.120	0.780 *
30	37.650	13.15 *	39.150	116.6	37.300	3.390 *	37.380	4.834	37.160	1.254	37.120	0.882
31			38.560	64.54 #	37.320	4.385			37.160	1.236		
Ten-Daily Mean												
I Ten-Daily			37.333	4.547	37.713	16.69	37.278	2.766	37.280	2.975	37.149	1.136
II Ten-Daily					37.749	17.94	37.250	2.390	37.202	1.605	37.142	1.111
III Ten-Daily	37.972	29.19	38.722	80.79	37.481	9.264	37.501	8.797	37.171	1.350	37.123	0.913
Monthly												
Min.	37.650	13.15	37.050	0.000	37.300	3.390	37.180	1.167	37.160	1.236	37.120	0.780
Max.	38.500	60.05	39.300	132.0	38.250	42.99	37.640	13.47	37.350	4.199	37.150	1.265
Mean	37.972	29.19	37.796	29.96	37.642	14.46	37.343	4.651	37.216	1.956	37.138	1.053

Annual Runoff in MCM = 111 Annual Runoff in mm = 38

Peak Observed Discharge = 132.0 cumecs on 29/07/2015 Corres. Water Level :39.3 m

Lowest Observed Discharge = 0.000 cumecs on 10/07/2015 Corres. Water Level :37.05 m

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff

Stage-Discharge Data for the period 2015 - 2016

Station Name : Watrak at Gadvel (Ratanpur) (01 02 12 010) **Division : Mahi Division, Gandhinagar**

Local River : Watrak **Sub-Division : Sabarmati Sub Divn., Ahmedabad**

Day	Dec		Jan		Feb		Mar		Apr		May	
	W.L	Q	WL	Q	WL	Q	WL	Q	WL	Q	WL	Q
1	37.110	0.630 *	37.040	0.100 *	37.000	0.000	R Dry	0.00	R Dry	0.00	R Dry	0.00
2	37.110	0.630 *	37.040	0.100 *	37.000	0.000	R Dry	0.00	R Dry	0.00	R Dry	0.00
3	37.110	0.630 *	37.040	0.100 *	37.000	0.000	R Dry	0.00	R Dry	0.00	R Dry	0.00
4	37.100	0.590 *	37.030	0.000	37.000	0.000	R Dry	0.00	R Dry	0.00	R Dry	0.00
5	37.100	0.590 *	37.030	0.000	37.000	0.000	R Dry	0.00	R Dry	0.00	R Dry	0.00
6	37.090	0.510 *	37.030	0.000	37.000	0.000	R Dry	0.00	R Dry	0.00	R Dry	0.00
7	37.090	0.510 *	37.030	0.000	37.000	0.000	R Dry	0.00	R Dry	0.00	R Dry	0.00
8	37.090	0.510 *	37.020	0.000	37.000	0.000	R Dry	0.00	R Dry	0.00	R Dry	0.00
9	37.080	0.430 *	37.020	0.000	37.000	0.000	R Dry	0.00	R Dry	0.00	R Dry	0.00
10	37.080	0.430 *	37.020	0.000	37.000	0.000	R Dry	0.00	R Dry	0.00	R Dry	0.00
11	37.070	0.370 *	37.020	0.000	37.000	0.000	R Dry	0.00	R Dry	0.00	R Dry	0.00
12	37.070	0.370 *	37.020	0.000	37.000	0.000	R Dry	0.00	R Dry	0.00	R Dry	0.00
13	37.070	0.370 *	37.010	0.000	37.000	0.000	R Dry	0.00	R Dry	0.00	R Dry	0.00
14	37.070	0.370 *	37.010	0.000	37.000	0.000	R Dry	0.00	R Dry	0.00	R Dry	0.00
15	37.070	0.370 *	37.010	0.000	37.000	0.000	R Dry	0.00	R Dry	0.00	R Dry	0.00
16	37.070	0.370 *	37.010	0.000	37.000	0.000	R Dry	0.00	R Dry	0.00	R Dry	0.00
17	37.070	0.370 *	37.010	0.000	37.000	0.000	R Dry	0.00	R Dry	0.00	R Dry	0.00
18	37.070	0.370 *	37.010	0.000	37.000	0.000	R Dry	0.00	R Dry	0.00	R Dry	0.00
19	37.070	0.370 *	37.010	0.000	R Dry	0.00	R Dry	0.00	R Dry	0.00	R Dry	0.00
20	37.070	0.370 *	37.010	0.000	R Dry	0.00	R Dry	0.00	R Dry	0.00	R Dry	0.00
21	37.070	0.370 *	37.010	0.000	R Dry	0.00	R Dry	0.00	R Dry	0.00	R Dry	0.00
22	37.070	0.370 *	37.010	0.000	R Dry	0.00	R Dry	0.00	R Dry	0.00	R Dry	0.00
23	37.060	0.300 *	37.010	0.000	R Dry	0.00	R Dry	0.00	R Dry	0.00	R Dry	0.00
24	37.060	0.300 *	37.010	0.000	R Dry	0.00	R Dry	0.00	R Dry	0.00	R Dry	0.00
25	37.060	0.300 *	37.010	0.000	R Dry	0.00	R Dry	0.00	R Dry	0.00	R Dry	0.00
26	37.060	0.300 *	37.010	0.000	R Dry	0.00	R Dry	0.00	R Dry	0.00	R Dry	0.00
27	37.060	0.300 *	37.000	0.000	R Dry	0.00	R Dry	0.00	R Dry	0.00	R Dry	0.00
28	37.050	0.240 *	37.000	0.000	R Dry	0.00	R Dry	0.00	R Dry	0.00	R Dry	0.00
29	37.050	0.240	37.000	0.000	R Dry	0.00	R Dry	0.00	R Dry	0.00	R Dry	0.00
30	37.050	0.240 *	37.000	0.000			R Dry	0.00	R Dry	0.00	R Dry	0.00
31	37.050	0.240	37.000	0.000			R Dry	0.00			R Dry	0.00
Ten-Daily Mean												
I Ten-Daily	37.096	0.546	37.030	0.030	37.000	0.000						
II Ten-Daily	37.070	0.370	37.012	0.000	37.000	0.000						
III Ten-Daily	37.058	0.291	37.005	0.000								
Monthly												
Min.	37.050	0.240	37.000	0.000	37.000	0.000						
Max.	37.110	0.630	37.040	0.100	37.000	0.000						
Mean	37.074	0.399	37.015	0.01	37.000	0						

Annual Runoff in MC

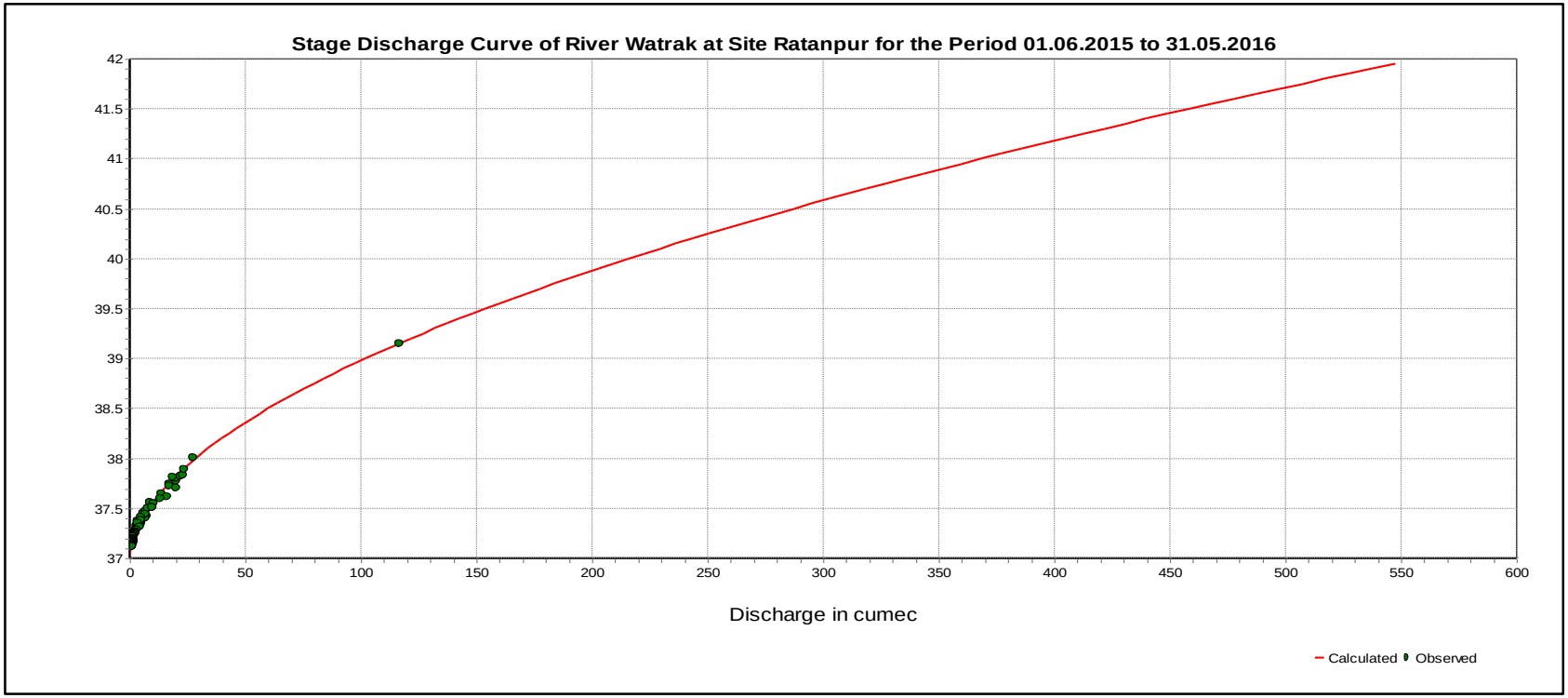
Peak Observed Disch **Peak Computed Discharge = 60.05 cumecs on 26/06/2015** **Corres. Water Level :38.5 m**

Lowest Observed Di: **Lowest Computed Discharge = 0.100 cumecs on 01/01/2016** **Corres. Water Level :37.04 m**

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff



Procedure - Standard

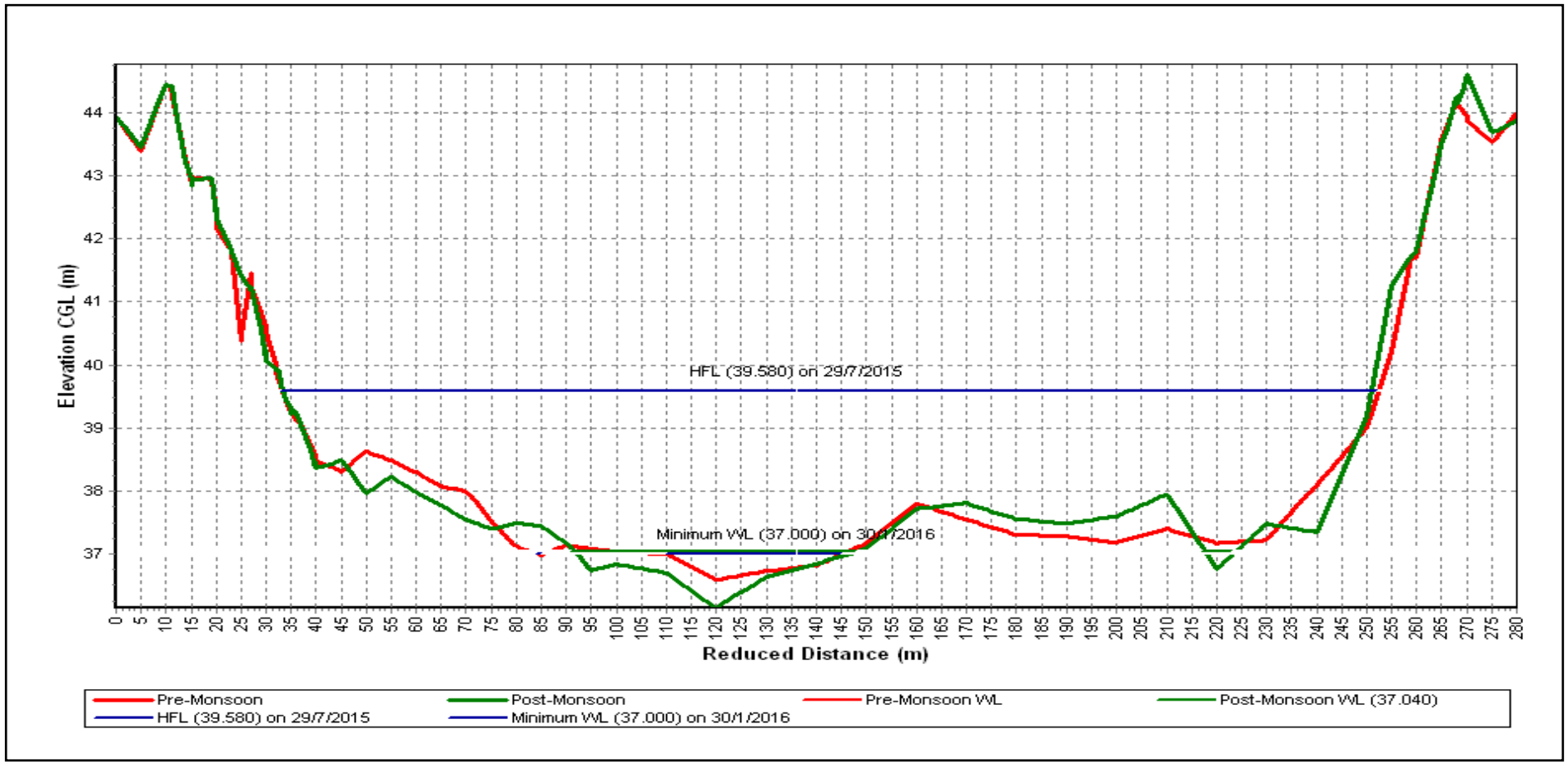
Equation Type - Power $Q=c*(h+a)^b$

LB	UB	a	b	c
37	42	-36.97	1.8731	27.076

Pre-Monsoon & Post-Monsoon X-Section for Water Year : 2015-2016

Station Name : Watrak at Gadvel (Ratanpur) (01 02 12 010) **Division : Mahi Division, Gandhinagar**

Local River : Watrak **Sub-Division : Sabarmati Sub Divn., Ahmedabad**



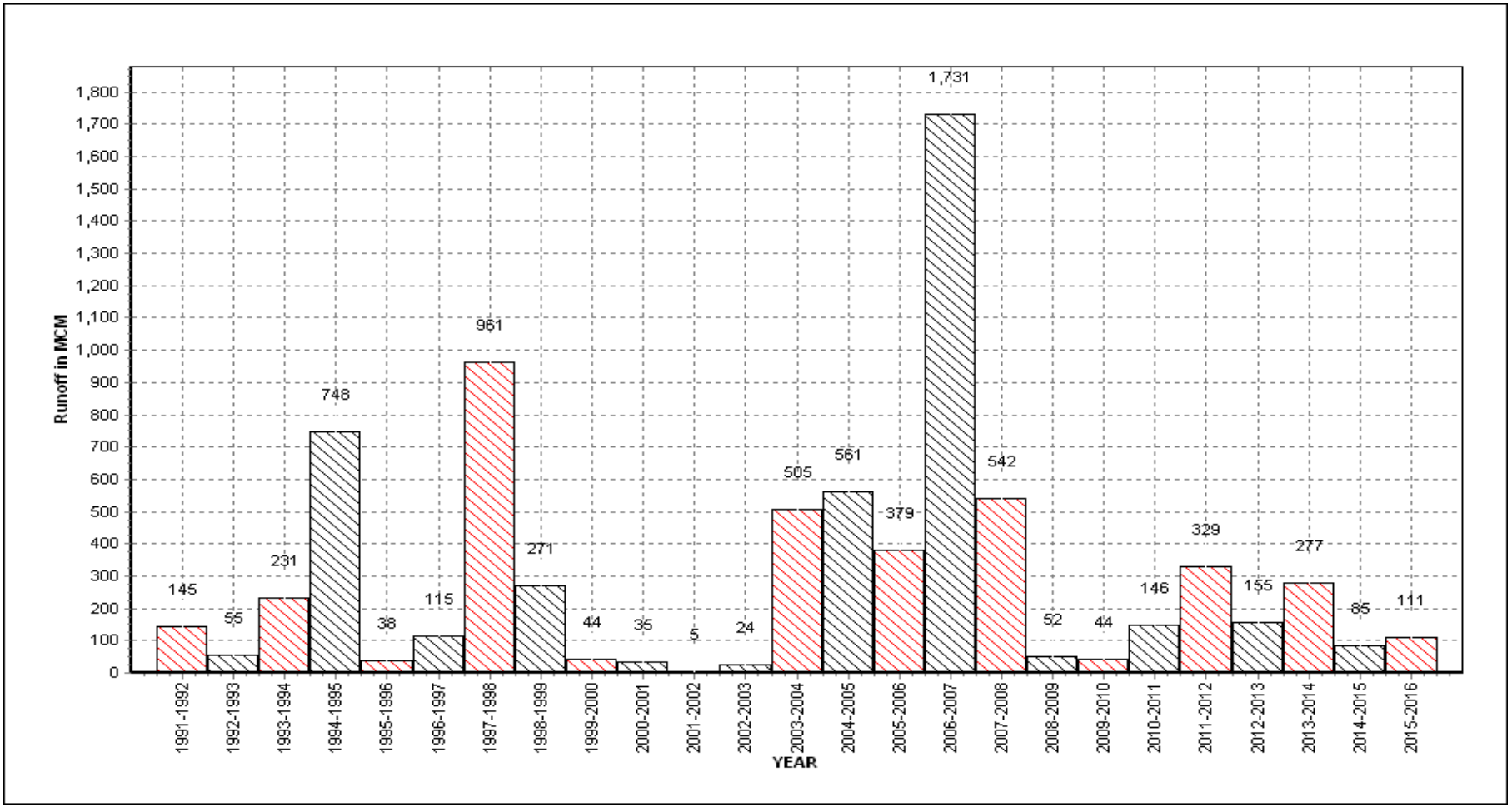
Historical Flood Level : 48.200 m on 28.07.1997 at 0200 hrs

Note: HFL marked on graph denotes Maximum Water Level observed during the Water Year 2015-15

Annual Runoff Values for the period: 1991 - 2016

Station Name : Watrak at Gadvel (Ratanpur) (01 02 12 010) **Division : Mahi Division, Gandhinagar**

Local River : Watrak **Sub-Division : Sabarmati Sub Divn., Ahmedabad**



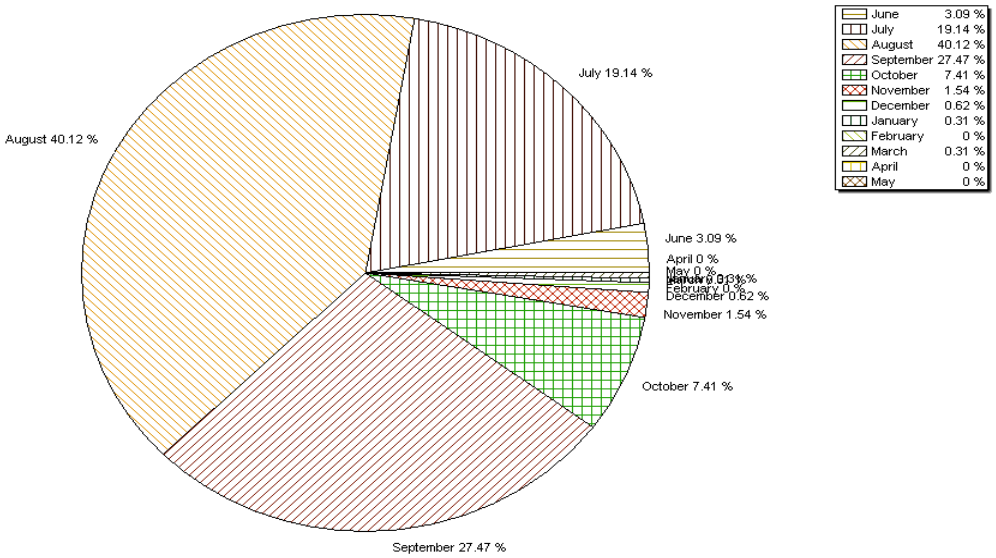
Note: Missing values have not been considered while arriving at Annual Runoff

Monthly Average Runoff based on period : 1991-2015

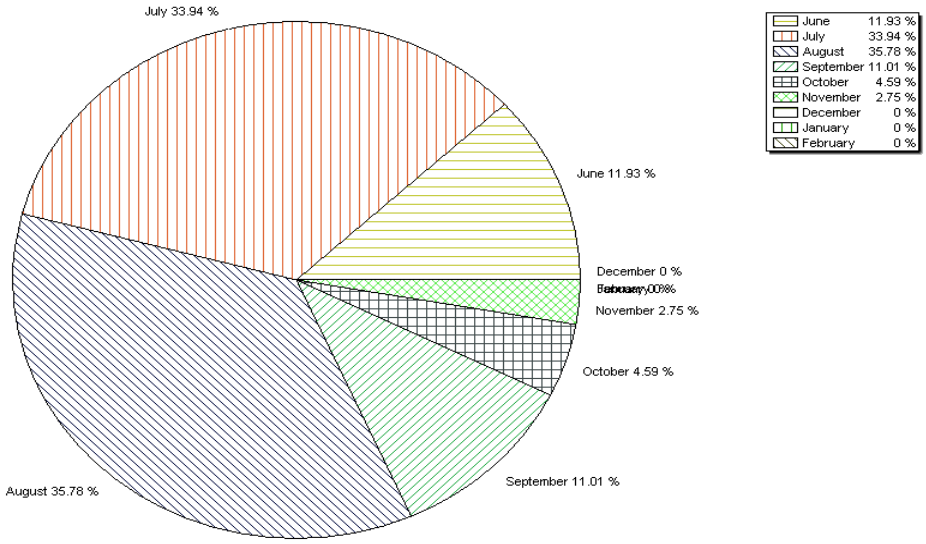
Station Name : Watrak at Gadvel (Ratanpur) (01 02 12 010) **Division : Mahi Division, Gandhinagar**

Local River : Watrak **Sub-Division : Sabarmati Sub Divn., Ahmedabad**

Monthly Average Runoff based on period : 1991-2015



Monthly Runoff for the Year : 2015-2016

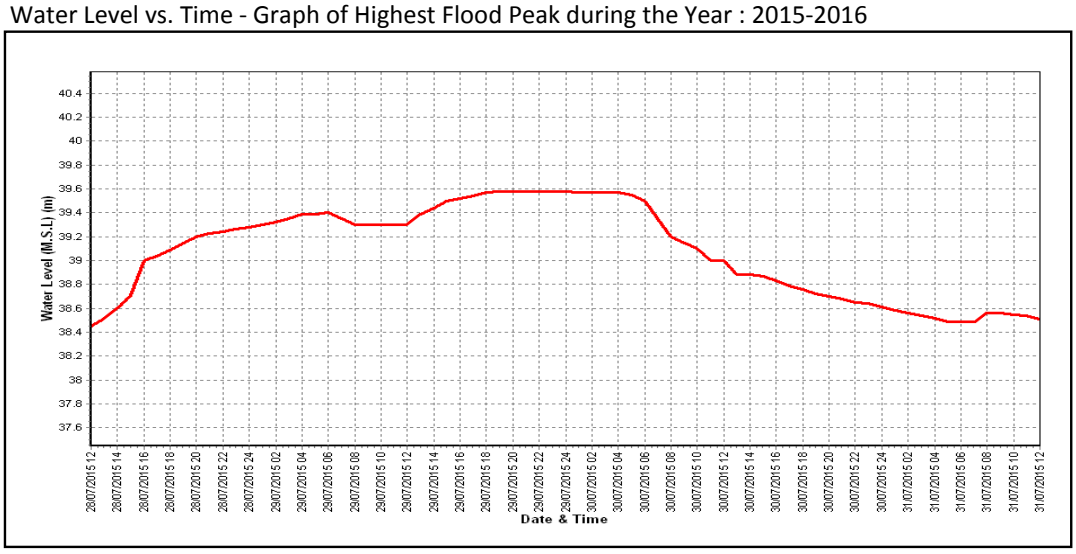


Water Level vs. Time - Graph of Highest Flood Peak during the Year : 2015-2016

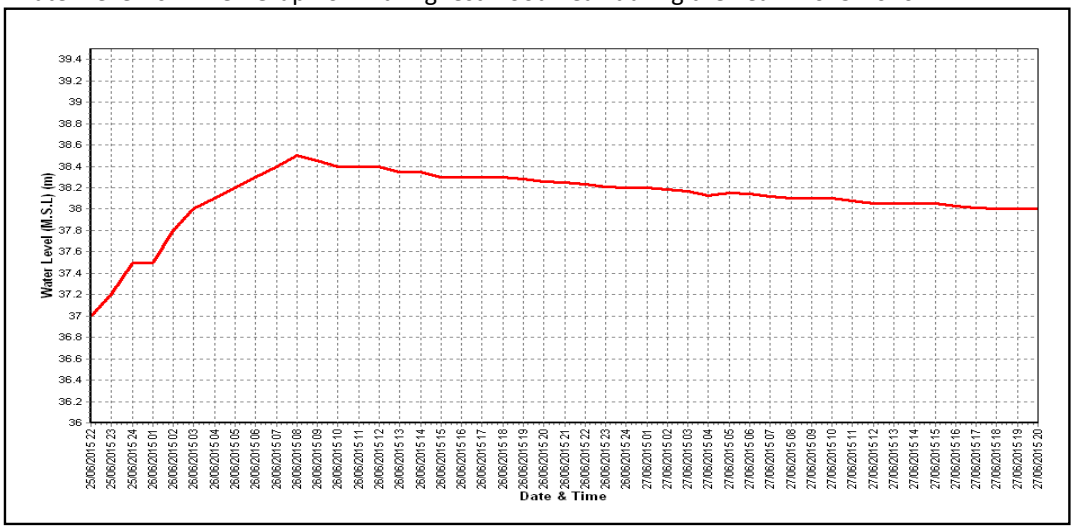
Station Name : Watrak at Gadvel (Ratanpur) (01 02 12 010) **Division : Mahi Division, Gandhinagar**

Local River : Watrak **Sub-Division : Sabarmati Sub Divn., Ahmedabad**

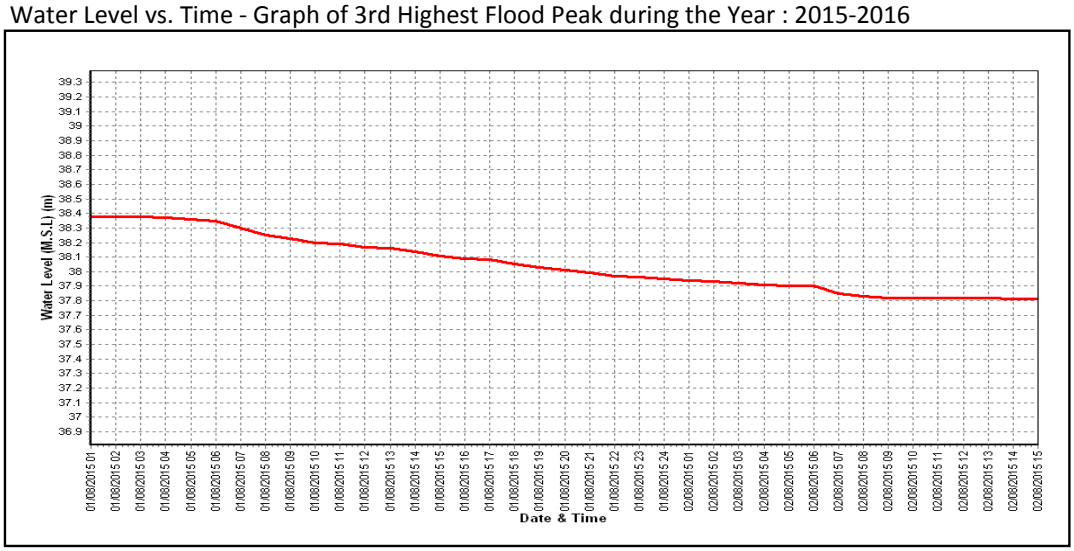
Water Level vs. Time - Graph of Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 2nd Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 3rd Highest Flood Peak during the Year : 2015-2016



Time Span: 72 Hrs

HISTORY SHEET

			Water Year	:	**2015-16**
Site	:	**Sabarmati at Derol Bridge**	**Code**	:	**01 02 12 006**
State	:	Gujarat	District		Sabarkantha
Basin	:	Sabarmati	Independent River	:	Sabarmati
Tributary	:	Sabarmati	Sub Tributary	:	
Sub-Sub Tributary	:		Local River	:	Sabarmati
Division	:	Mahi Division, Gandhinagar	Sub-Division	:	N.W.R.Sub Div., Himatnagar
Drainage Area	:	6724 Sq. Km.	Bank	:	Left
Latitude	:	23°34'24"N	Longitude	:	72°48'25"E
Zero of Gauge (m)	:	89 (m.s.l) 87 (m.s.l)	19/08/80 01/06/05	-	31/05/05 -
		Opening Date	**Closing Date**		
Gauge	:	19/08/80			
Discharge	:	01/06/91			
Sediment	:	25/09/92			
Water Quality	:	15/07/92			

Annual Maximum / Minimum discharge with corresponding Water Level (m.s.l)

	Maximum			Minimum		
Year	**Q (cumecs)**	**WL (m)**	**Date**	**Q (cumecs)**	**WL (m)**	**Date**
1992-1993	1964	94.130	08/09/92	1.894	89.840	21/08/92
1993-1994	1611	93.634	18/07/93	5.400	89.980	10/11/93
1994-1995	3050	94.730	20/08/94	6.360	89.880	24/12/94
1995-1996	55.80	90.550	22/07/95	1.891	89.680	08/08/95
1996-1997	34.00	91.000	30/08/96	0.301	89.500	29/09/96
1997-1998	1290	93.230	26/06/97	0.840	89.600	10/06/97
1998-1999	25.40	91.300	18/09/98	0.041	89.780	06/10/98
1999-2000	29.00	91.205	22/06/99	0.000	River Dry	26/01/00
2000-2001	River Dry					
2001-2002	19.10	90.890	12/07/01	0.000	River Dry	17/01/02
2002-2003	20.40	90.950	29/06/02	0.000	River Dry	25/01/03
2003-2004	73.85	91.070	28/08/03	0.000	River Dry	26/01/04
2004-2005	55.50	90.750	06/08/04	0.000	River Dry	09/05/05
2005-2006	224.7	92.300	03/10/05	0.000	River Dry	01/06/05
2006-2007	3079*	94.700	16/08/06	0.000	River Dry	01/06/06
2007-2008	842.2	92.075	09/08/07	0.000	River Dry	01/06/07
2008-2009	66.49	89.575	27/08/08	0.000	River Dry	01/06/08
2009-2010	72.99	89.650	30/08/09	0.000	River Dry	01/06/09
2010-2011	205.5	90.200	25/07/10	0.000	River Dry	01/06/10
2011-2012	386.5	90.400	12/09/11	5.085	87.700	13/10/11
2012-2013	67.8	88.800	12/09/12	0.000	87.450	15/07/12
2013-2014	169.3	89.6	02/08/13	0.000	River Dry	01/06/13
2014-2015	205.2	89.575	09/09/14	0.000	87.07	01/06/14
2015-2016	3129	92.3	30/07/15	0.000	87.160	28/01/16

Stage-Discharge Data for the period 2015 - 2016

Station Name : Sabarmati at Derol Bridge (01 02 12 006) **Division : Mahi Division, Gandhinagar**

Local River : Sabarmati **Sub-Division : N.W.R.Sub Div., Himatnagar**

Day	Jun		Jul		Aug		Sep		Oct		Nov	
	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q
1	R. Dry	0.000	87.200	0.240 *	88.530	87.37	87.660	9.725	87.335	1.517	87.225	0.370 *
2	R. Dry	0.000	87.160	0.100 *	88.950	198.4 *	87.650	9.564	87.330	1.290 *	87.225	0.370 *
3	R. Dry	0.000	87.130	0.000	88.560	116.5	87.650	9.511	87.320	1.380	87.220	0.350 *
4	R. Dry	0.000	87.085	0.000	88.230	79.29	87.650	9.297	87.315	1.110 *	87.220	0.350 *
5	R. Dry	0.000	87.075	0.000	88.190	58.57	87.640	9.159	87.310	1.257	87.220	0.350 *
6	R. Dry	0.000	87.070	0.000	88.110	55.96	87.640	9.230 *	87.310	0.943	87.215	0.320 *
7	R. Dry	0.000	87.055	0.000	88.130	65.75	87.630	10.15	87.305	1.037	87.215	0.320 *
8	R. Dry	0.000	87.045	0.000	88.120	60.17	87.630	8.945	87.300	0.894	87.215	0.320 *
9	R. Dry	0.000	87.040	0.000	88.080	39.90 *	87.630	8.890	87.300	0.879	87.210	0.290 *
10	R. Dry	0.000	87.040	0.000	87.905	28.32	87.630	8.823	87.295	0.624	87.210	0.290 *
11	R. Dry	0.000	87.035	0.000	87.745	18.08	87.620	8.429	87.290	0.850 *	87.210	0.290 *
12	R. Dry	0.000	87.030	0.000	88.740	139.4	87.620	8.320	87.285	0.746	87.210	0.290 *
13	R. Dry	0.000	87.020	0.000	89.200	330.7	87.610	8.050 *	87.280	0.659	87.205	0.250 *
14	R. Dry	0.000	87.015	0.000	89.275	289.2	87.610	7.851	87.275	0.622	87.205	0.250 *
15	R. Dry	0.000	87.010	0.000	88.385	136.6	87.600	7.188	87.275	0.412	87.205	0.250 *
16	R. Dry	0.000	87.005	0.000	88.270	62.19 *	87.600	7.097	87.270	0.503	87.205	0.250 *
17	R. Dry	0.000	87.000	0.000	88.250	76.58	87.590	7.310 *	87.265	0.615	87.200	0.240 *
18	R. Dry	0.000	87.000	0.000	88.230	70.04	87.590	6.887	87.260	0.600 *	87.200	0.240 *
19	R. Dry	0.000	87.000	0.000	88.220	53.98	87.590	6.786	87.260	0.632	87.200	0.240 *
20	R. Dry	0.000	87.000	0.000	87.960	26.26	87.590	7.310 *	87.255	0.631	87.200	0.240 *
21	R. Dry	0.000	87.000	0.000	87.850	16.58	87.590	6.062	87.255	0.621	87.200	0.240 *
22	R. Dry	0.000	87.000	0.000	87.770	14.00	87.630	8.756	87.250	0.520 *	87.200	0.240 *
23	R. Dry	0.000	87.000	0.000	87.750	14.47 *	87.620	8.296	87.250	0.619	87.195	0.220 *
24	R. Dry	0.000	87.000	0.000	87.730	13.40	87.620	8.112	87.250	0.520 *	87.195	0.220 *
25	88.070	25.88	87.000	0.000	87.720	12.85	87.610	8.050 *	87.245	0.490 *	87.195	0.220 *
26	87.735	12.56	87.200	0.240 *	87.710	12.09	87.610	6.975	87.245	0.615	87.195	0.220 *
27	87.520	5.070 #	87.980	22.00	87.700	10.80	87.430	2.890 *	87.240	0.460 *	87.195	0.220 *
28	87.360	1.690 *	88.250	24.87	87.690	10.25	87.350	1.948	87.240	0.460 *	87.190	0.200 *
29	87.290	0.850 #	89.400	314.2	87.680	9.971	87.345	1.823	87.235	0.420 *	87.190	0.200 *
30	87.250	0.520 #	92.300	3129	87.670	10.52 *	87.345	1.604	87.235	0.420 *	87.190	0.200 *
31			89.600	422.1	87.660	9.771			87.230	0.390 *		
Ten-Daily Mean												
I Ten-Daily			87.090	0.034	88.281	79.02	87.641	9.329	87.312	1.093	87.217	0.333
II Ten-Daily			87.011	0.000	88.427	120.3	87.602	7.523	87.271	0.627	87.204	0.254
III Ten-Daily	87.537	7.762	88.157	355.6	87.721	12.25	87.515	5.452	87.243	0.503	87.195	0.218
Monthly												
Min.	87.250	0.520	87.000	0.000	87.660	9.771	87.345	1.604	87.230	0.390	87.190	0.200
Max.	88.070	25.88	92.300	3129	89.275	330.7	87.660	10.15	87.335	1.517	87.225	0.370
Mean	87.537	7.762	87.443	126.2	88.129	68.64	87.586	7.435	87.275	0.734	87.205	0.268

Annual Runoff in MCM = 549 Annual Runoff in mm = 82

Peak Observed Discharge = 3129 cumecs on 30/07/2015 Corres. Water Level :92.3 m

Lowest Observed Discharge = 0.000 cumecs on 03/07/2015 Corres. Water Level :87.13 m

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff

Stage-Discharge Data for the period 2015 - 2016

Station Name : Sabarmati at Derol Bridge (01 02 12 006) **Division : Mahi Division, Gandhinagar**

Local River : Sabarmati **Sub-Division : N.W.R.Sub Div., Himatnagar**

Day	Dec			Jan			Feb		Mar		Apr		May	
	W.L	Q		WL	Q		WL	Q	WL	Q	WL	Q	WL	Q
1	87.190	0.200	*	87.175	0.160	*	87.160	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
2	87.190	0.200	*	87.175	0.160	*	87.160	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
3	87.190	0.200	*	87.175	0.160	*	87.160	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
4	87.190	0.200	*	87.170	0.130	*	87.160	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
5	87.190	0.200	*	87.170	0.130	*	87.160	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
6	87.190	0.200	*	87.170	0.130	*	87.155	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
7	87.185	0.170	*	87.170	0.130	*	87.155	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
8	87.185	0.170	*	87.170	0.130	*	87.155	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
9	87.185	0.170	*	87.170	0.130	*	87.155	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
10	87.185	0.170	*	87.170	0.130	*	87.155	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
11	87.185	0.170	*	87.170	0.130	*	87.155	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
12	87.185	0.170	*	87.170	0.130	*	87.155	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
13	87.185	0.170	*	87.170	0.130	*	87.155	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
14	87.180	0.160	*	87.170	0.130	*	87.155	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
15	87.180	0.160	*	87.170	0.130	*	87.155	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
16	87.180	0.160	*	87.165	0.100	*	87.155	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
17	87.180	0.160	*	87.165	0.100	*	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
18	87.180	0.160	*	87.165	0.100	*	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
19	87.180	0.160	*	87.165	0.100	*	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
20	87.180	0.160	*	87.165	0.100	*	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
21	87.175	0.150	*	87.165	0.100	*	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
22	87.175	0.150	*	87.165	0.100	*	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
23	87.175	0.150	*	87.165	0.100	*	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
24	87.175	0.150	*	87.165	0.100	*	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
25	87.175	0.150	*	87.165	0.100	*	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
26	87.175	0.150	*	87.165	0.100	*	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
27	87.175	0.150	*	87.165	0.100	*	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
28	87.175	0.150	*	87.160	0.000		R. Dry	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
29	87.175	0.150	*	87.160	0.000		R. Dry	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
30	87.175	0.150	*	87.160	0.000				R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
31	87.175	0.150	*	87.160	0.000				R. Dry	0.000			R. Dry	0.000
Ten-Daily Mean														
I Ten-Daily	87.188	0.188		87.171	0.139		87.158	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
II Ten-Daily	87.181	0.163		87.167	0.115		87.155	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
III Ten-Daily	87.175	0.150		87.163	0.064		R. Dry	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
Monthly														
Min.	87.175	0.150		87.160	0.000		87.155	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
Max.	87.190	0.200		87.175	0.160		87.160	0.000	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000
Mean	87.181	0.166		87.167	0.105		rdry	0	R. Dry	0.000	R. Dry	0.000	R. Dry	0.000

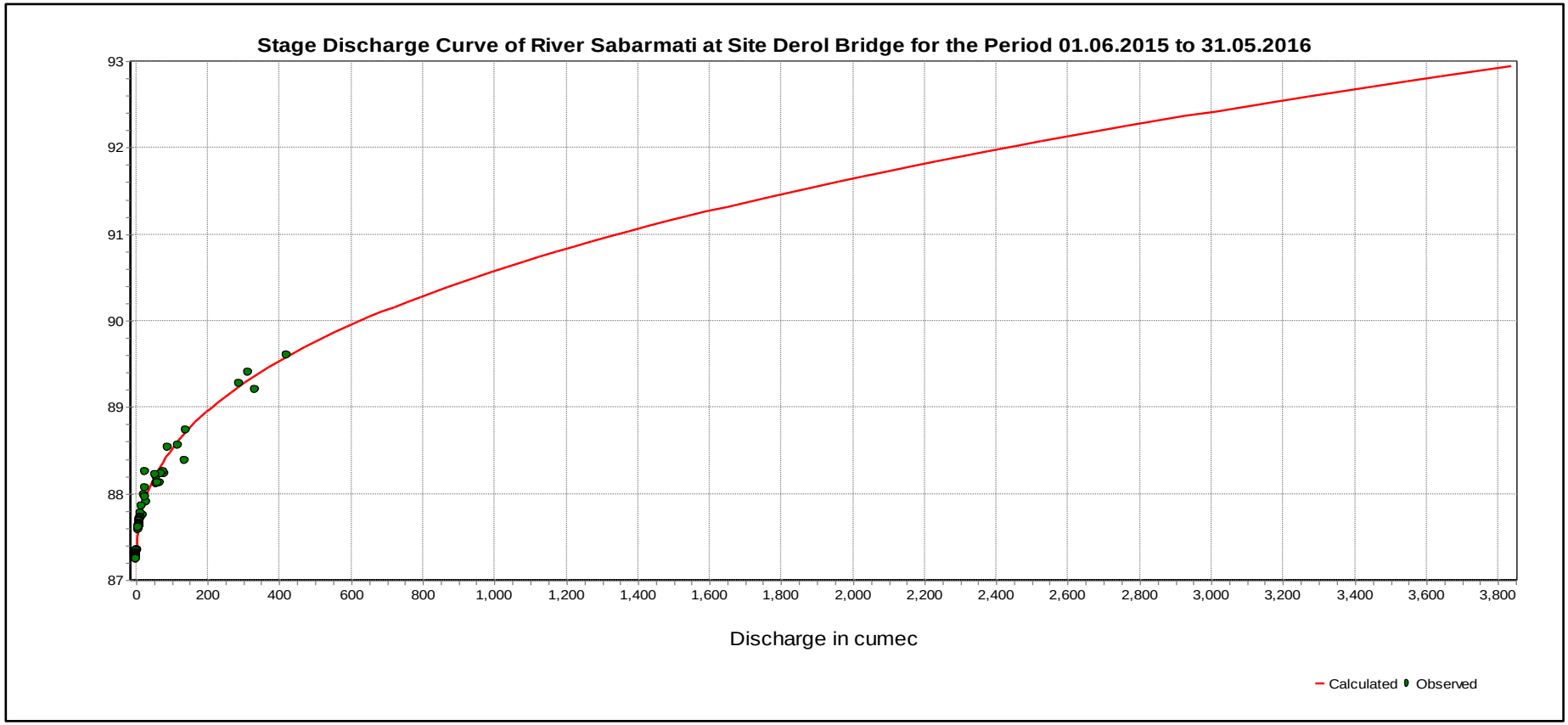
Peak Computed Discharge = 198.4 cumecs on 02/08/2015 **Corres. Water Level :88.95 m**

Lowest Computed Discharge = 0.100 cumecs on 02/07/2015 **Corres. Water Level :87.16 m**

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff



Procedure - Standard

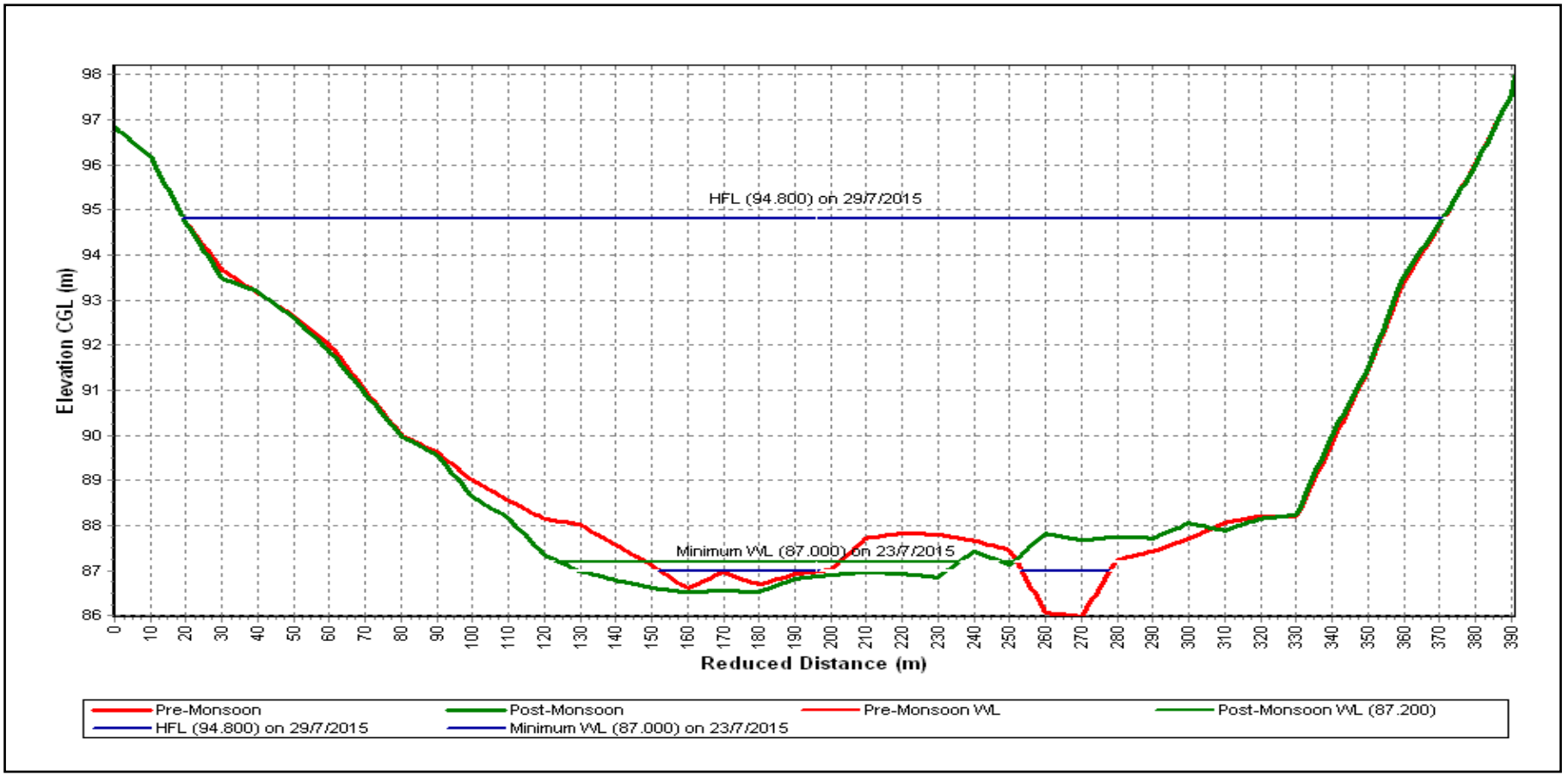
Equation Type - Power $Q=c*(h+a)^b$

LB	UB	a	b	c
87.2	93	-87.055	2.61	37.41

Pre-Monsoon & Post-Monsoon X-Section for Water Year : 2015-2016

Station Name : Sabarmati at Derol Bridge (01 02 12 006) **Division : Mahi Division, Gandhinagar**

Local River : Sabarmati **Sub-Division : N.W.R.Sub Div., Himatnagar**



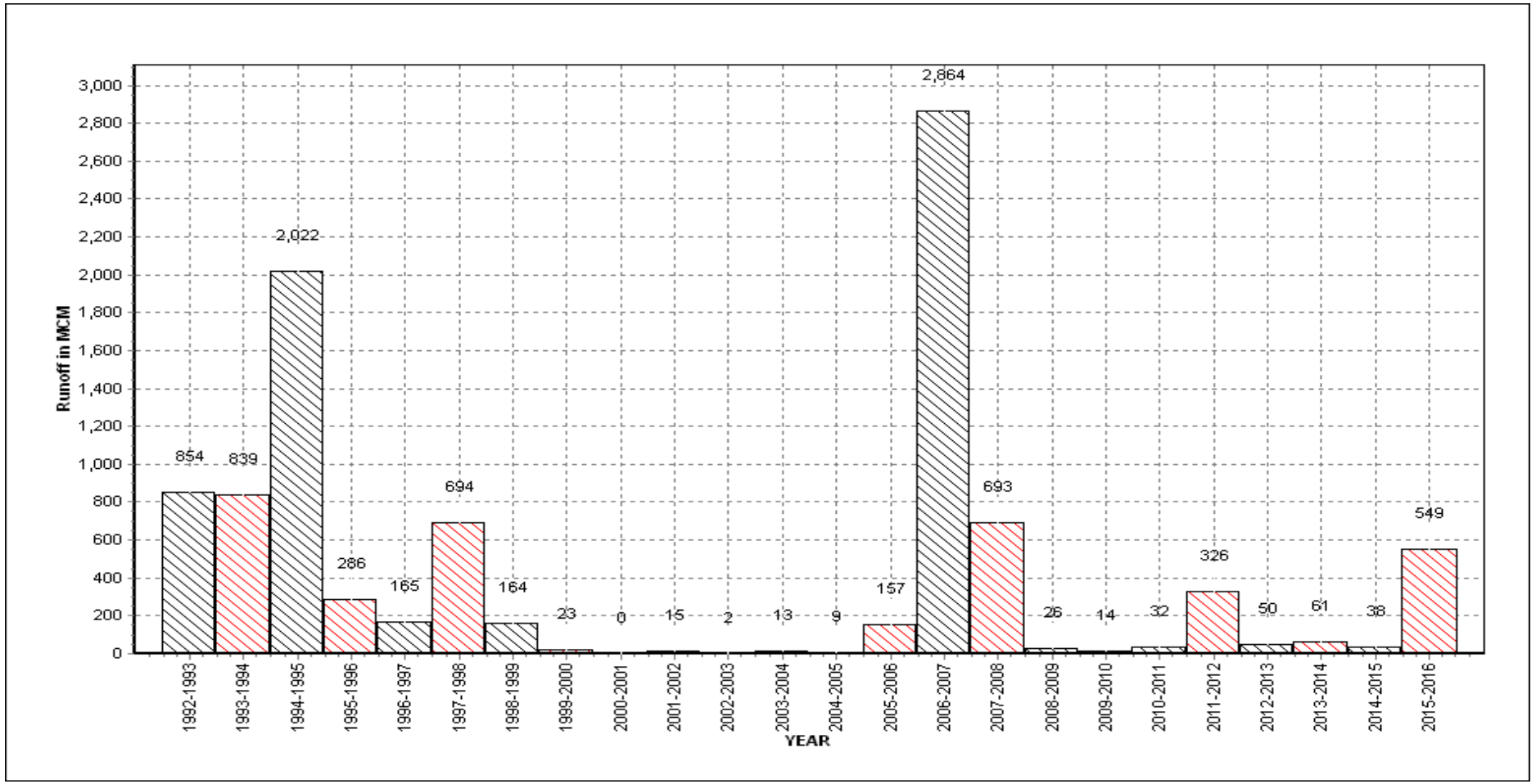
Historic Flood Level - 95.83 m on 17.07.1993 at 1800 hrs

Note: HFL marked on graph denotes Maximum Water Level observed during the Water Year 2015-16

Annual Runoff Values for the period: 1992 - 2016

Station Name : Sabarmati at Derol Bridge (01 02 12 006) **Division : Mahi Division, Gandhinagar**

Local River : Sabarmati **Sub-Division : N.W.R.Sub Div., Himatnagar**

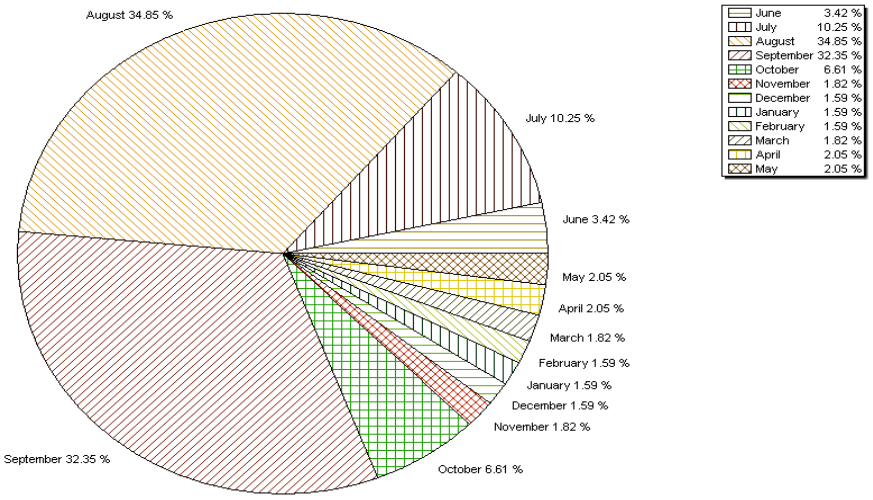


Note: Missing values have not been considered while arriving at Annual Runoff

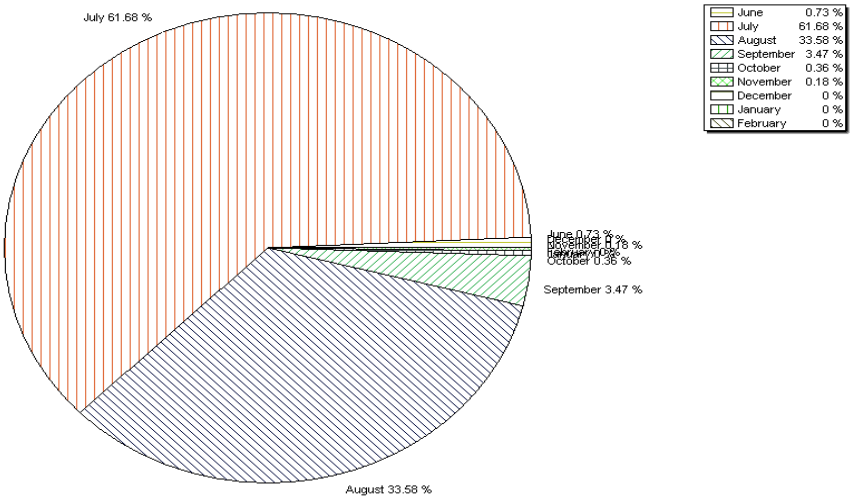
Station Name : Sabarmati at Derol Bridge (01 02 12 006) **Division : Mahi Division, Gandhinagar**

Local River : Sabarmati **Sub-Division : N.W.R.Sub Div., Himatnagar**

Monthly Average Runoff based on period : 1992-2015

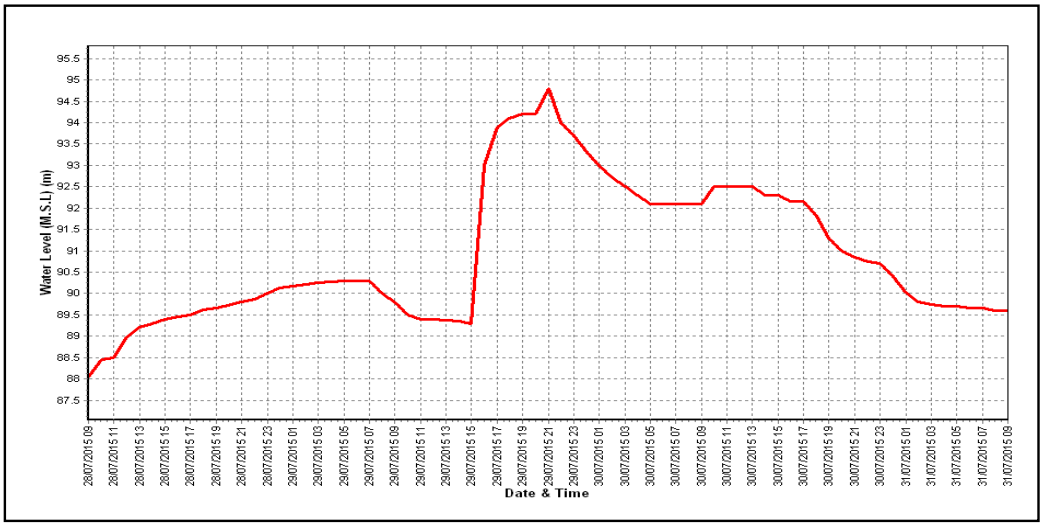


Monthly Runoff for the Year : 2015-2016

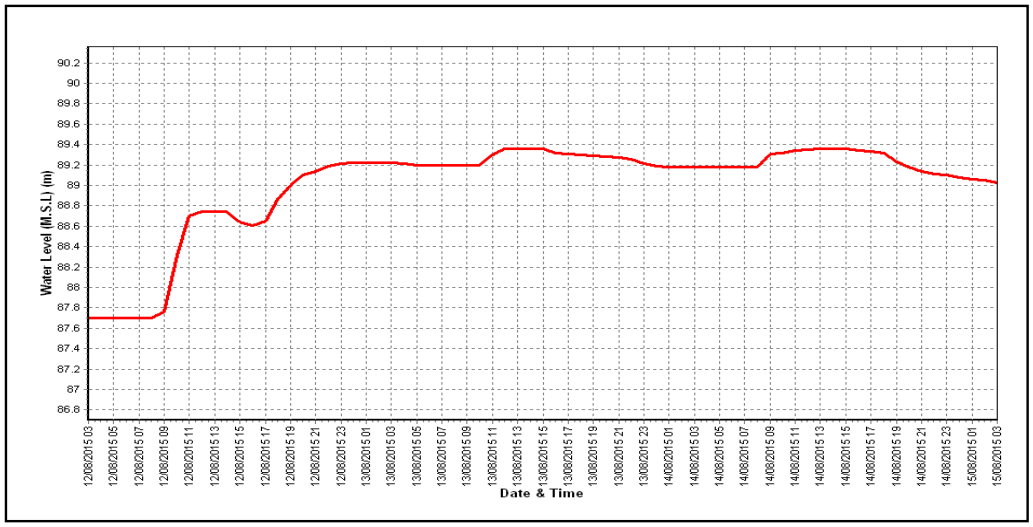


Station Name : Sabarmati at Derol Bridge (01 02 12 006) **Division : Mahi Division, Gandhinagar**
Local River : Sabarmati **Sub-Division : N.W.R.Sub Div., Himatnagar**

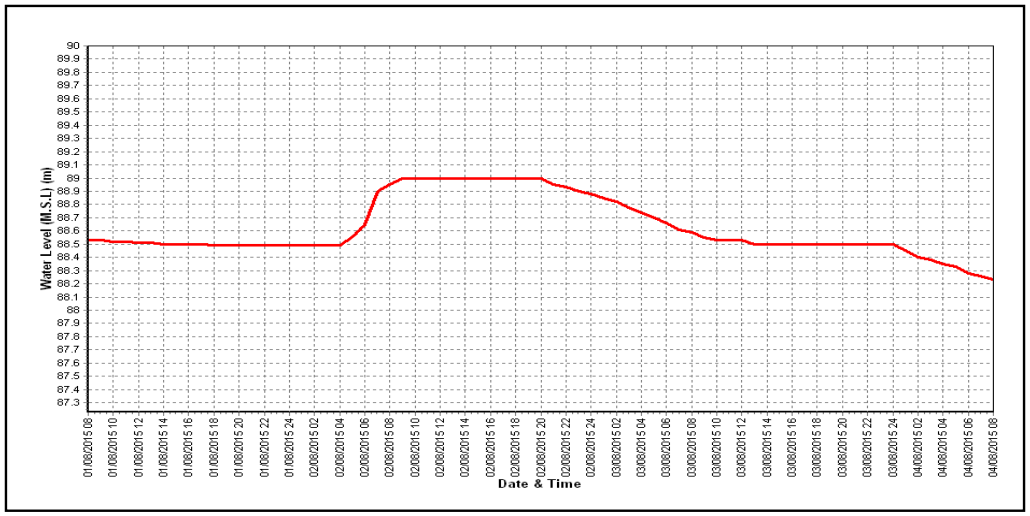
Water Level vs. Time - Graph of Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 2nd Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 3rd Highest Flood Peak during the Year : 2015-2016



Time Span: 72 Hrs

HISTORY SHEET

Water Year : 2015-16

Site : Sabarmati at Kheroj **Code : 01 02 12 003**

State : Gujarat District : Sabarkantha

Basin : Sabarmati Independent River : Sabarmati

Tributary : Sabarmati Sub Tributary :

Sub-Sub Tributary : Local River : Sabarmati

Division : Mahi Division, Gandhinagar Sub-Division : N.W.R.Sub Div., Himatnagar

Drainage Area : 3650 Sq. Km. Bank : Left

Latitude : 24°13'45"N Longitude : 73°00'26"E

Zero of Gauge (m) : 0 (A) 01/01/81 - 31/12/87
211.68 (m.s.l) 01/01/88 - 30/06/93
210.5 (m.s.l) 01/07/93 - 16/07/03
208 (m.s.l) 17/07/03 -

	Opening Date	Closing Date
Gauge	01/06/81	
Discharge	22/06/92	
Sediment	--	
Water Quality	--	

Annual Maximum / Minimum discharge with corresponding Water Level (m.s.l)

	Maximum			Minimum		
Year	Q (cumecs)	WL (m)	Date	Q (cumecs)	WL (m)	Date
1992-1993	325.0	213.880	08/09/92	0.000	River Dry	19/03/93
1993-1994	653.4	215.180	17/07/93	0.000	River Dry	26/01/94
1994-1995	790.2	215.000	20/08/94	0.000	211.830	03/04/95
1995-1996	164.5	213.170	31/07/95	0.000	211.600	31/01/96
1996-1997	470.7	214.060	11/09/96	0.000	River Dry	20/12/96
1997-1998	401.0	213.475	25/06/97	0.000	211.760	26/01/98
1998-1999	229.3	211.680	27/08/98	0.000	River Dry	23/05/99
1999-2000	23.70	212.455	21/07/99	0.000	River Dry	20/11/99
2000-2001	30.63	212.500	02/07/00	0.000	River Dry	29/01/01
2001-2002	118.5	213.440	14/06/01	0.000	River Dry	28/01/02
2002-2003	148.5	212.800	02/09/02	0.000	River Dry	24/11/02
2003-2004	265.8	210.950	29/07/03	0.000	River Dry	14/01/04
2004-2005	87.18	210.650	08/08/04	0.000	River Dry	09/05/05
2005-2006	955.1	213.250	02/08/05	0.000	River Dry	01/06/05
2006-2007	1402	215.450	19/08/06	0.000	River Dry	01/06/06
2007-2008	619.4	212.850	09/07/07	0.000	208.600	01/06/07
2008-2009	205.3	210.875	12/08/08	0.000	River Dry	01/06/08
2009-2010	270.9	211.335	23/07/09	0.000	River Dry	01/06/09
2010-2011	224.03	211.115	31/08/10	0.000	River Dry	01/06/10
2011-2012	441.8	212.090	12/09/11	0.000	River Dry	22/04/12
2012-2013	451.3	212.260	08/09/12	0.000	River Dry	01/06/12
2013-2014	166.2	210.77	28/07/13	0.000	River Dry	01/06/13
2014-2015	240.3	210.84	10/09/14	0.000	River Dry	01/06/14
2015-2016	8351	215.05	29/07/15	0.000	209.500	21/11/15

Stage-Discharge Data for the period 2015 - 2016

Station Name : Sabarmati at Kheroj (01 02 12 003) **Division : Mahi Division, Gandhinagar**

Local River : Sabarmati **Sub-Division : N.W.R.Sub Div., Himatnagar**

Day	Jun		Jul		Aug		Sep		Oct		Nov	
	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q
1	R Dry	0.000	209.630	1.220 *	210.910	151.2	209.940	12.86	209.760	3.742	209.570	0.470 *
2	R Dry	0.000	209.590	0.670 *	210.595	113.5	209.930	11.18	209.750	4.240 *	209.570	0.470 *
3	R Dry	0.000	209.570	0.470 *	210.460	84.74	209.910	10.21	209.740	3.631	209.560	0.400 *
4	R Dry	0.000	209.560	0.400 *	210.380	75.80	209.890	6.554	209.730	3.570 *	209.550	0.320 *
5	R Dry	0.000	209.550	0.320 *	210.300	73.47	209.880	7.591	209.720	3.231	209.550	0.320 *
6	R Dry	0.000	209.530	0.200 *	210.240	69.92	209.870	9.850 *	209.710	3.149	209.540	0.260 *
7	R Dry	0.000	209.520	0.150 *	210.210	53.41	209.860	5.250	209.710	3.038	209.540	0.260 *
8	R Dry	0.000	209.510	0.110 *	210.170	56.03	209.850	5.094	209.700	2.842	209.540	0.260 *
9	R Dry	0.000	209.490	0.000	210.140	34.95 *	209.840	5.379	209.700	2.762	209.530	0.200 *
10	R Dry	0.000	209.480	0.000	210.110	43.44	209.830	5.192	209.695	2.593	209.530	0.200 *
11	R Dry	0.000	209.480	0.000	210.090	35.25	209.820	4.292	209.690	2.450 *	209.530	0.200 *
12	R Dry	0.000	209.480	0.000	210.170	60.16	209.810	4.694	209.680	2.523	209.530	0.200 *
13	R Dry	0.000	209.470	0.000	210.520	116.2	209.810	6.670 *	209.660	2.330	209.520	0.150 *
14	R Dry	0.000	209.470	0.000	210.340	77.78	209.810	4.800	209.650	2.072	209.520	0.150 *
15	R Dry	0.000	209.450	0.000	210.290	58.05 *	209.800	4.047	209.650	1.821	209.520	0.150 *
16	R Dry	0.000	209.450	0.000	210.320	63.56 *	209.790	3.853	209.640	1.738	209.520	0.150 *
17	R Dry	0.000	209.440	0.000	210.390	82.72	209.790	5.790 *	209.640	1.524	209.510	0.110 *
18	R Dry	0.000	209.430	0.000	210.270	79.62	209.790	4.014	209.630	1.220 *	209.510	0.110 *
19	R Dry	0.000	209.430	0.000	210.200	64.07	209.810	5.078	209.620	1.376	209.510	0.110 *
20	R Dry	0.000	209.430	0.000	210.150	57.00	209.820	5.389	209.610	1.256	209.510	0.110 *
21	R Dry	0.000	209.410	0.000	210.120	44.15	209.830	5.678	209.610	1.231	209.500	0.000
22	R Dry	0.000	209.710	2.980 *	210.100	53.59	209.910	13.81	209.610	0.920 *	209.500	0.000
23	R Dry	0.000	210.100	31.87	210.080	27.67 *	209.900	13.46	209.610	1.186	209.500	0.000
24	209.660	1.770 *	209.860	11.44	210.070	49.18	209.870	10.29	209.600	0.790 *	209.490	0.000
25	210.215	36.32	209.765	7.040	210.040	31.21	209.840	8.170 *	209.600	0.790 *	209.490	0.000
26	210.650	159.4	210.925	184.3	210.020	23.26	209.820	5.291	209.600	0.790 #	209.490	0.000
27	209.920	13.18	211.170	254.3	210.000	22.04	209.810	6.680 *	209.590	0.680 #	209.490	0.000
28	209.750	4.230 *	211.720	868.2	209.990	19.94	209.800	4.566	209.580	0.570 #	209.490	0.000
29	209.690	2.440 *	215.050	8351 #	209.980	18.22	209.790	4.282	209.580	0.570 #	209.480	0.000
30	209.660	1.770 *	211.875	927.1	209.970	16.94 *	209.780	4.010	209.580	0.570 #	209.480	0.000
31			211.150	271.0	209.950	15.44			209.570	0.480 #		
Ten-Daily Mean												
I Ten-Daily			209.543	0.354	210.352	75.64	209.880	7.916	209.721	3.280	209.548	0.316
II Ten-Daily			209.453	0.000	210.274	69.44	209.805	4.863	209.647	1.831	209.518	0.144
III Ten-Daily	209.935	31.30	210.976	991.7	210.029	29.24	209.835	7.624	209.594	0.780	209.491	
Monthly												
Min.	209.660	1.770	209.410	0.000	209.950	15.44	209.780	3.853	209.570	0.480	209.480	0.110
Max.	210.650	159.4	215.050	8351	210.910	151.2	209.940	13.81	209.760	4.240	209.570	0.470
Mean	209.935	31.3	210.022	352	210.212	57.18	209.840	6.801	209.652	1.925	209.519	0.23

Annual Runoff in MCM = 1138 Annual Runoff in mm = 312

Peak Observed Discharge = 8351 cumecs on 29/07/2015 Corres. Water Level :215.05 m

Lowest Observed Discharge = 0.000 cumecs on 09/07/2015 Corres. Water Level :209.49 m

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff

Stage-Discharge Data for the period 2015 - 2016

Station Name : Sabarmati at Kheroj (01 02 12 003) **Division : Mahi Division, Gandhinagar**

Local River : Sabarmati **Sub-Division : N.W.R.Sub Div., Himatnagar**

Day	Dec		Jan		Feb		Mar		Apr		May	
	W.L	Q	WL	Q	WL	Q	WL	Q	WL	Q	WL	Q
1	209.470	0.000	209.390	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
2	209.470	0.000	209.390	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
3	209.470	0.000	209.380	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
4	209.470	0.000	209.370	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
5	209.460	0.000	209.370	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
6	209.460	0.000	209.360	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
7	209.460	0.000	209.350	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
8	209.450	0.000	209.350	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
9	209.450	0.000	209.340	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
10	209.450	0.000	209.340	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
11	209.450	0.000	209.330	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
12	209.440	0.000	209.330	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
13	209.440	0.000	209.320	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
14	209.440	0.000	209.310	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
15	209.430	0.000	209.300	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
16	209.430	0.000	209.290	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
17	209.430	0.000	209.280	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
18	209.430	0.000	209.270	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
19	209.430	0.000	209.270	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
20	209.430	0.000	209.270	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
21	209.410	0.000	209.260	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
22	209.410	0.000	209.260	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
23	209.410	0.000	209.260	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
24	209.410	0.000	209.260	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
25	209.410	0.000	209.250	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
26	209.410	0.000	209.240	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
27	209.410	0.000	209.230	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
28	209.410	0.000	209.220	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
29	209.410	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
30	209.400	0.000	R Dry	0.000			R Dry	0.000	R Dry	0.000	R Dry	0.000
31	209.400	0.000	R Dry	0.000			R Dry	0.000			R Dry	0.000
Ten-Daily Mean												
I Ten-Daily	209.461	0.000	209.364	0.000		0.000		0.000		0.000		0.000
II Ten-Daily	209.435	0.000	209.297	0.000		0.000		0.000		0.000		0.000
III Ten-Daily	209.408	0.000	209.247	0.000		0.000		0.000		0.000		0.000
Monthly												
Min.	209.400	0.000	209.220	0.000		0.000		0.000		0.000		0.000
Max.	209.470	0.000	209.390	0.000		0.000		0.000		0.000		0.000
Mean	209.434	0.000	209.307	0.000		0.000		0.000		0.000		0.000

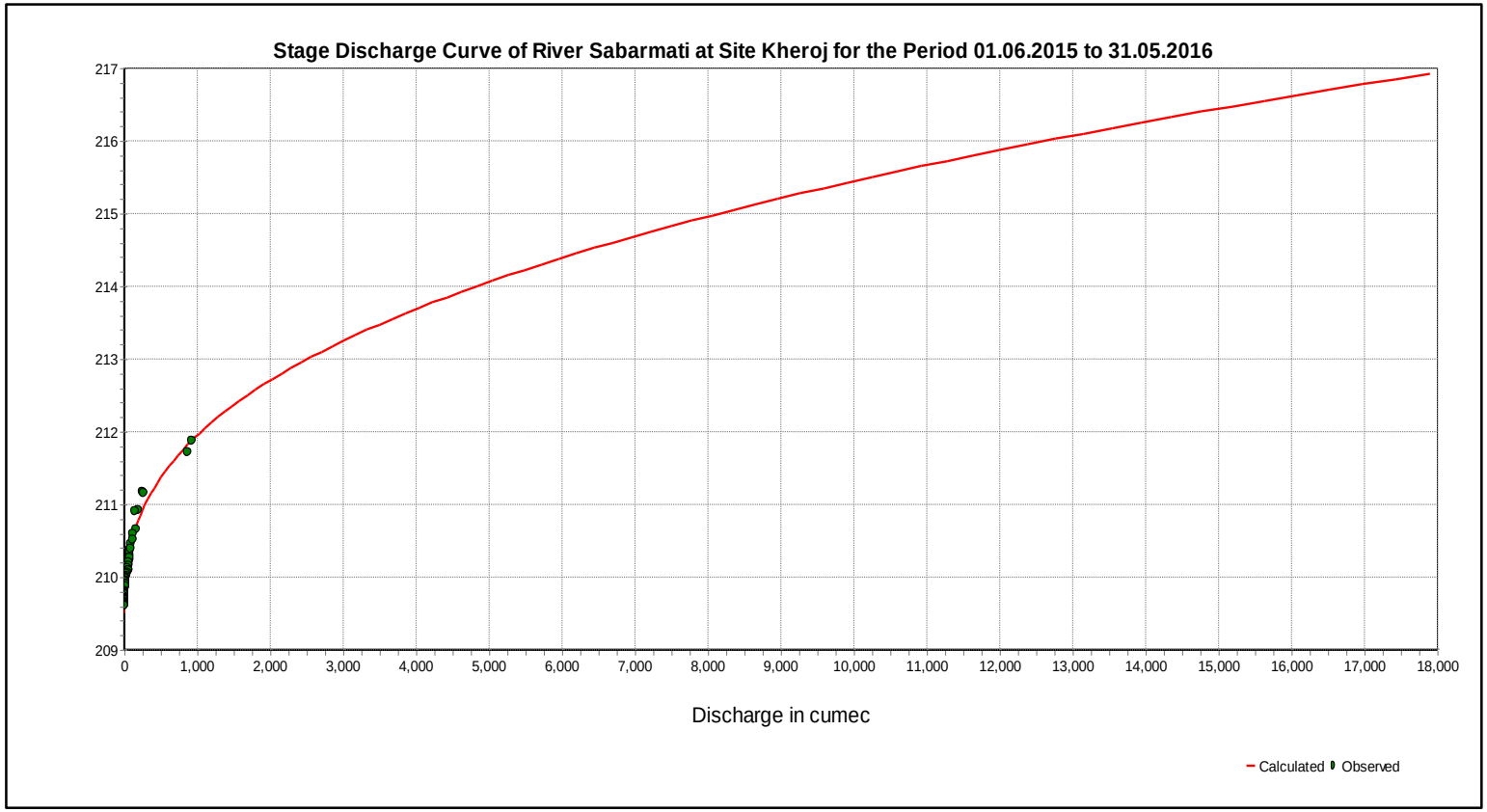
Peak Computed Discharge = 63.56 cumecs on 16/08/2015 **Corres. Water Level :210.32 m**

Lowest Computed Discharge = 0.110 cumecs on 08/07/2015 **Corres. Water Level :209.51 m**

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff



Procedure - Standard

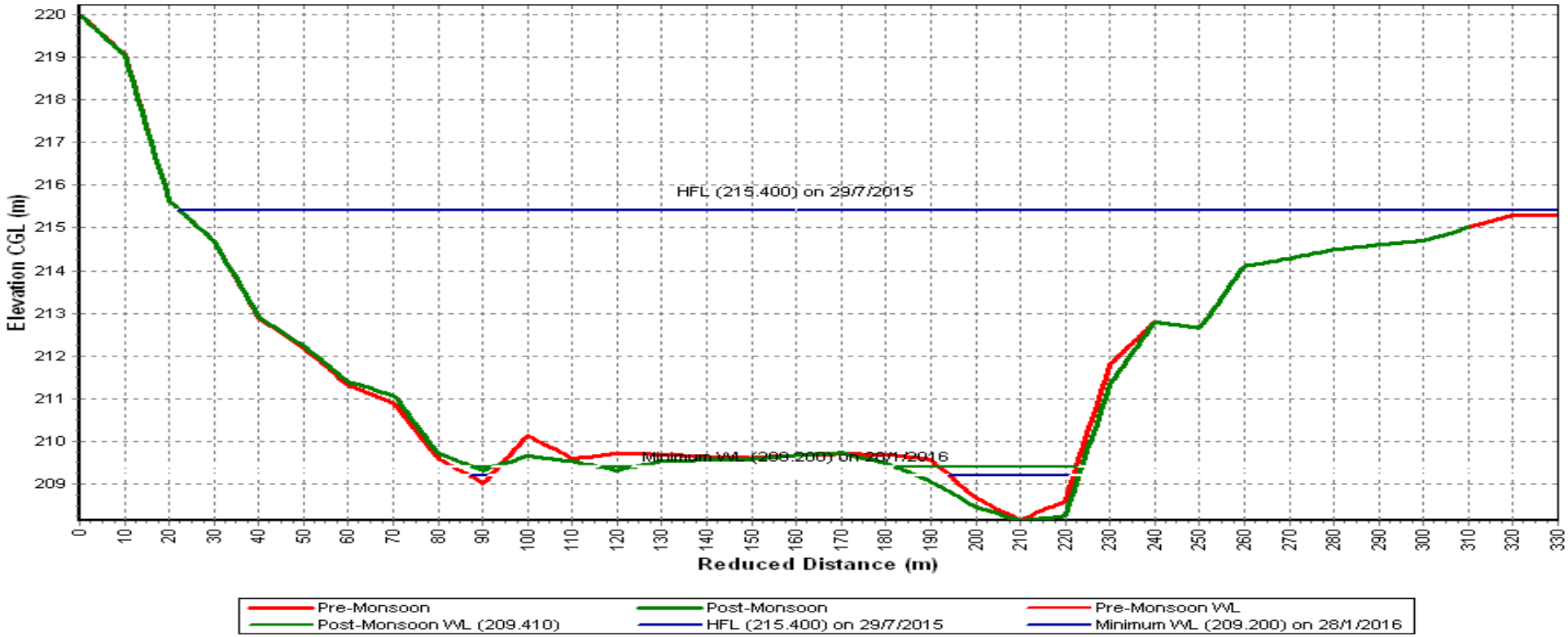
Equation Type - Power $Q=c*(h+a)^b$

LB	UB	a	b	c
209.5	217	-209.43	2.647	86.53

Pre-Monsoon & Post-Monsoon X-Section for Water Year : 2015-2016

Station Name : Sabarmati at Kheroj (01 02 12 003) **Division : Mahi Division, Gandhinagar**

Local River : Sabarmati **Sub-Division : N.W.R.Sub Div., Himatnagar**



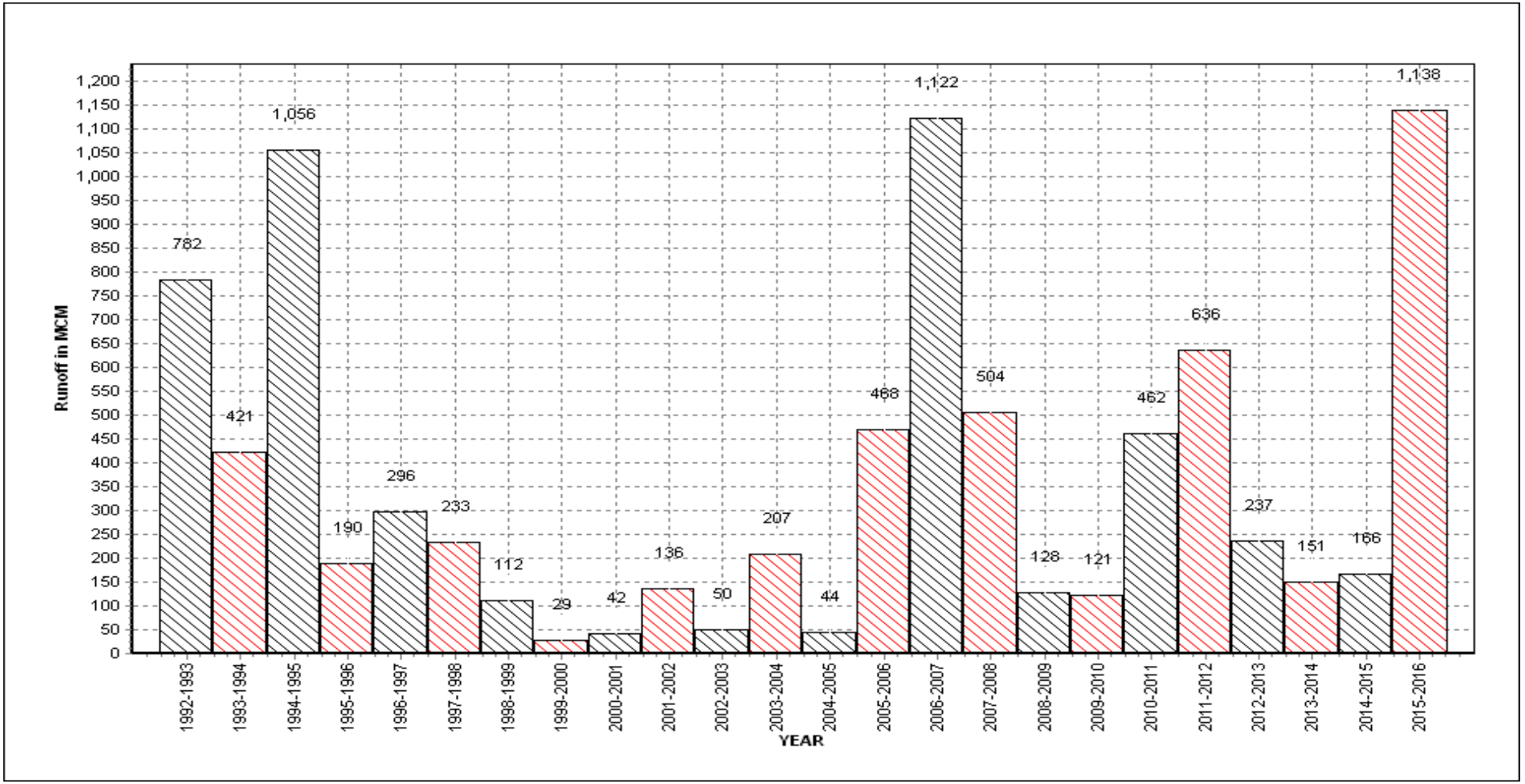
HFL obsereved - 218.000m on 19.08.2006 at 1600 hrs

HFL on grapph shows Max Water Level during 2015-16

Annual Runoff Values for the period: 1992 - 2016

Station Name : Sabarmati at Kheroj (01 02 12 003) **Division : Mahi Division, Gandhinagar**

Local River : Sabarmati **Sub-Division : N.W.R.Sub Div., Himatnagar**



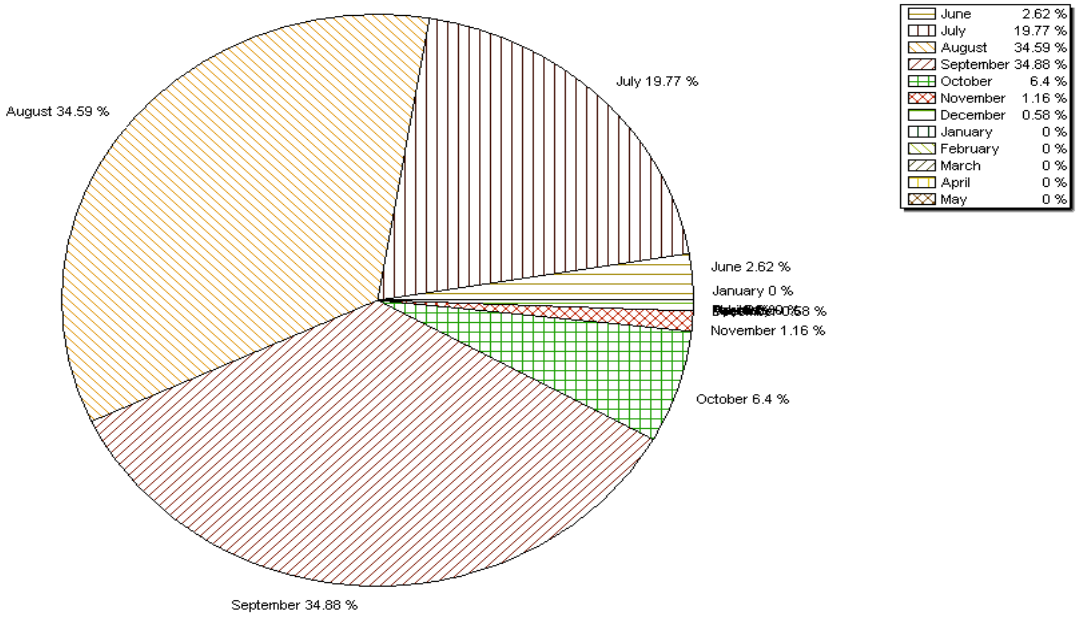
Note: Missing values have not been considered while arriving at Annual Runoff

Monthly Average Runoff based on period : 1992-2015

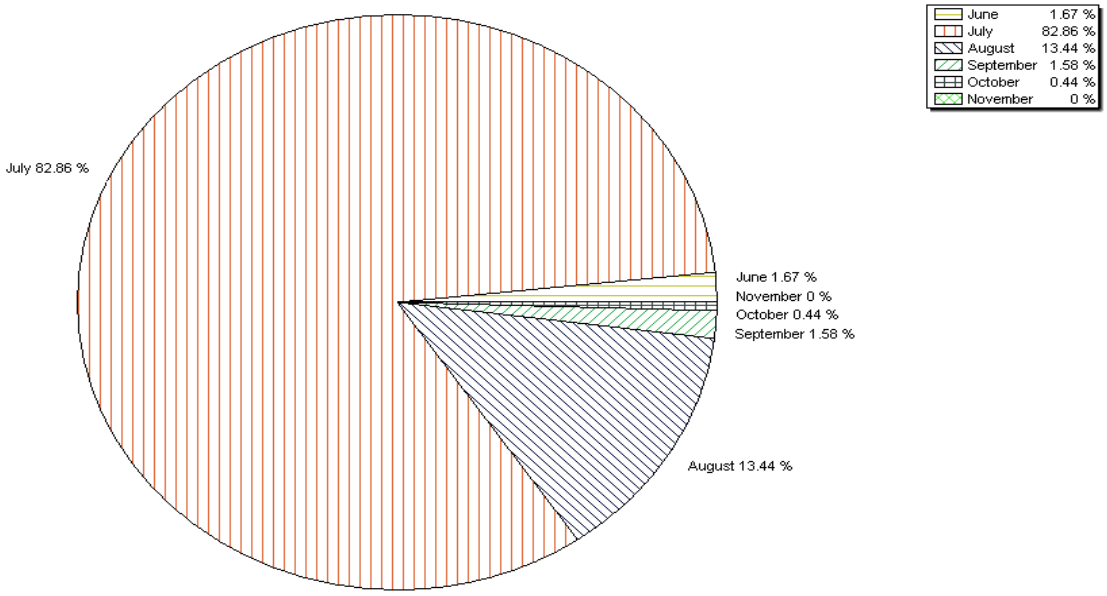
Station Name : Sabarmati at Kheroj (01 02 12 003) **Division : Mahi Division, Gandhinagar**

Local River : Sabarmati **Sub-Division : N.W.R.Sub Div., Himatnagar**

Monthly Average Runoff based on period : 1992-2015



Monthly Runoff for the Year : 2015-2016

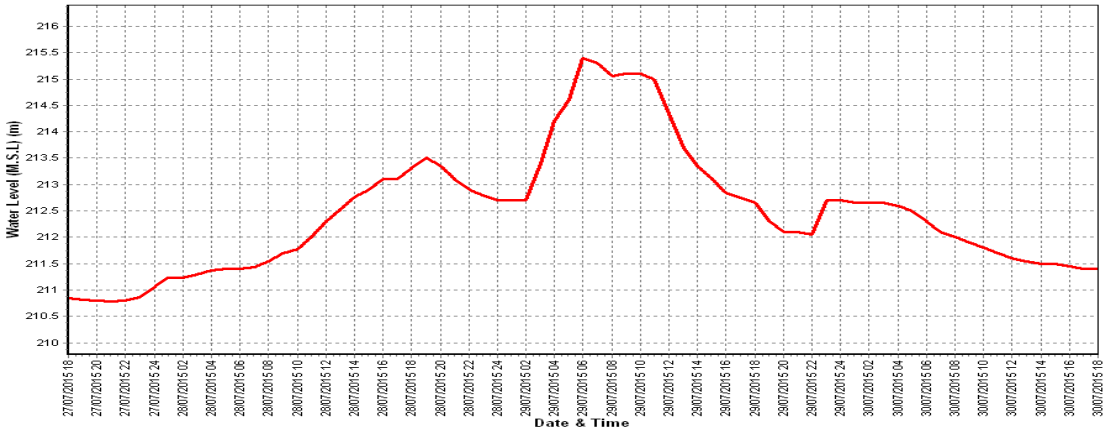


Water Level vs. Time - Graph of Highest Flood Peak during the Year : 2015-2016

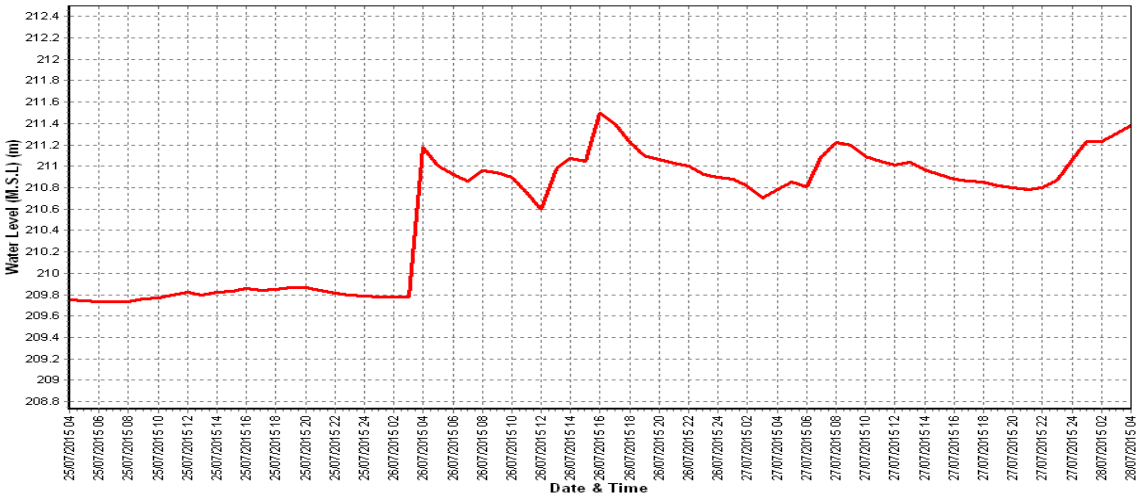
Station Name : Sabarmati at Kheroj (01 02 12 003) **Division : Mahi Division, Gandhinagar**

Local River : Sabarmati **Sub-Division : N.W.R.Sub Div., Himatnagar**

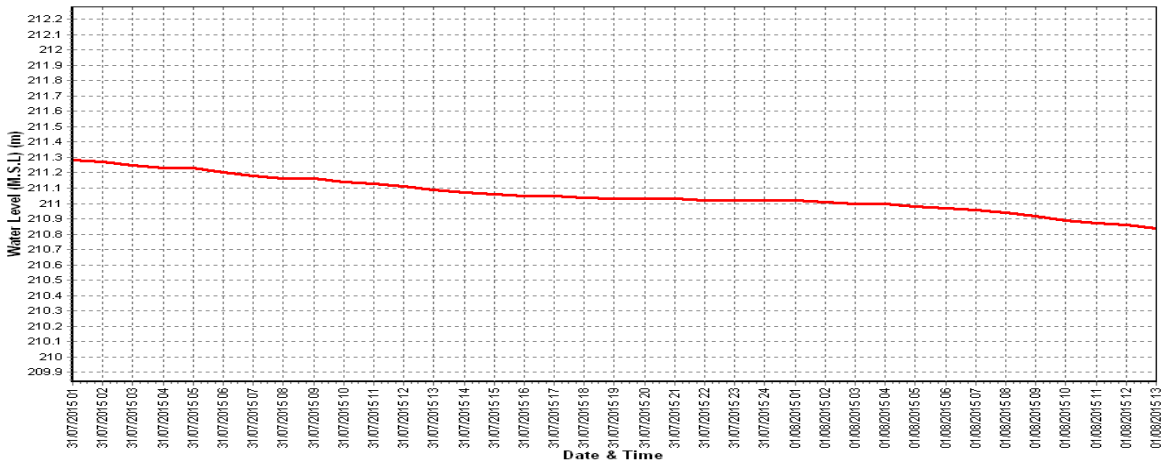
Water Level vs. Time - Graph of Highest Flood Peak during the Year : 2015-2017



Water Level vs. Time - Graph of 2nd Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 3rd Highest Flood Peak during the Year : 2015-2015



Time Span: 72 Hrs

HISTORY SHEET

			Water Year	**:**	**2015-16**
Site	**:**	**Wakal at Kotra(Jotasan)**	**Code**	**:**	**01 02 12 001**
State	:	Gujarat	District		Sabarkantha
Basin	:	Sabarmati	Independent River	:	Sabarmati
Tributary	:	Wakal	Sub Tributary	:	
Sub-Sub Tributary	:		Local River	:	Wakal
Division	:	Mahi Division, Gandhinagar	Sub-Division	:	N.W.R.Sub Div., Himatnagar
Drainage Area	:	1421 Sq. Km.	Bank	:	Left
Latitude	:	24°21'20"N	Longitude	:	73°10'05" E

Zero of Gauge (m)	:	0 (A)(Kotra)	01/06/79	- 31/05/87
		200 (m.s.l)(Kotra)	01/06/87	- 03/08/95
		199 (m.s.l)(Jotasan)	04/08/95	- 31/05/02
		285 (m.s.l)(Jotasan)	01/06/02	-
		Opening Date	Closing Date	
Gauge	:	03/07/1979(Kotra)		
		14/06/95(Jotasan)		
Discharge	:	14/06/1995(Jotasan)		
Sediment	:	--		
Water Quality	:	--		

Annual Maximum / Minimum discharge with corresponding Water Level (m.s.l)

	Maximum			Minimum		
Year	**Q (cumecs)**	**WL (m)**	**Date**	**Q (cumecs)**	**WL (m)**	**Date**
1995-1996	45.00	200.380	03/09/95	0.000	River Dry	26/01/96
1996-1997	49.60	200.820	11/09/96	0.000	199.040	26/01/97
1997-1998	49.20	200.850	02/08/97	0.000	River Dry	01/06/97
1998-1999	19.60	200.500	19/09/98	0.000	199.090	29/10/98
1999-2000	24.30	200.380	20/07/99	0.000	River Dry	02/01/00
2000-2001	14.65	200.830	14/07/00	0.000	River Dry	04/12/00
2001-2002	29.40	200.340	12/08/01	0.000	River Dry	20/01/02
2002-2003	49.00	287.590	02/09/02	0.000	River Dry	10/05/03
2003-2004	62.00	287.500	29/07/03	0.000	River Dry	03/04/04
2004-2005	82.50	287.360	08/08/04	0.000	River Dry	06/02/05
2005-2006	93.13	287.590	26/09/05	0.000	River Dry	01/06/05
2006-2007	1340	291.550	20/08/06	0.000	River Dry	01/06/06
2007-2008	267.1	288.325	09/07/07	0.000	River Dry	01/06/07
2008-2009	80.03	287.435	05/08/08	0.000	River Dry	01/06/08
2009-2010	113.7	287.835	23/07/09	0.000	River Dry	01/06/09
2010-2011	210.1	288.325	25/07/10	0.000	River Dry	01/06/10
2011-2012	291.7	288.700	12/09/11	0.000	River Dry	01/06/11
2012-2013	181.0	288.380	08/09/12	0.000	River Dry	01/06/12
2013-2014	80.41	287.65	29/09/13	0.000	River Dry	01/06/13
2014-2015	424.6	288.05	09/09/14	0.000	River Dry	01/06/14
2015-2016	1059	290.87	29/07/15	0.000	River Dry	01/06/15

Stage-Discharge Data for the period 2015 - 2016

Station Name : Wakal at Kotra(Jotasan) (01 02 12 001) **Division : Mahi Division, Gandhinagar**

Local River : Wakal **Sub-Division : N.W.R.Sub Div., Himatnagar**

Day	Jun		Jul		Aug		Sep		Oct		Nov	
	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q
1	R.dry	0.000	286.800	0.504	287.480	61.40	287.070	11.91	286.840	4.172	286.570	0.000 *
2	R.dry	0.000	286.780	3.440 *	287.360	45.14	287.060	11.81	286.820	3.642	286.570	0.000 *
3	R.dry	0.000	286.760	2.980 *	287.320	34.97	287.050	10.51	286.800	3.235	286.560	0.000 *
4	R.dry	0.000	286.740	2.560 *	287.300	37.94	287.030	9.897	286.780	3.440 *	286.560	0.000 *
5	R.dry	0.000	286.730	2.370 *	287.280	35.49	287.020	9.350	286.770	3.200 *	286.560	0.000 *
6	R.dry	0.000	286.720	2.180 *	287.240	31.55	287.010	11.27 *	286.750	3.238	286.560	0.000 *
7	R.dry	0.000	286.710	2.000 *	287.210	28.10	286.990	7.335	286.750	2.934	286.550	0.000 *
8	R.dry	0.000	286.700	1.830 *	287.200	27.08	286.980	6.897	286.740	2.853	286.550	0.000 *
9	R.dry	0.000	286.700	1.830 *	287.190	20.96 *	286.960	6.655	286.740	2.802	286.550	0.000 *
10	R.dry	0.000	286.700	1.830 *	287.170	21.79	286.940	6.461	286.730	2.516	286.550	0.000 *
11	R.dry	0.000	286.700	1.830 *	287.160	20.11	286.930	5.943	286.730	2.370 *	286.550	0.000 *
12	R.dry	0.000	286.690	1.670 *	287.300	37.83	286.910	5.625	286.730	2.494	286.540	0.000 *
13	R.dry	0.000	286.690	1.670 *	287.400	50.90	286.910	7.260 *	286.720	2.248	286.540	0.000 *
14	R.dry	0.000	286.690	1.670 *	287.210	28.19	286.900	5.339	286.710	2.161	286.540	0.000 *
15	R.dry	0.000	286.690	1.670 *	287.250	24.93 *	286.890	5.038	286.710	2.024	286.540	0.000 *
16	R.dry	0.000	286.690	1.670 *	287.280	27.05 *	286.890	5.053	286.710	2.166	286.540	0.000 *
17	R.dry	0.000	286.690	1.670 *	287.340	42.60	286.890	5.319	286.700	2.056	286.540	0.000 *
18	R.dry	0.000	286.690	1.670 *	287.280	36.20	286.900	6.352	286.690	1.670 *	286.540	0.000 *
19	R.dry	0.000	286.680	1.510 *	287.200	27.36	286.930	6.757	286.680	1.851	286.540	0.000 *
20	R.dry	0.000	286.680	1.510 *	287.190	26.34	286.920	7.610 *	286.680	1.797	286.540	0.000 *
21	R.dry	0.000	286.670	1.360 *	287.180	25.64	286.930	6.861	286.670	1.725	286.540	0.000 *
22	R.dry	0.000	286.670	1.360 *	287.160	21.85	287.000	8.419	286.660	1.230 *	286.540	0.000 *
23	286.760	2.980 *	287.240	24.96	287.150	18.52 *	287.030	10.57	286.650	1.463	286.530	0.000 *
24	286.730	2.370 *	287.050	10.93	287.140	20.03	287.060	11.31	286.650	1.100 *	286.530	0.000 *
25	287.013	16.54	286.960	4.511	287.140	19.81	286.990	7.584	286.640	0.970 *	286.530	0.000 *
26	287.380	36.35	287.120	15.85	287.130	17.96	286.950	6.494	286.630	1.265	286.530	0.000 *
27	287.220	24.04	287.490	53.08	287.120	17.68	286.930	7.980 *	286.610	1.148	286.530	0.000 *
28	287.080	14.65 #	287.860	87.42 #	287.110	16.33	286.910	6.753	286.600	1.061	286.530	0.000 *
29	286.830	3.475	290.870	1059	287.090	14.82	286.880	5.092	286.590	0.815	286.530	0.000 *
30	286.810	0.749	288.590	275.9	287.090	15.17 *	286.850	4.739	286.580	0.617	286.530	0.000 *
31			287.550	70.23	287.070	13.61			286.580	0.000 *		
Ten-Daily Mean												
I Ten-Daily	R.dry	0.000	286.734	2.152	287.275	34.44	287.011	9.210	286.772	3.203	286.558	0.000
II Ten-Daily	R.dry	0.000	286.689	1.654	287.261	32.15	286.907	6.030	286.706	2.084	286.541	0.000
III Ten-Daily	286.978	12.64	287.643	145.9	287.125	18.31	286.953	7.580	286.624	1.036	286.532	0.000
Monthly												
Min.	286.730	0.749	286.670	0.504	287.070	13.61	286.850	4.739	286.580	0.000	286.530	0.000
Max.	287.380	36.35	290.870	1059	287.480	61.40	287.070	11.91	286.840	4.172	286.570	0.000
Mean	286.978	12.64	287.042	52.99	287.217	27.98	286.957	7.606	286.698	2.073	286.544	0.000

Annual Runoff in MCM = 251 Annual Runoff in mm = 177

Peak Observed Discharge = 1059 cumecs on 29/07/2015 Corres. Water Level :290.87 m

Lowest Observed Discharge = 0.504 cumecs on 01/07/2015 Corres. Water Level :286.8 m

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff

Stage-Discharge Data for the period 2015 - 2016

Station Name : Wakal at Kotra(Jotasan) (01 02 12 001) **Division : Mahi Division, Gandhinagar**

Local River : Wakal **Sub-Division : N.W.R.Sub Div., Himatnagar**

Day	Dec		Jan		Feb		Mar		Apr		May	
	W.L	Q	WL	Q	WL	Q	WL	Q	WL	Q	WL	Q
1	286.530	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
2	286.530	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
3	286.520	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
4	286.520	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
5	286.510	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
6	286.510	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
7	286.510	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
8	286.510	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
9	286.500	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
10	286.500	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
11	286.500	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
12	286.490	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
13	286.490	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
14	286.480	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
15	286.480	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
16	286.480	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
17	286.480	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
18	286.480	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
19	286.480	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
20	286.480	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
21	286.480	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
22	286.480	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
23	286.480	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
24	286.480	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
25	286.480	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
26	286.480	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
27	286.480	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
28	286.480	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
29	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
30	286.480	0.000	R.dry	0.000			R.dry	0.000	R.dry	0.000	R.dry	0.000
31	286.480	0.000	R.dry	0.000			R.dry	0.000			R.dry	0.000
Ten-Daily Mean												
I Ten-Daily	286.514	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
II Ten-Daily	286.484	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
III Ten-Daily	286.480	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
Monthly												
Min.	286.480	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
Max.	286.530	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
Mean	286.492	0.000	286.480	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000

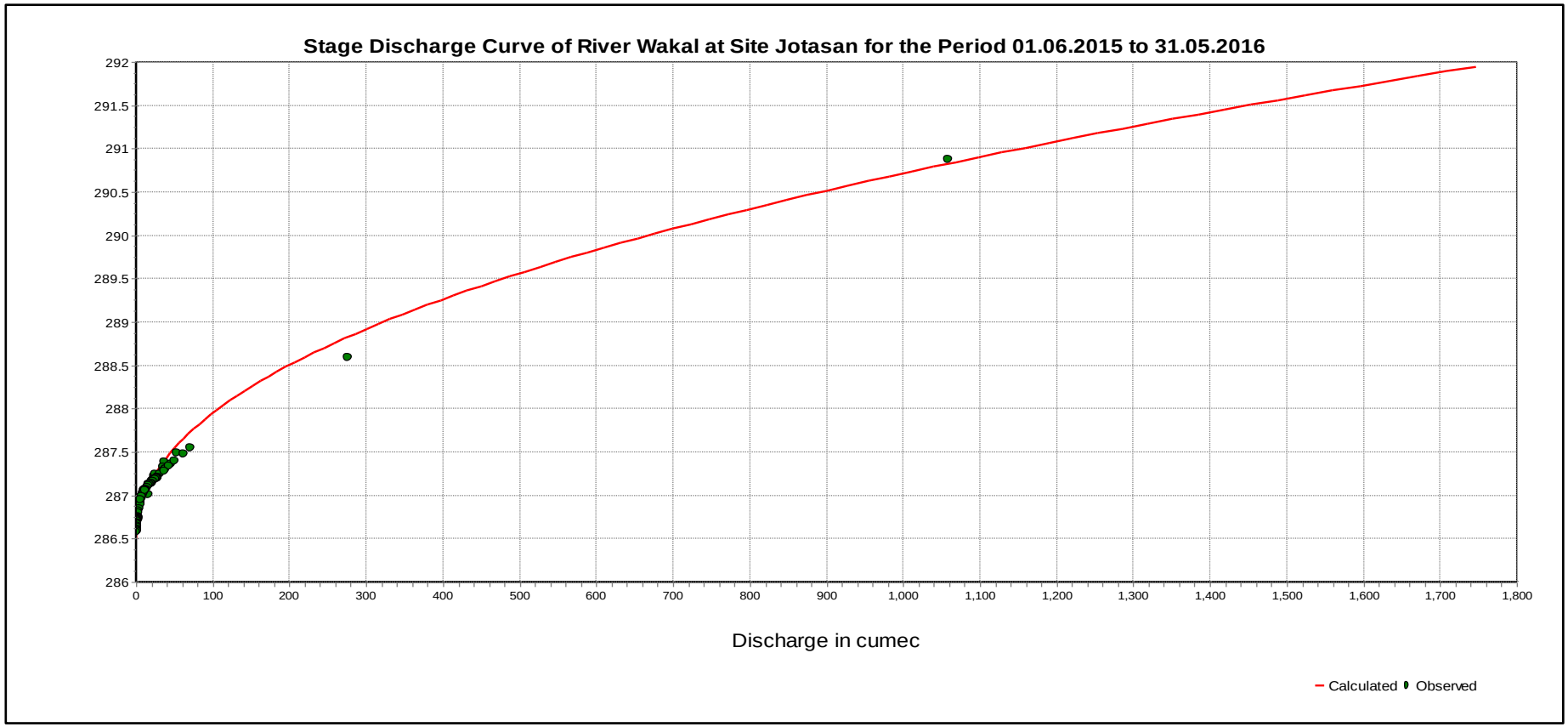
Peak Computed Discharge = 27.05 cumecs on 16/08/2015 **Corres. Water Level :287.28 m**

Lowest Computed Discharge = 0.000 cumecs on 31/10/2015 **Corres. Water Level :286.58 m**

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff



Procedure - Standard

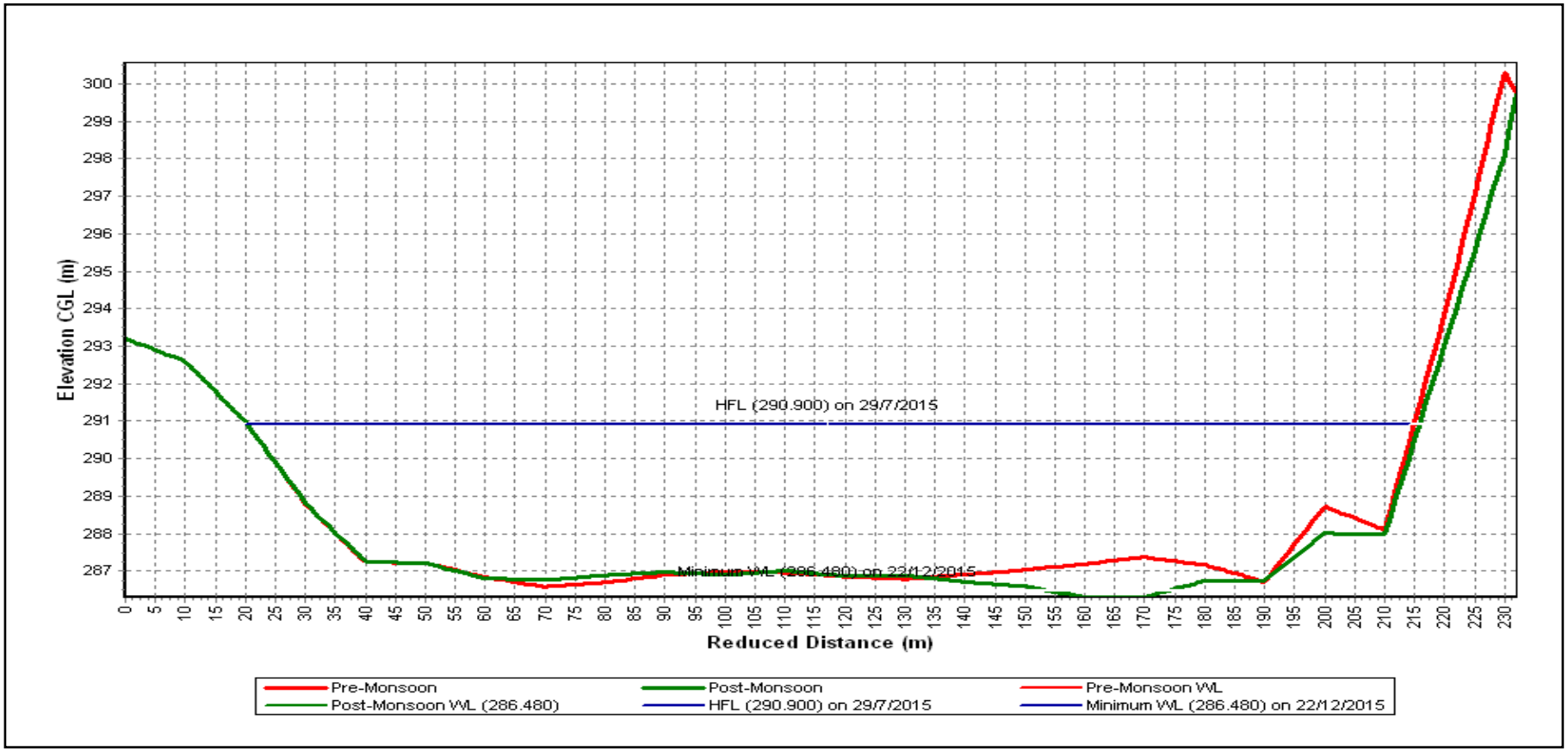
Equation Type - Power $Q=c*(h+a)^b$

LB	UB	a	b	c
286.5	292	-286.46	2.193	41.798

Pre-Monsoon & Post-Monsoon X-Section for Water Year : 2015-2016

Station Name : Wakal at Kotra(Jotasan) (01 02 12 001) **Division : Mahi Division, Gandhinagar**

Local River : Wakal **Sub-Division : N.W.R.Sub Div., Himatnagar**



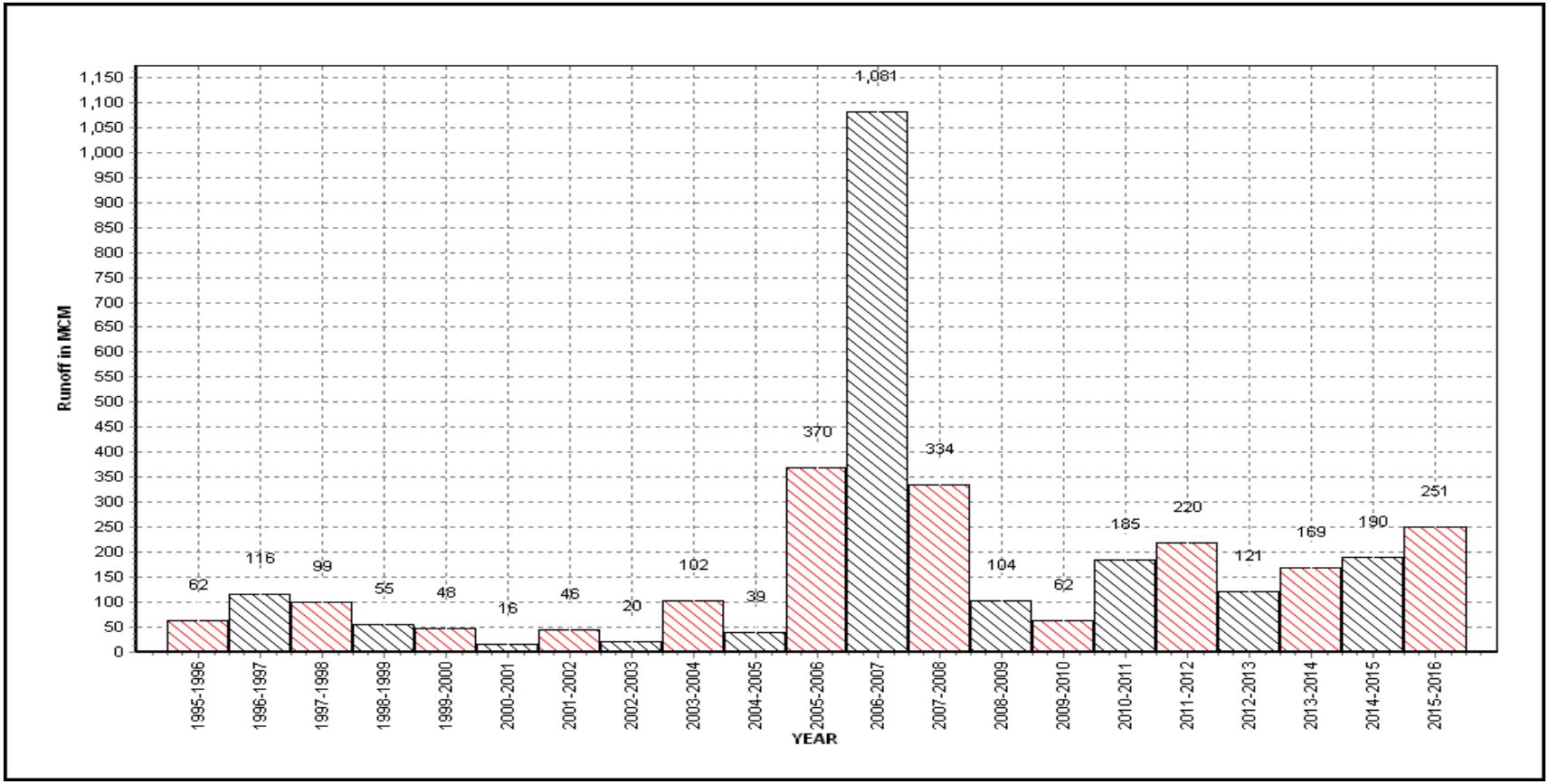
Historic Flood Level-291.600m on 20.08.2006 at 0700hrs

Note: HFL marked on graph denotes Maximum WaterLevel observed during the Water Year 2015-16

Annual Runoff Values for the period: 1995 - 2016

Station Name : Wakal at Kotra(Jotasan) (01 02 12 001) **Division : Mahi Division, Gandhinagar**

Local River : Wakal **Sub-Division : N.W.R.Sub Div., Himatnagar**

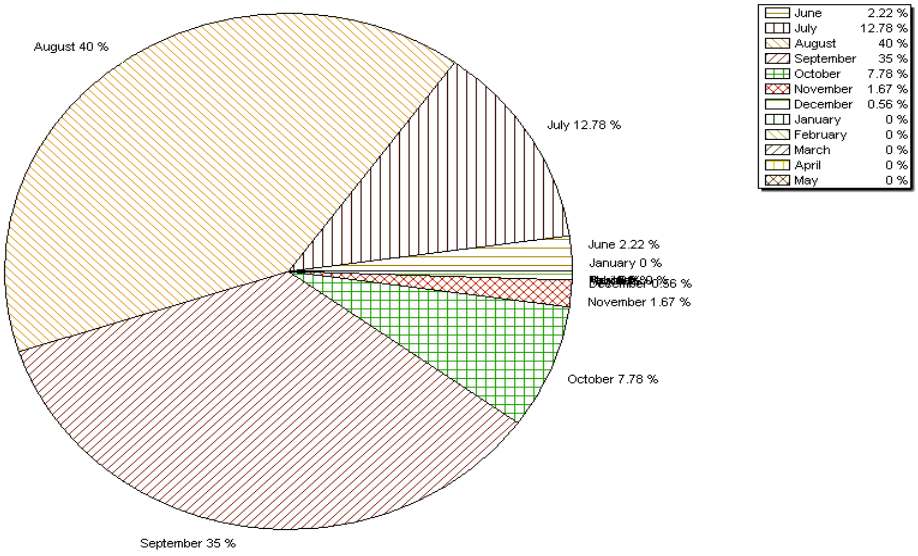


Note: Missing values have not been considered while arriving at Annual Runoff

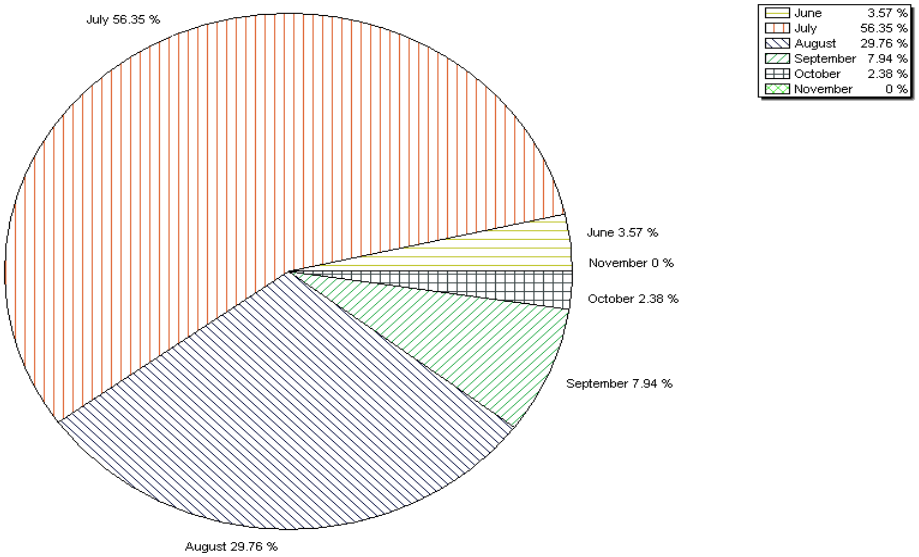
Station Name : Wakal at Kotra(Jotasan) (01 02 12 001) **Division : Mahi Division, Gandhinagar**

Local River : Wakal **Sub-Division : N.W.R.Sub Div., Himatnagar**

Monthly Average Runoff based on period : 1995-2015



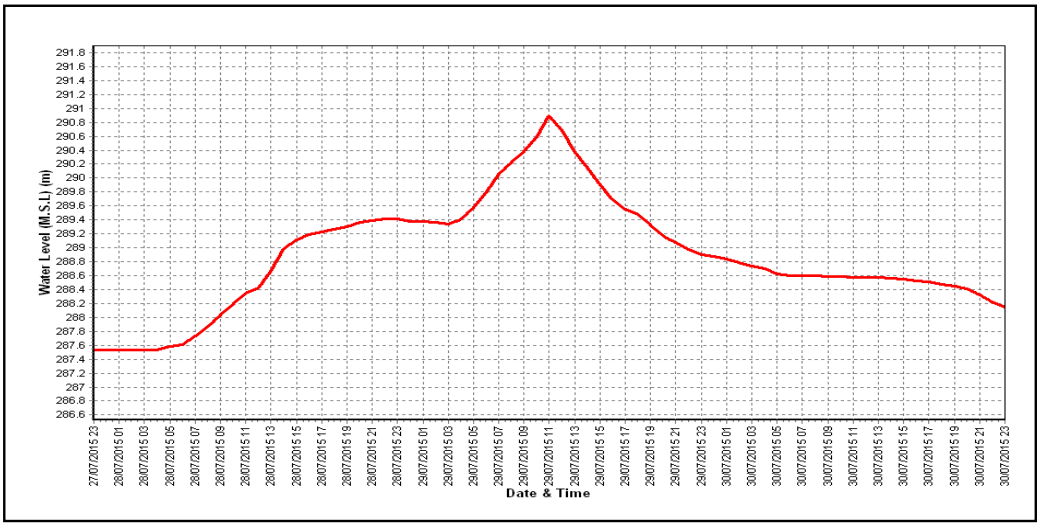
Monthly Runoff for the Year : 2015-2016



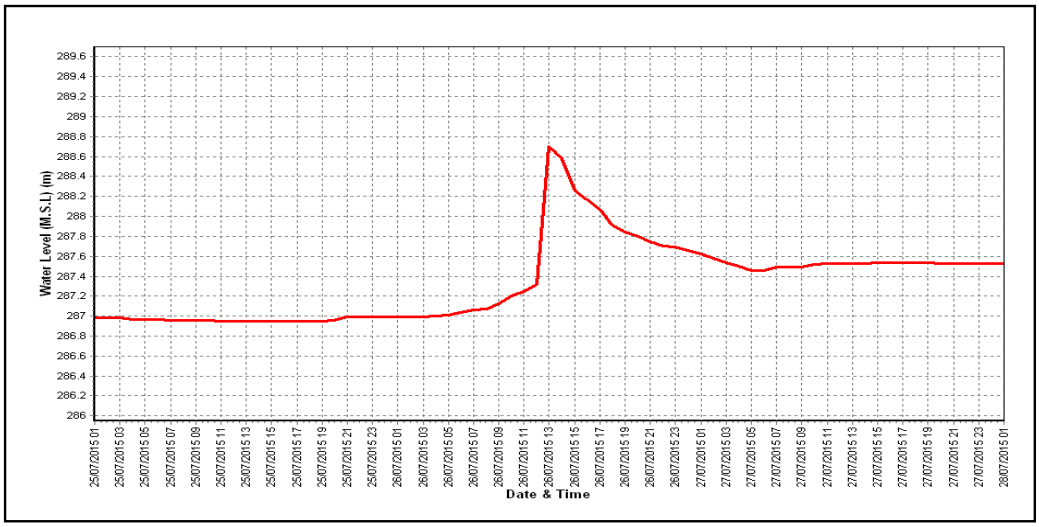
Station Name : Wakal at Kotra(Jotasan) (01 02 12 001) **Division : Mahi Division, Gandhinagar**

Local River : Wakal **Sub-Division : N.W.R.Sub Div., Himatnagar**

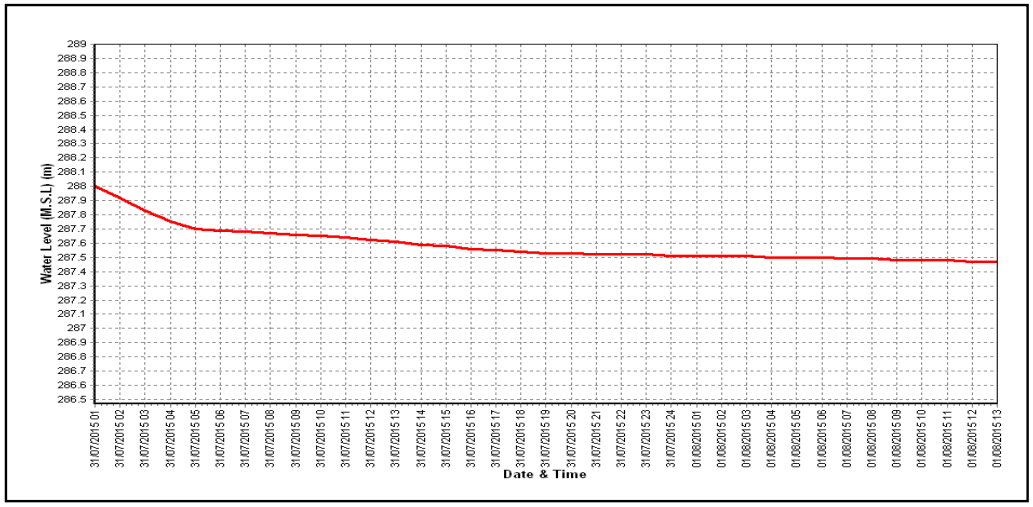
Water Level vs. Time - Graph of Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 2nd Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 3rd Highest Flood Peak during the Year : 2015-2016



Time Span: 72 Hrs

HISTORY SHEET

			Water Year	:	**2015-16**
Site	:	**Luni at Gandhav**	**Code**	:	**01 02 01 002**
State	:	Rajasthan	District		Badmer
			Independent		
Basin	:	WFR of Kach.-Saur. & Luni	River	:	Luni
Tributary	:	-	Sub Tributary	:	
Sub-Sub Tributary	:		Local River	:	Luni
Division	:	Mahi Division Gandhinagar	Sub Division	:	Banas-Luni Sub Div Palanpur
Drainage Area	:	32010 Sq. Km.	Bank	:	
Latitude	:	24°59'22"	Longitude	:	71°40'47"
Zero of Gauge (m)	:	31.000	24/06/74	-	
		Opening Date	Closing Date		
Gauge	:	24/06/74			
Discharge	:	24/06/74			
Sediment	:				
Water Quality	:				

Annual Maximum / Minimum discharge with mean WL during observation

	Maximum			Minimum		
Year	**Q (cumecs)**	**WL (m)**	**Date**	**Q (cumecs)**	**WL (m)**	**Date**
1974-1975	River Dry					
1975-1976	813.8	35.532	18/09/75	0.000	River Dry	16/02/76
1976-1977	1116	35.720	17/08/76	0.000	River Dry	02/03/77
1977-1978	562.1	35.540	04/08/77	0.000	River Dry	27/01/78
1978-1979	207.0	35.000	02/09/78	0.000	River Dry	25/01/79
1979-1980	4300	38.880	19/07/79	0.000	River Dry	26/01/80
1980-1981	95.00	34.840	04/08/80	0.000	River Dry	26/01/81
1981-1982	6.000	31.905	28/07/81	0.000	River Dry	25/01/82
1982-1983	138.0	33.150	22/08/82	0.000	River Dry	25/01/83
1983-1984	1655	34.855	29/07/83	0.000	River Dry	27/02/84
1986-1987	1.100	32.455	28/07/86	0.000	River Dry	25/01/87
1987-1988						River Dry
1988-1989						River Dry
1989-1990						River Dry
1990-1991	4191	37.475	07/07/90	0.000	River Dry	18/05/91
1991-1992	3.102	31.650	03/08/91	0.000	31.345	22/01/92
1992-1993	1761	35.200	09/09/92	0.000	River Dry	02/04/93
1993-1994	310.2	33.450	19/07/93	0.000	River Dry	09/05/94
1994-1995	407.1	33.140	23/08/94	0.000	River Dry	07/04/95
1995-1996	1505	34.200	28/07/95	0.000	River Dry	30/01/96
1996-1997	51.80	32.740	23/08/96	0.000	River Dry	25/01/97
1997-1998	531.2	32.645	29/08/97	0.000	River Dry	12/01/98
1998-1999	43.75	32.550	11/06/98	0.000	River Dry	25/01/99
1999-2000	130.6	34.300	04/08/99	0.000	River Dry	26/01/00
2000-2001	7.580	32.140	15/07/00	0.000	River Dry	25/01/01
2001-2002	545.5	34.410	13/07/01	0.000	River Dry	01/05/02
2002-2003						River Dry
2003-2004	9.697	32.690	26/07/03	0.000	River Dry	26/01/04
2004-2005	2.338	32.320	17/07/04	0.000	River Dry	25/05/05
2005-2006						River Dry
2006-2007						River Dry
2007-2008	1236*	35.400	09/07/07	0.000	River Dry	01/06/07
2008-2009						River Dry
2009-2010	0	32.0	10/09/2009	0.000	River Dry	01/06/09
2010-2011	0	32.56	22/10/2010	0.000	River Dry	01/06/10
2011-2012						River Dry
2012-2013	0	33.99	15/08/12	0.000	River Dry	01/06/12
2013-2014	0	32.7	01/06/13	0.000	River Dry	14/06/13
2014-2015	0	32.68	05/09/14	0.000	River Dry	01/06/14
2015-2016	416*	34.255	28/07/15	0	32.5	10/08/15

Stage-Discharge Data for the period 2015 - 2016

Station Name : Luni at Gandhav (01 02 01 002) **Division : Mahi Division, Gandhinagar**

Local River : Luni **Sub-Division : B.L.Sub Divn, Palanpur**

Day	Jun		Jul		Aug		Sep		Oct		Nov	
	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q
1	R Dry	0.000	R Dry	0.000	33.900	273.0 *	32.250	0.000	R Dry	0.000	R Dry	0.000
2	R Dry	0.000	R Dry	0.000	33.900	273.0 *	32.250	0.000	R Dry	0.000	R Dry	0.000
3	R Dry	0.000	R Dry	0.000	33.700	203.0 *	32.200	0.000	R Dry	0.000	R Dry	0.000
4	32.200	0.000	R Dry	0.000	33.500	141.0 *	32.200	0.000	R Dry	0.000	R Dry	0.000
5	32.400	0.000	R Dry	0.000	33.500	141.0 *	32.200	0.000	R Dry	0.000	R Dry	0.000
6	32.300	0.000	R Dry	0.000	33.500	141.0 *	32.200	0.000	R Dry	0.000	R Dry	0.000
7	32.300	0.000	R Dry	0.000	33.500	141.0 *	32.100	0.000	R Dry	0.000	R Dry	0.000
8	32.150	0.000	R Dry	0.000	33.100	46.00 *	32.100	0.000	R Dry	0.000	R Dry	0.000
9	32.100	0.000	R Dry	0.000	32.800	5.370 *	32.100	0.000	R Dry	0.000	R Dry	0.000
10	32.100	0.000	R Dry	0.000	32.500	0.000	32.100	0.000	R Dry	0.000	R Dry	0.000
11	32.100	0.000	R Dry	0.000	32.500	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
12	32.200	0.000	R Dry	0.000	32.500	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
13	32.200	0.000	R Dry	0.000	32.400	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
14	32.200	0.000	R Dry	0.000	32.400	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
15	32.200	0.000	R Dry	0.000	32.400	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
16	32.200	0.000	R Dry	0.000	32.400	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
17	R Dry	0.000	R Dry	0.000	32.400	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
18	R Dry	0.000	R Dry	0.000	32.400	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
19	R Dry	0.000	R Dry	0.000	32.400	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
20	R Dry	0.000	R Dry	0.000	32.300	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
21	R Dry	0.000	R Dry	0.000	32.300	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
22	R Dry	0.000	R Dry	0.000	32.300	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
23	R Dry	0.000	R Dry	0.000	32.300	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
24	R Dry	0.000	R Dry	0.000	32.300	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
25	R Dry	0.000	R Dry	0.000	32.300	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
26	R Dry	0.000	R Dry	0.000	32.250	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
27	R Dry	0.000	R Dry	0.000	32.250	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
28	R Dry	0.000	34.255	416.0 *	32.250	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
29	R Dry	0.000	34.255	416.0 *	32.250	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
30	R Dry	0.000	34.255	416.0 *	32.250	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
31			33.900	273.0 *	32.250	0.000			R Dry	0.000		
Ten-Daily Mean												
I Ten-Daily	32.221	0.000	R dry	0.000	33.390	136.4	32.170	0.000	R dry	0.000	R dry	0.000
II Ten-Daily	32.183	0.000	R dry	0.000	32.410	0.000	R dry	0.000	R dry	0.000	R dry	0.000
III Ten-Daily	R dry	0.000	34.166	138.3	32.273	0.000	R dry	0.000	R dry	0.000	R dry	0.000
Monthly												
Min.	32.100	0.000	33.900	0.000	32.250	0.000	32.100	0.000	R dry	0.000	R dry	0.000
Max.	32.400	0.000	34.255	416.0	33.900	273.0	32.250	0.000	R dry	0.000	R dry	0.000
Mean	32.204	0	34.166	49.06	32.677	44.01	32.170	0	R dry	0	R dry	0

Annual Runoff in MCM = 249 Annual Runoff in mm = 8

Peak Observed Discharge = 0.000 cumecs on 03/06/2015

Lowest Observed Discharge = 0.000 cumecs on 03/06/2015

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

Note:Missing values ignored while arriving at Annual Runoff

Stage-Discharge Data for the period 2015 - 2016

Station Name : Luni at Gandhav (01 02 01 002) **Division : Mahi Division, Gandhinagar**

Local River : Luni **Sub-Division : B.L.Sub Divn, Palanpur**

Day	Dec		Jan		Feb		Mar		Apr		May	
	W.L	Q	WL	Q	WL	Q	WL	Q	WL	Q	WL	Q
1	32.300	0.000	32.250	0.000	32.250	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
2	32.250	0.000	32.250	0.000	32.250	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
3	32.200	0.000	32.250	0.000	32.250	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
4	32.200	0.000	32.250	0.000	32.250	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
5	32.200	0.000	32.250	0.000	32.250	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
6	32.200	0.000	32.250	0.000	32.200	0.000	R Dry	0.000 *	R Dry	0.000	R Dry	0.000
7	32.200	0.000	32.200	0.000	32.200	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
8	32.300	0.000	32.250	0.000	32.200	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
9	32.400	0.000	32.250	0.000	32.200	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
10	32.400	0.000	32.300	0.000	32.200	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
11	32.350	0.000	32.300	0.000	32.200	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
12	32.350	0.000	32.300	0.000	32.200	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
13	32.300	0.000	32.300	0.000	32.200	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
14	32.300	0.000	32.300	0.000	32.200	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
15	32.300	0.000	32.300	0.000	32.200	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
16	32.300	0.000	32.300	0.000	32.200	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
17	32.300	0.000	32.250	0.000	32.200	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
18	32.300	0.000	32.250	0.000	32.150	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
19	32.300	0.000	32.250	0.000	32.150	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
20	32.250	0.000	32.250	0.000	32.100	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
21	32.250	0.000	32.250	0.000	32.100	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
22	32.250	0.000	32.250	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
23	32.250	0.000	32.250	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
24	32.400	0.000	32.200	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
25	32.300	0.000	32.200	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
26	32.300	0.000	32.200	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
27	32.300	0.000	32.200	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
28	32.300	0.000	32.200	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
29	32.300	0.000	32.200	0.000	R Dry	0.000 *	R Dry	0.000	R Dry	0.000	R Dry	0.000
30	32.250	0.000	32.200	0.000			R Dry	0.000	R Dry	0.000	R Dry	0.000
31	32.250	0.000	32.200	0.000			R Dry	0.000			R Dry	0.000
Ten-Daily Mean												
I Ten-Daily	32.265	0.000	32.250	0.000	32.225	0.000	R dry	0.000	R dry	0.000	R dry	0.000
II Ten-Daily	32.305	0.000	32.280	0.000	32.180	0.000	R dry	0.000	R dry	0.000	R dry	0.000
III Ten-Daily	32.286	0.000	32.214	0.000	32.100	0.000	R dry	0.000	R dry	0.000	R dry	0.000
Monthly												
Min.	32.200	0.000	32.200	0.000	32.100	0.000	R dry	0.000	R dry	0.000	R dry	0.000
Max.	32.400	0.000	32.300	0.000	32.250	0.000	R dry	0.000	R dry	0.000	R dry	0.000
Mean	32.285	0	32.247	0	32.198	0	R dry	0	R dry	0	R dry	0

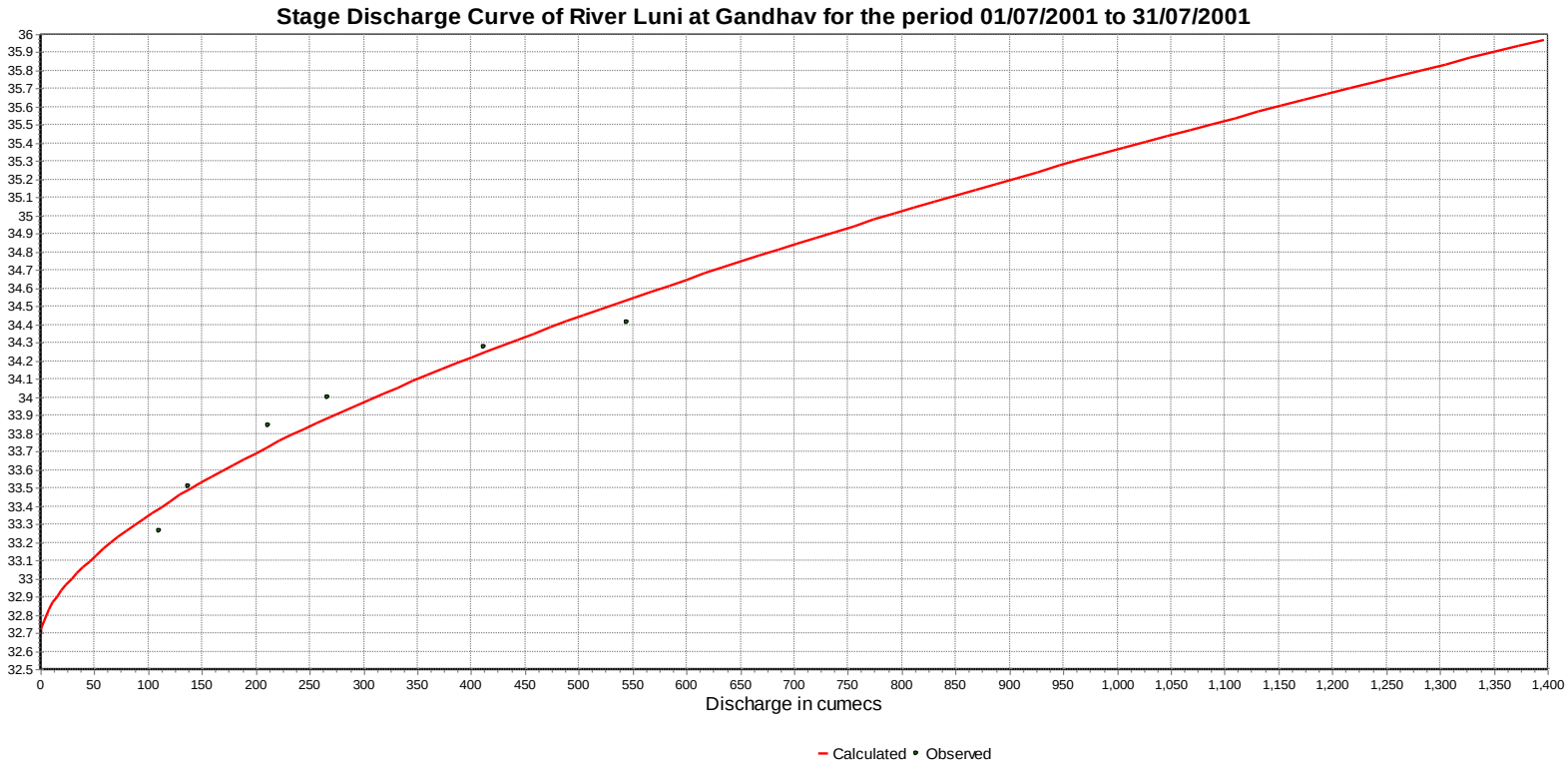
Peak Computed Discharge = 416.0 cumecs on 28/07/2015 Corres. Water Level :34.255 m

Lowest Computed Discharge = 0.000 cumecs on 29/02/2016

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

Note:Missing values ignored while arriving at Annual Runoff

Estimatio of Discharge at site has been done using the curve for july 2001



Procedure - Standard

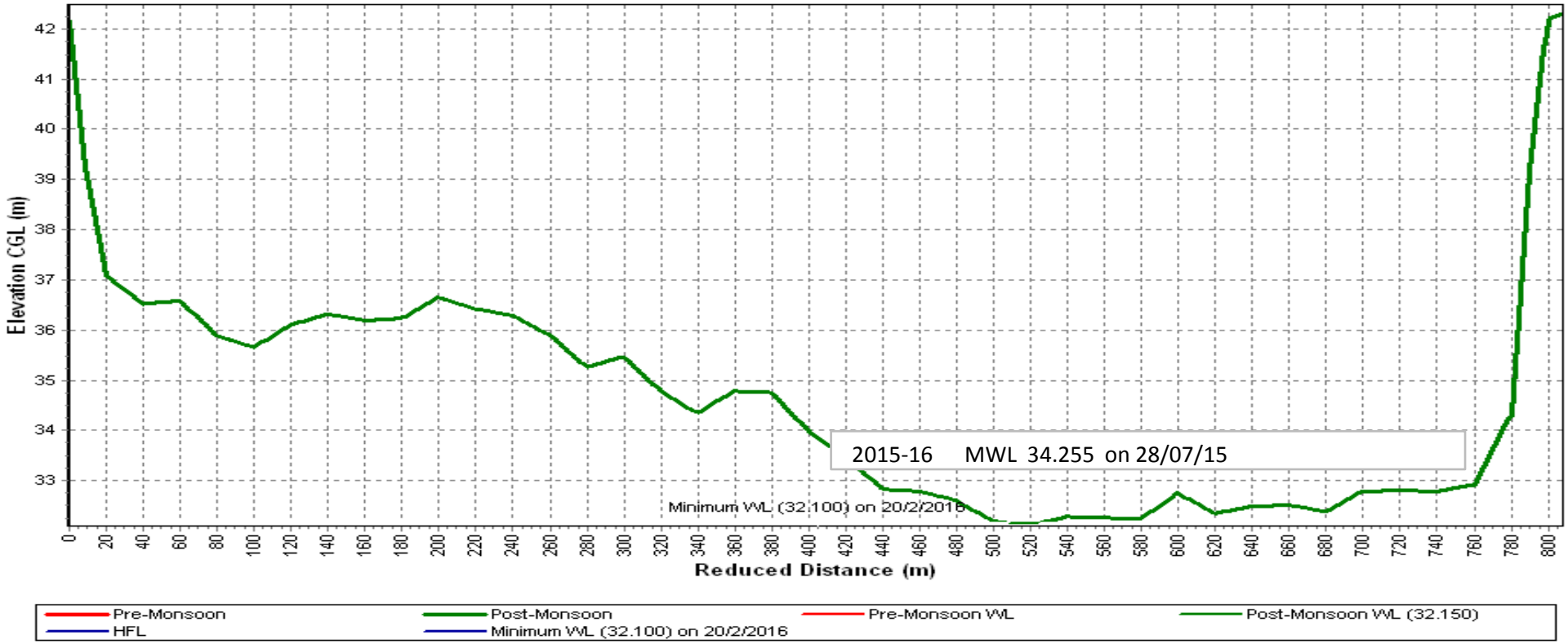
Equation Type - Power Q=c*(h+a)b

LB	UB	a	b	c
32.7	36	-32.69	1.638	199.83

Pre-Monsoon & Post-Monsoon X-Section for Water Year : 2015-2016

Station Name : Luni at Gandhav (01 02 01 002) **Division : Mahi Division, Gandhinagar**

Local River : Luni **Sub-Division : B.L.Sub Divn, Palanpur**



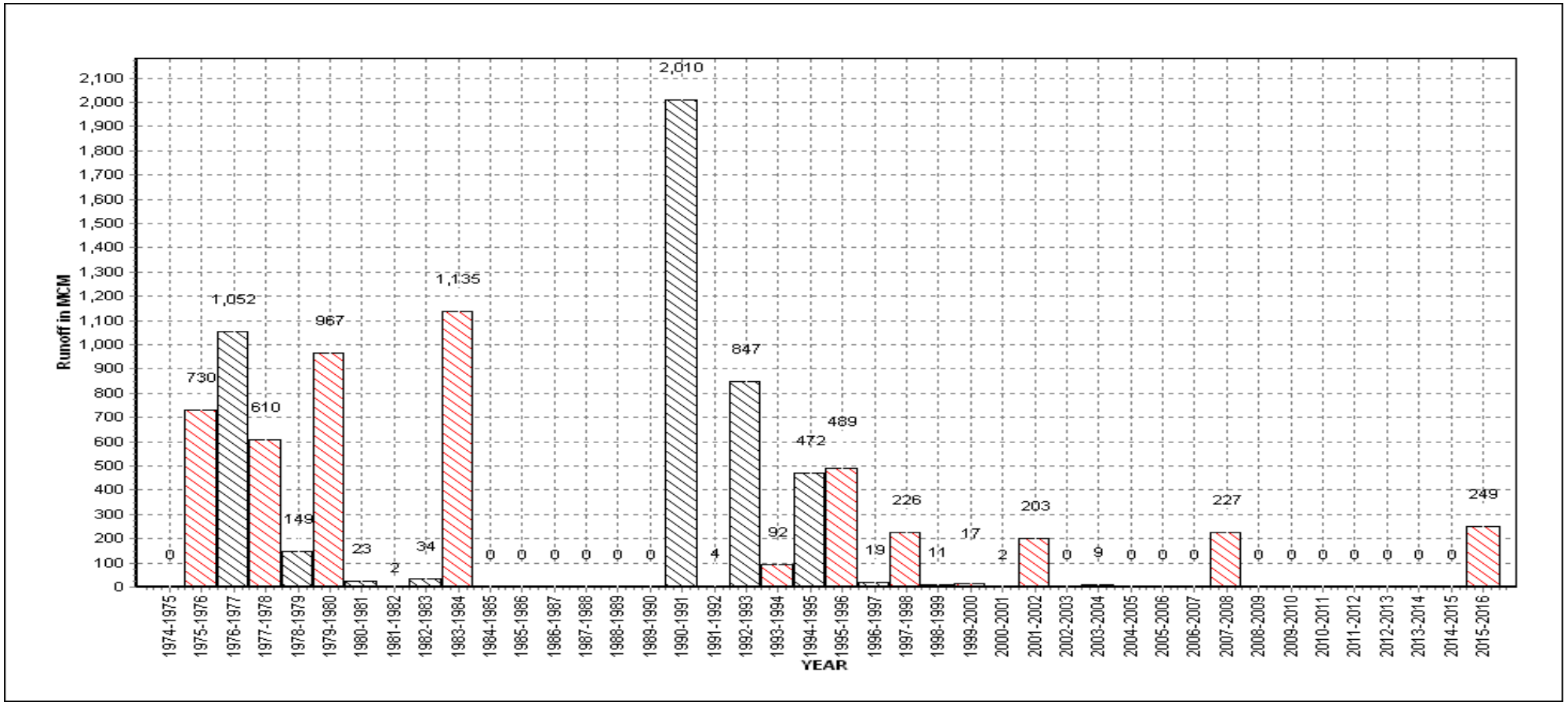
MWL current year 2015-16 was 34.255 on 28/07/15

Historic Flood Level - 37.625 m on 07.07.1990 at 2100 hrs

Annual Runoff Values for the period: 1974 - 2016

Station Name : Luni at Gandhav (01 02 01 002) **Division : Mahi Division, Gandhinagar**

Local River : Luni **Sub-Division : B.L.Sub Divn, Palanpur**



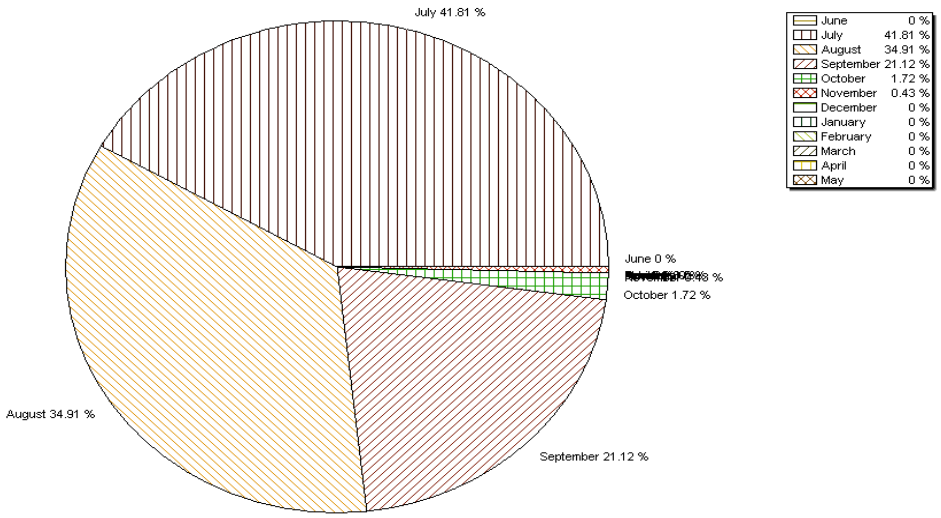
Note: Missing values have not been considered while arriving at Annual Runoff

Monthly Average Runoff based on period : 1974-2015

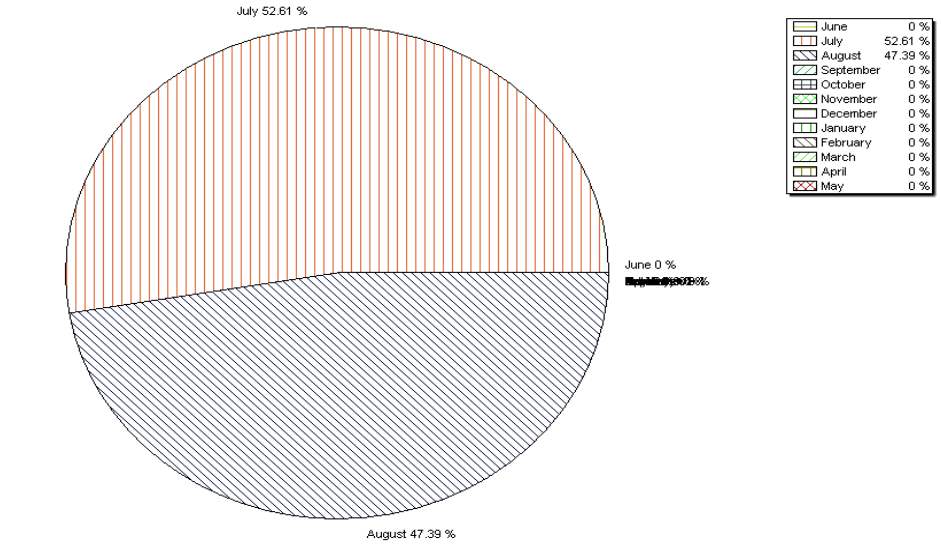
Station Name : Luni at Gandhav (01 02 01 002) **Division : Mahi Division, Gandhinagar**

Local River : Luni **Sub-Division : B.L.Sub Divn, Palanpur**

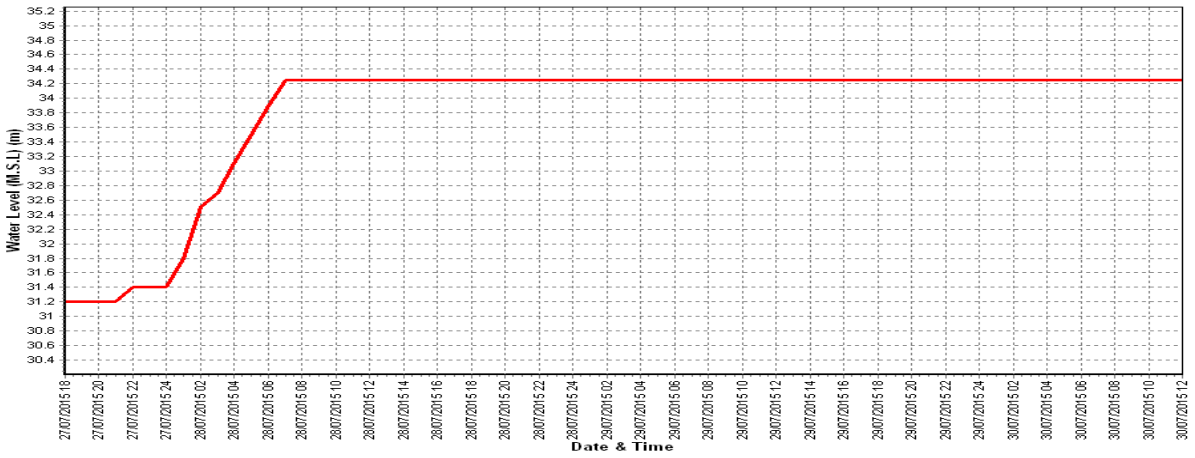
Monthly Average Runoff based on period : 1974-2015



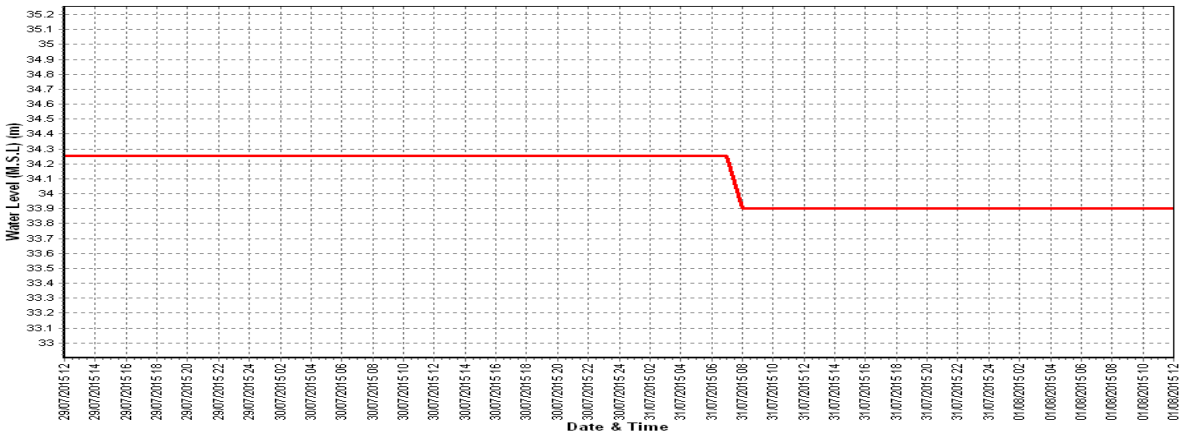
Monthly Runoff for the Year : 2015-2016



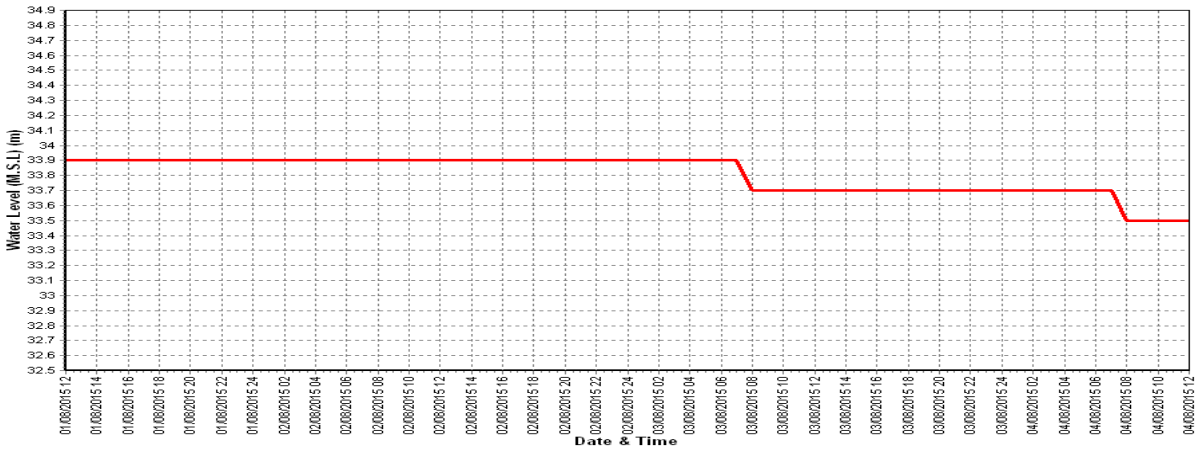
Water Level vs. Time - Graph of Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 2nd Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 3rd Highest Flood Peak during the Year : 2015-2016



HISTORY SHEET

			Water Year	:	**2015-16**
Site	:	**Luni at Balotra**	**Code**	:	**01 02 01 001**
State	:	Rajasthan	District		Badmer
			Independent		
Basin	:	WFR of Kach.-Saur. & Luni	River	:	Luni
Tributary	:		Sub Tributary	:	
Sub-Sub Tributary	:		Local River	:	Luni
Division	:	Mahi Division, Gandhinagar	Sub-Division	:	B.L.Sub Divn, Palanpur
Drainage Area	:	19000 Sq. Km.	Bank	:	Left
Latitude	:	25°49'19" N	Longitude	:	72°13'23" E
Zero of Gauge (m)	:	102 (m.s.l)	05/07/90		-
		Opening Date	Closing Date		
Gauge	:	05/07/90			
Discharge	:	05/07/90			
Sediment	:	--			
Water Quality	:	--			

Annual Maximum / Minimum discharge with corresponding Water Level (m.s.l)

	Maximum			Minimum		
Year	**Q (cumecs)**	**WL (m)**	**Date**	**Q (cumecs)**	**WL (m)**	**Date**
1990-1991	1875	107.150	06/07/90	0.000	Dry	25/01/91
1991-1992	River Dry					
1992-1993	2907	106.040	09/09/92	0.000	Dry	25/01/93
1993-1994	30.36	102.890	20/07/93	0.000	Dry	25/01/94
1994-1995	364.3	103.797	16/08/94	0.000	Dry	25/01/95
1995-1996	2691	105.450	28/07/95	0.000	Dry	26/01/96
1996-1997	130.0	103.200	21/08/96	0.000	Dry	25/01/97
1997-1998	785.0	104.420	28/08/97	0.000	Dry	25/01/98
1998-1999	River Dry					
1999-2000	468.1	103.915	02/08/99	0.000	Dry	27/01/00
2000-2001	River Dry					
2001-2002	River Dry					
2002-2003	River Dry					
2003-2004	River Dry					
2004-2005	River Dry					
2005-2006	River Dry					
2006-2007	617.8	104.075	02/08/06	0.000	Dry	01/06/06
2007-2008	918.5	104.180	08/07/07	0.000	Dry	01/06/08
2008-2009	River Dry					
2009-2010	River Dry					
2010-2011	River Dry					
2011-2012	River Dry					
2012-2013	River Dry					
2013-2014	River Dry					
2014-2015	River Dry					
2015-2016	155.7	103.637	01/08/15	0.000	102.13	07/08/15

Stage-Discharge Data for the period 2015 - 2016

Station Name : Luni at Balotra (01 02 01 001) **Division : Mahi Division, Gandhinagar**

Local River : Luni **Sub-Division : B.L.Sub Divn, Palanpur**

Day	Jun		Jul		Aug		Sep		Oct		Nov	
	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q
1	R.dry	0.000	R.dry	0.000	103.638	155.7	R.dry	0.000	R.dry	0.000	R.dry	0.000
2	R.dry	0.000	R.dry	0.000	103.360	137.6	R.dry	0.000	R.dry	0.000	R.dry	0.000
3	R.dry	0.000	R.dry	0.000	103.085	110.6	R.dry	0.000	R.dry	0.000	R.dry	0.000
4	R.dry	0.000	R.dry	0.000	102.980	95.14	R.dry	0.000	R.dry	0.000	R.dry	0.000
5	R.dry	0.000	R.dry	0.000	102.670	80.62	R.dry	0.000	R.dry	0.000	R.dry	0.000
6	R.dry	0.000	R.dry	0.000	102.385	11.40	R.dry	0.000	R.dry	0.000	R.dry	0.000
7	R.dry	0.000	R.dry	0.000	102.130	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
8	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
9	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
10	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
11	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
12	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
13	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
14	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
15	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
16	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
17	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
18	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
19	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
20	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
21	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
22	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
23	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
24	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
25	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
26	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
27	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
28	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
29	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
30	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
31			R.dry	0.000	R.dry	0.000			R.dry	0.000		
Ten-Daily Mean												
I Ten-Daily	R.dry	0.000	R.dry	0.000	103.020	59.11	R.dry	0.000	R.dry	0.000	R.dry	0.000
II Ten-Daily	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
III Ten-Daily	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
Monthly												
Min.	R.dry	0.000	R.dry	0.000	102.385	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
Max.	R.dry	0.000	R.dry	0.000	103.637	155.7	R.dry	0.000	R.dry	0.000	R.dry	0.000
Mean	R.dry	0.000	R.dry	0.000	103.020	19.07	R.dry	0.000	R.dry	0.000	R.dry	0.000

Annual Runoff in MCM = 51 Annual Runoff in mm = 3

Peak Observed Discharge = 155.7 cumecs on 01/08/2015 Corres. Water Level :103.6375 m

Lowest Observed Discharge = 0.000 cumecs on 01/06/2015

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

Note:Missing values ignored while arriving at Annual Runoff

Stage-Discharge Data for the period 2015 - 2016

Station Name : Luni at Balotra (01 02 01 001) **Division : Mahi Division, Gandhinagar**

Local River : Luni **Sub-Division : B.L.Sub Divn, Palanpur**

Day	Dec		Jan		Feb		Mar		Apr		May	
	W.L	Q	WL	Q	WL	Q	WL	Q	WL	Q	WL	Q
1	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
2	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
3	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
4	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
5	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
6	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
7	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
8	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
9	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
10	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
11	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
12	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
13	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
14	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
15	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
16	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
17	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
18	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
19	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
20	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
21	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
22	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
23	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
24	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
25	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
26	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
27	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
28	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
29	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
30	R.dry	0.000	R.dry	0.000			R.dry	0.000	R.dry	0.000	R.dry	0.000
31	R.dry	0.000	R.dry	0.000			R.dry	0.000			R.dry	0.000
Ten-Daily Mean												
I Ten-Daily	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
II Ten-Daily	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
III Ten-Daily	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
Monthly												
Min.	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
Max.	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
Mean	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000

Annual Runoff in MC

Peak Observed Discl

Lowest Observed Di

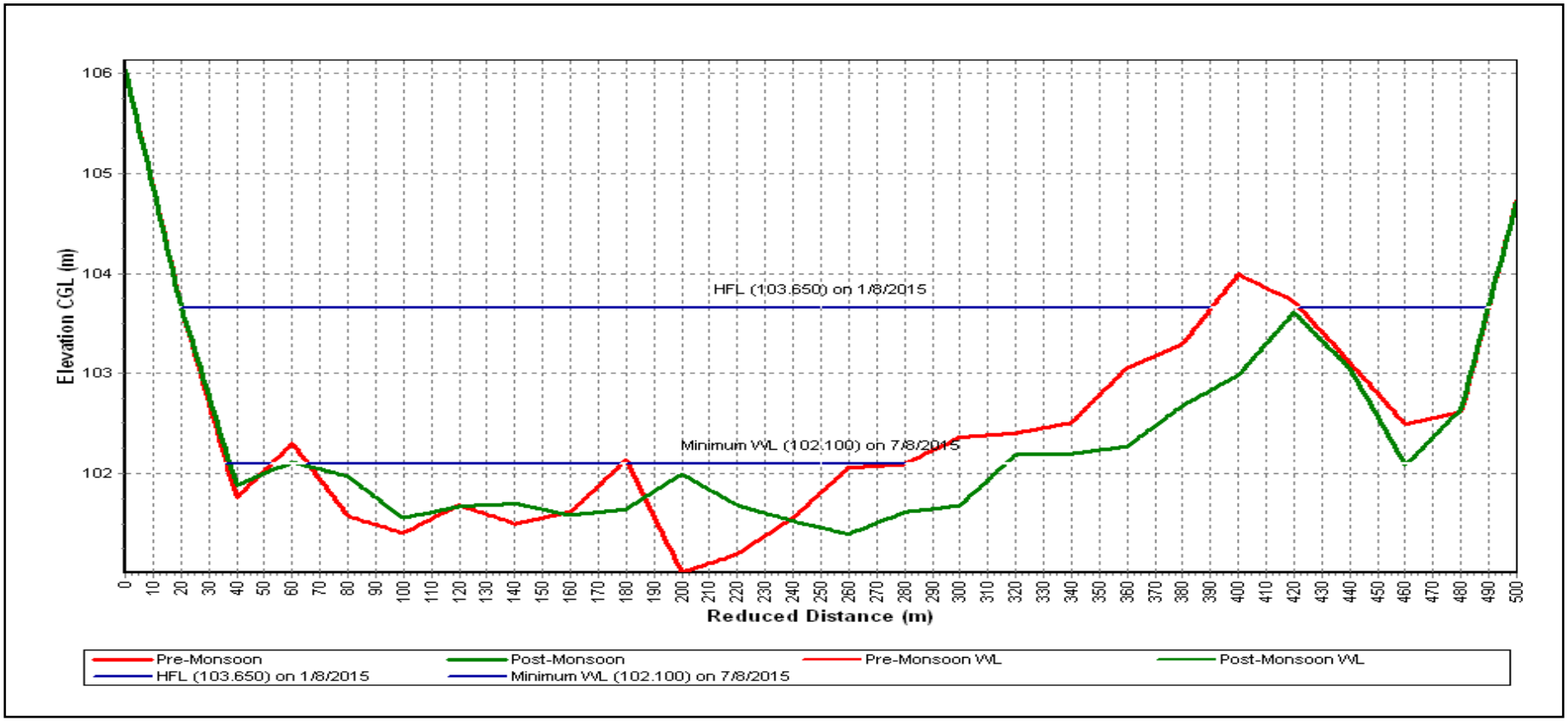
Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

Note:Missing values ignored while arriving at Annual Runoff

Pre-Monsoon & Post-Monsoon X-Section for Water Year : 2015-2016

Station Name : Luni at Balotra (01 02 01 001) **Division : Mahi Division, Gandhinagar**

Local River : Luni **Sub-Division : B.L.Sub Divn, Palanpur**



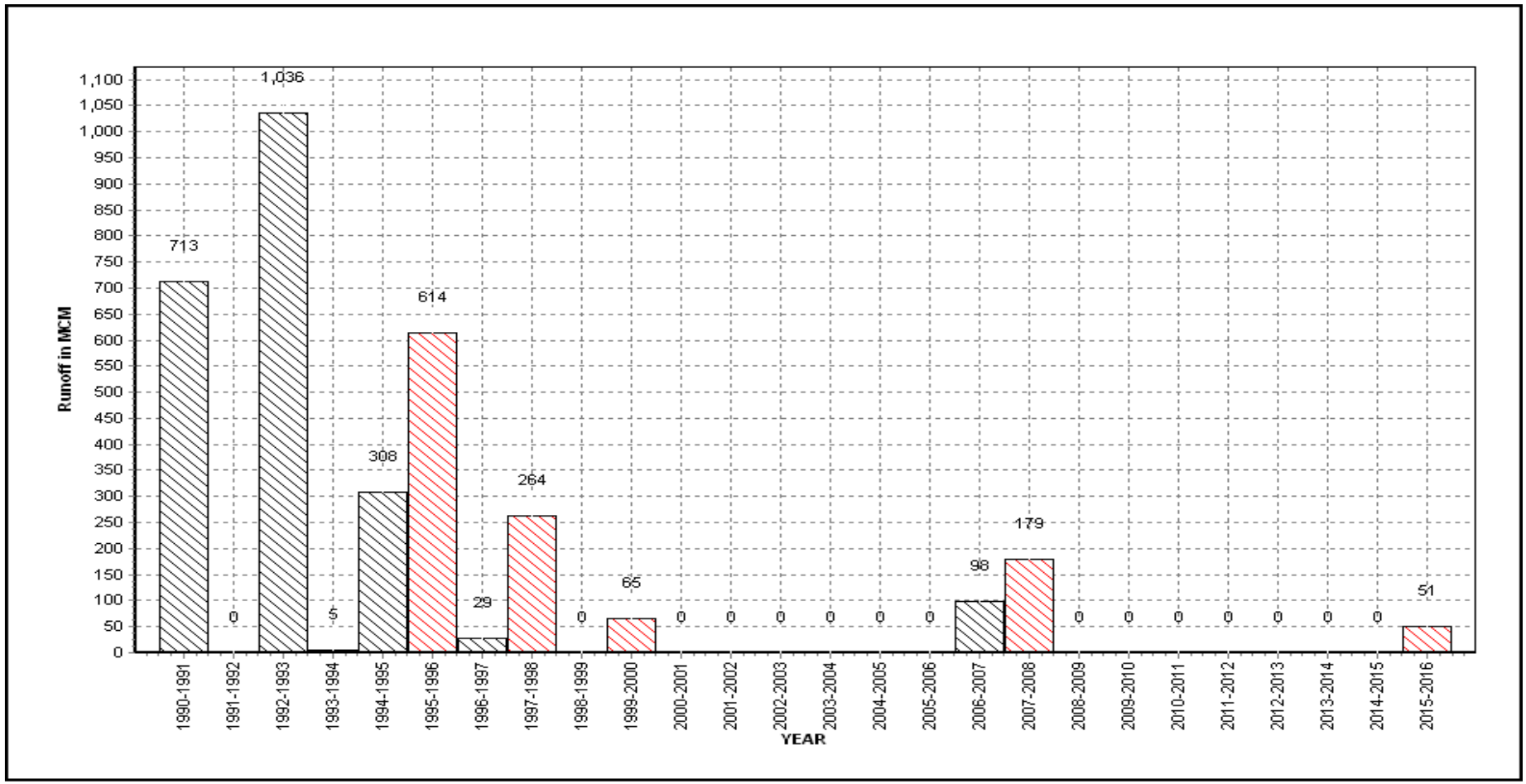
Historic Flood Level - 108.755 m on 18.07.1979

Note: HFL marked on graph denotes Maximum Water Level observed during the Water Year 2015-16

Annual Runoff Values for the period: 1990 - 2016

Station Name : Luni at Balotra (01 02 01 001) **Division : Mahi Division, Gandhinagar**

Local River : Luni **Sub-Division : B.L.Sub Divn, Palanpur**



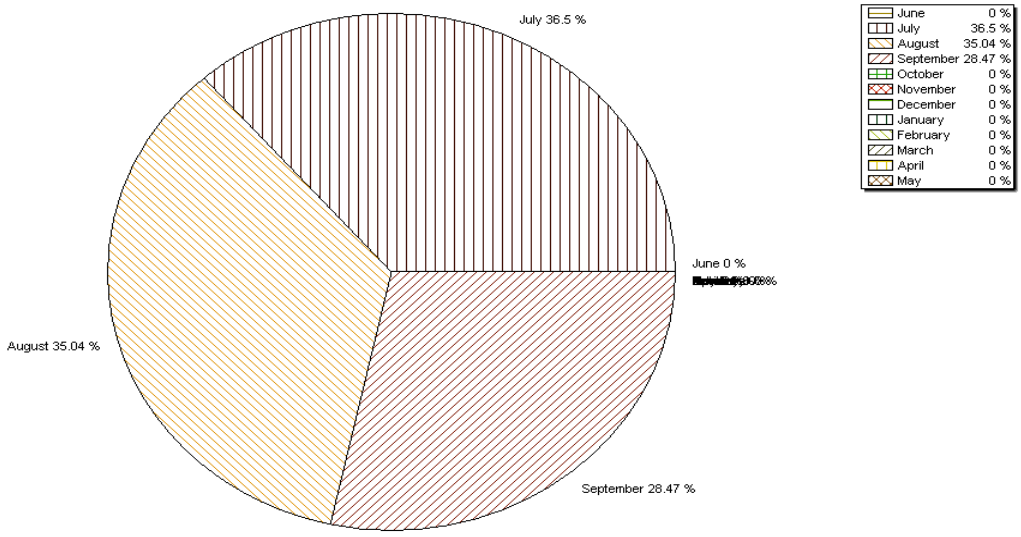
Note: Missing values have not been considered while arriving at Annual Runoff

Monthly Average Runoff based on period : 1990-2015

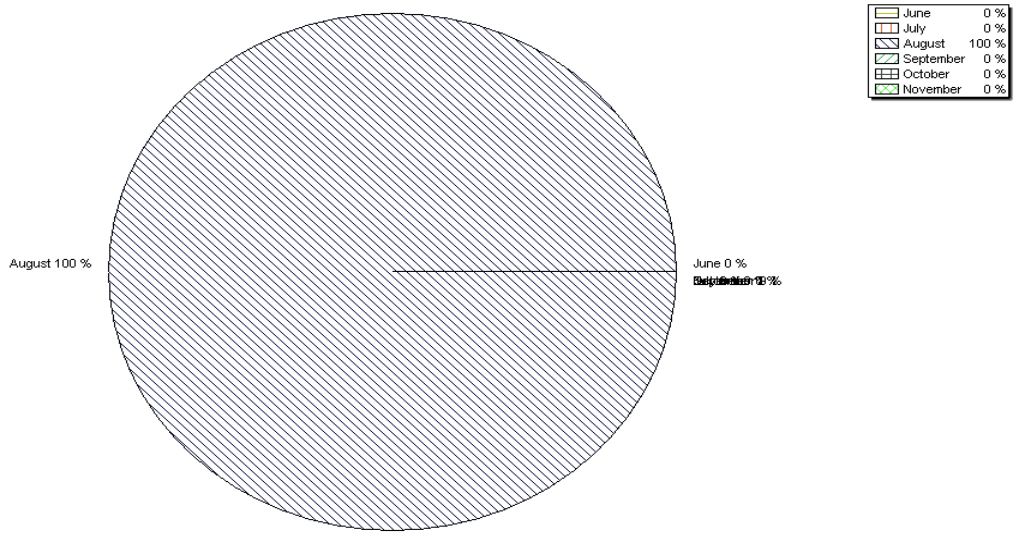
Station Name : Luni at Balotra (01 02 01 001) **Division : Mahi Division, Gandhinagar**

Local River : Luni **Sub-Division : B.L.Sub Divn, Palanpur**

Monthly Average Runoff based on period : 1990-2015



Monthly Runoff for the Year : 2015-2016

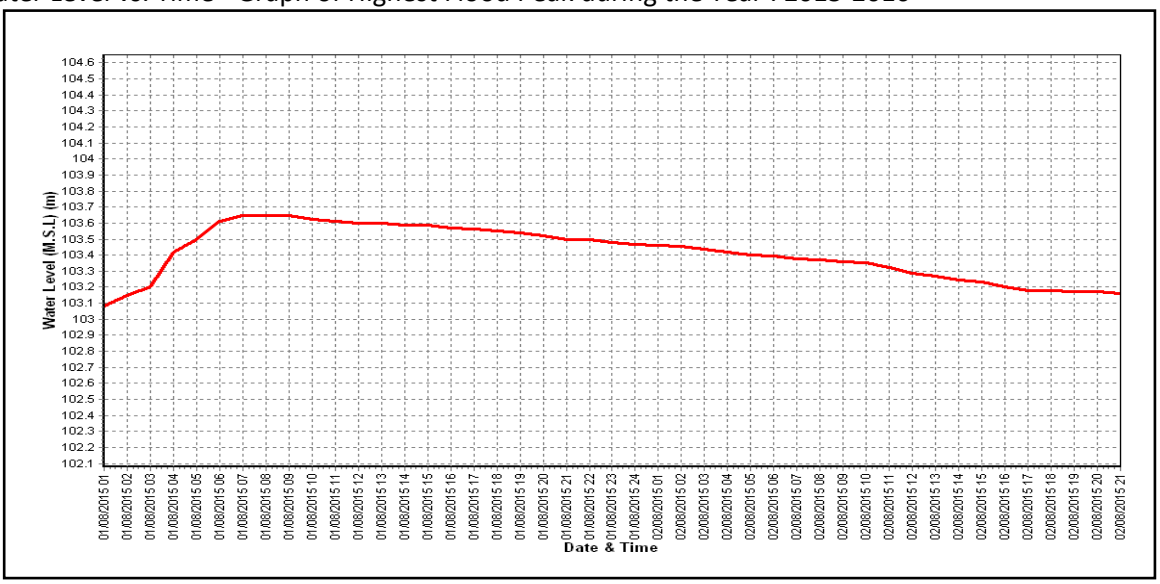


Water Level vs. Time - Graph of Highest Flood Peak during the Year : 2015-2016

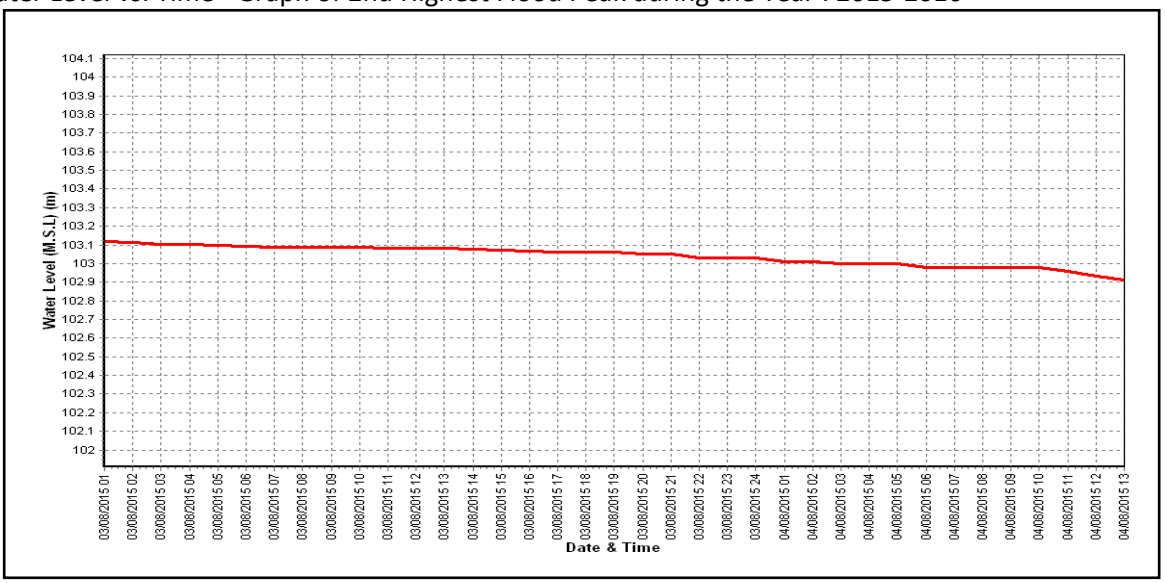
Station Name : Luni at Balotra (01 02 01 001) **Division : Mahi Division, Gandhinagar**

Local River : Luni **Sub-Division : B.L.Sub Divn, Palanpur**

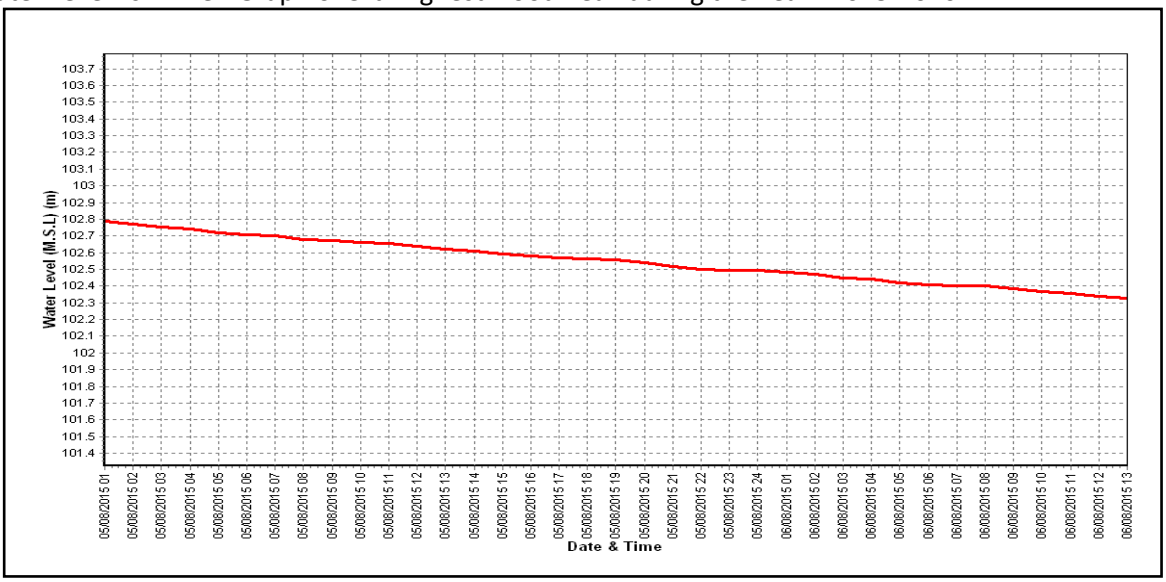
Water Level vs. Time - Graph of Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 2nd Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 3rd Highest Flood Peak during the Year : 2015-2016



Time Span: 72 Hrs

HISTORY SHEET

			Water Year	:	**2015-16**
Site	:	**Banas at Kamalpur**	**Code**	:	**01 02 02 007**
State	:	Gujarat	District		Banaskantha
Basin	:	WFR of Kach.-Saur. & Luni	Independent River	:	Banas
Tributary	:	-	Sub Tributary	:	
Sub-Sub Tributary	:		Local River	:	Banas
Division	:	Mahi Division, Gandhinagar	Sub-Division	:	B.L.Sub Divn, Palanpur
Drainage Area	:	6960 Sq. Km.	Bank	:	Right
Latitude	:	23°47'59" N	Longitude	:	71°45'00" E
Zero of Gauge (m)	:	34 (m.s.l)	01/06/70	-	
		Opening Date	Closing Date		
Gauge	:	21/07/71			
Discharge	:	25/07/71			
Sediment	:	25/08/73			
Water Quality	:	01/06/77			

Annual Maximum / Minimum discharge with corresponding Water Level (m.s.l)

	Maximum			Minimum		
Year	**Q (cumecs)**	**WL (m)**	**Date**	**Q (cumecs)**	**WL (m)**	**Date**
1971-1972	0.000	34.460	05/10/71	0.000	River Dry	26/01/72
1972-1973	River Dry					
1973-1974	371.0	36.515	05/09/73	0.000	River Dry	28/06/73
1974-1975	13.50	35.115	23/08/74	0.000	River Dry	27/01/75
1975-1976	380.7	36.175	13/08/75	0.000	River Dry	16/06/75
1976-1977	906.7	36.710	17/08/76	0.000	River Dry	22/05/77
1977-1978	3678	37.375	27/07/77	0.100	34.775	09/06/77
1978-1979	591.4	36.365	31/08/78	0.600	35.085	27/05/79
1979-1980	100.0	35.930	13/08/79	0.000	River Dry	21/05/80
1980-1981	262.7	36.032	24/06/80	0.000	River Dry	12/05/81
1981-1982	175.1	36.095	18/08/81	0.000	River Dry	30/03/82
1982-1983	1515	37.305	25/07/82	0.000	River Dry	13/03/83
1983-1984	342.7	36.375	03/08/83	0.000	River Dry	06/03/84
1984-1985	330.0	37.100	05/08/84	0.000	River Dry	07/02/85
1985-1986	38.51	35.395	07/08/85	0.000	River Dry	25/01/86
1986-1987	River Dry					
1987-1988	River Dry					
1988-1989	190.0	36.200	06/08/88	0.000	River Dry	29/01/89
1989-1990	70.00	35.235	26/08/89	0.000	River Dry	25/01/90
1990-1991	776.0	36.525	24/08/90	0.000	River Dry	25/01/91
1991-1992	6.233	35.303	24/07/91	0.000	River Dry	26/01/92
1992-1993	4221	38.010	08/09/92	0.000	River Dry	26/01/93
1993-1994	3120	36.771	18/07/93	0.000	River Dry	17/12/93
1994-1995	3691	37.270	09/09/94	0.000	River Dry	13/07/94
1995-1996	456.7	36.075	19/07/95	0.000	River Dry	09/11/95
1996-1997	River Dry					

1997-1998	789.4	37.165	26/06/97	0.000	River Dry	12/01/98
1998-1999	63.00	35.850	17/10/98	0.000	River Dry	12/01/99
1999-2000	River Dry					
2000-2001	20.04	35.570	16/07/00	0.000	River Dry	25/01/01
2001-2002	11.40	35.400	18/06/01	0.000	River Dry	26/01/02
2002-2003	River Dry					
2003-2004	395.3	36.245	29/07/03	0.000	River Dry	26/01/04
2004-2005	73.00	35.950	06/08/04	0.000	River Dry	12/02/05
2005-2006	43.74	35.700	02/08/05	0.000	River Dry	01/06/05
2006-2007	1480	37.545	20/08/06	0.000	River Dry	01/06/06
2007-2008	51.81	35.140	08/08/07	0.000	River Dry	01/06/07
2008-2009	117.6	35.465	02/08/08	0.000	River Dry	01/06/08
2009-2010	11.25	34.890	30/09/09	0.000	River Dry	01/06/09
2010-2011	320.2	36.080	25/07/10	0.000	River Dry	01/06/10
2011-2012	82.4	35.455	13/09/11	0.000	River Dry	24/11/11
2012-2013	38.6	35.220	14/09/12	0.000	River Dry	01/06/12
2013-2014	71.53	35.61	29/09/13	0.000	River Dry	01/06/13
2014-2015	172.8	36	10/09/14	0.000	River Dry	01/06/14
2015-2016	1071	37.075	29/07/15	0.000	35.100	01/06/15

Stage-Discharge Data for the period 2015 - 2016

Station Name : Banas at Kamalpur (01 02 02 007) **Division : Mahi Division, Gandhinagar**

Local River : Banas **Sub-Division : B.L.Sub Divn, Palanpur**

Day	Jun		Jul		Aug		Sep		Oct		Nov	
	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q
1	R Dry	0.000	R Dry	0.000	35.800	108.1	R Dry	0.000	34.920	4.686	R Dry	0.000
2	R Dry	0.000	R Dry	0.000	35.100	17.10 *	R Dry	0.000	R Dry	0.000	R Dry	0.000
3	R Dry	0.000	R Dry	0.000	34.700	1.884	R Dry	0.000	R Dry	0.000	R Dry	0.000
4	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
5	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
6	R Dry	0.000	R Dry	0.000	34.700	1.488	R Dry	0.000	R Dry	0.000	R Dry	0.000
7	R Dry	0.000	R Dry	0.000	34.690	0.858	R Dry	0.000	R Dry	0.000	R Dry	0.000
8	R Dry	0.000	R Dry	0.000	34.680	0.631	R Dry	0.000	R Dry	0.000	R Dry	0.000
9	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
10	R Dry	0.000	R Dry	0.000	34.660	0.555	R Dry	0.000	R Dry	0.000	R Dry	0.000
11	R Dry	0.000	R Dry	0.000	34.650	0.559	R Dry	0.000	R Dry	0.000	R Dry	0.000
12	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
13	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
14	R Dry	0.000	R Dry	0.000	34.660	1.142	R Dry	0.000	R Dry	0.000	R Dry	0.000
15	R Dry	0.000	R Dry	0.000	34.700	1.218 *	R Dry	0.000	R Dry	0.000	R Dry	0.000
16	R Dry	0.000	R Dry	0.000	34.570	0.199 *	R Dry	0.000	R Dry	0.000	R Dry	0.000
17	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
18	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
19	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
20	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
21	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
22	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
23	R Dry	0.000	R Dry	0.000	R Dry	0.000	35.150	21.13 #	R Dry	0.000	R Dry	0.000
24	R Dry	0.000	34.940	13.61	R Dry	0.000	34.920	6.665	R Dry	0.000	R Dry	0.000
25	R Dry	0.000	34.830	10.48	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
26	R Dry	0.000	35.000	10.60 *	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
27	R Dry	0.000	35.700	122.8	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
28	R Dry	0.000	36.180	333.7	R Dry	0.000	34.920	5.192	R Dry	0.000	R Dry	0.000
29	R Dry	0.000	37.075	1071	R Dry	0.000	34.940	5.041	R Dry	0.000	R Dry	0.000
30	R Dry	0.000	37.050	987.2	R Dry	0.000	34.920	4.919	R Dry	0.000	R Dry	0.000
31			36.000	242.8	R Dry	0.000			R Dry	0.000		
Ten-Daily Mean												
I Ten-Daily		0.000		0.000	34.904	13.06		0.000	34.920	0.469		0.000
II Ten-Daily		0.000		0.000	34.645	0.312		0.000		0.000		0.000
III Ten-Daily		0.000	35.847	253.8		0.000	34.970	4.295		0.000		0.000
Monthly												
Min.		0.000	34.830	0.000	34.570	0.000	34.920	0.000	34.920	0.000		0.000
Max.		0.000	37.075	1071	35.800	108.1	35.150	21.13	34.920	4.686		0.000
Mean		0	35.847	90.06	34.810	4.313	34.970	1.432	34.920	0.151		0.000

Annual Runoff in MCM = 257 Annual Runoff in mm = 37

Peak Observed Discharge = 1071 cumecs on 29/07/2015 Corres. Water Level :37.075 m

Lowest Observed Discharge = 0.000 cumecs on 01/06/2015

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff

Stage-Discharge Data for the period 2015 - 2016

Station Name : Banas at Kamalpur (01 02 02 007) **Division : Mahi Division, Gandhinagar**

Local River : Banas **Sub-Division : B.L.Sub Divn, Palanpur**

Day	Dec		Jan		Feb		Mar		Apr		May	
	W.L	Q	WL	Q	WL	Q	WL	Q	WL	Q	WL	Q
1	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
2	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
3	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
4	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
5	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
6	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
7	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
8	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
9	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
10	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
11	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
12	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
13	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
14	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
15	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
16	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
17	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
18	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
19	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
20	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
21	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
22	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
23	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
24	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
25	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
26	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
27	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
28	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
29	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
30	R Dry	0.000	R Dry	0.000			R Dry	0.000	R Dry	0.000	R Dry	0.000
31	R Dry	0.000	R Dry	0.000			R Dry	0.000			R Dry	0.000
Ten-Daily Mean												
I Ten-Daily		0.000		0.000		0.000		0.000		0.000		0.000
II Ten-Daily		0.000		0.000		0.000		0.000		0.000		0.000
III Ten-Daily		0.000		0.000		0.000		0.000		0.000		0.000
Monthly												
Min.		0.000		0.000		0.000		0.000		0.000		0.000
Max.		0.000		0.000		0.000		0.000		0.000		0.000
Mean		0.000		0.000		0.000		0.000		0.000		0.000

Annual Runoff in M(

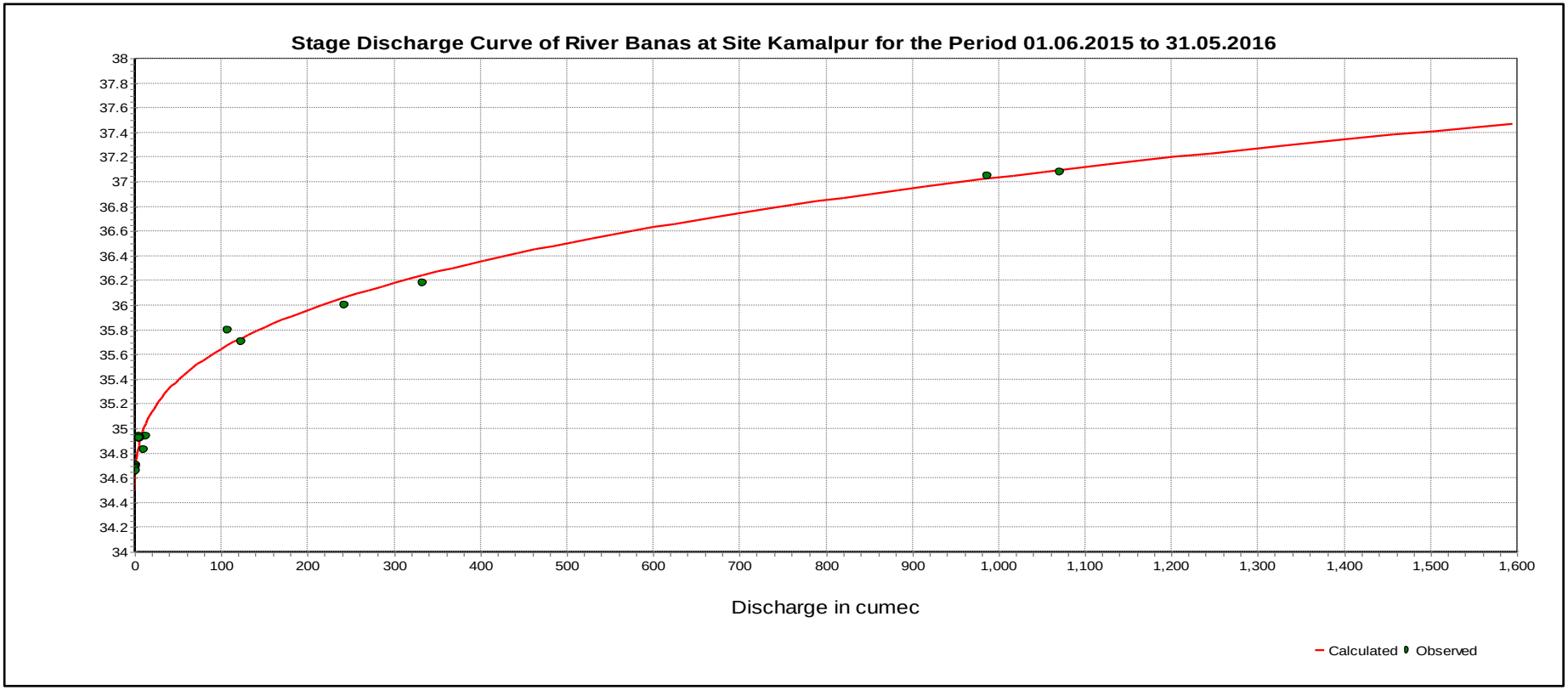
Peak Observed Discl **Peak Computed Discharge = 17.10 cumecs on 02/08/2015** **Corres. Water Level :35.1 m**

Lowest Observed Di **Lowest Computed Discharge = 0.000 cumecs on 09/08/2015**

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff



Procedure - Standard

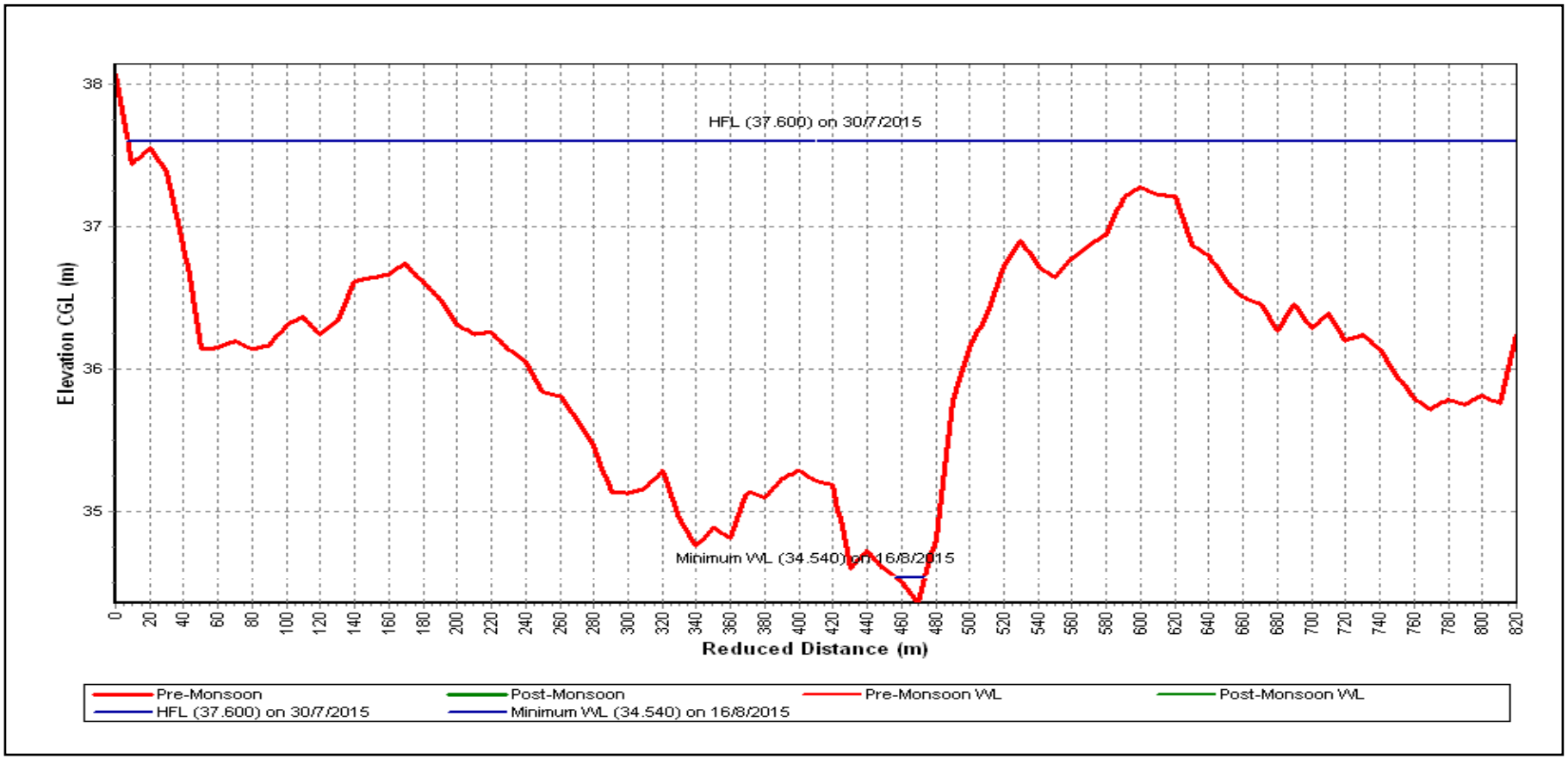
Equation Type - Power $Q=c*(h+a)^b$

LB	UB	a	b	c
34.5	37.5	-34.41	3.046	52.878

Pre-Monsoon & Post-Monsoon X-Section for Water Year : 2015-2016

Station Name : Banas at Kamalpur (01 02 02 007) **Division : Mahi Division, Gandhinagar**

Local River : Banas **Sub-Division : B.L.Sub Divn, Palanpur**



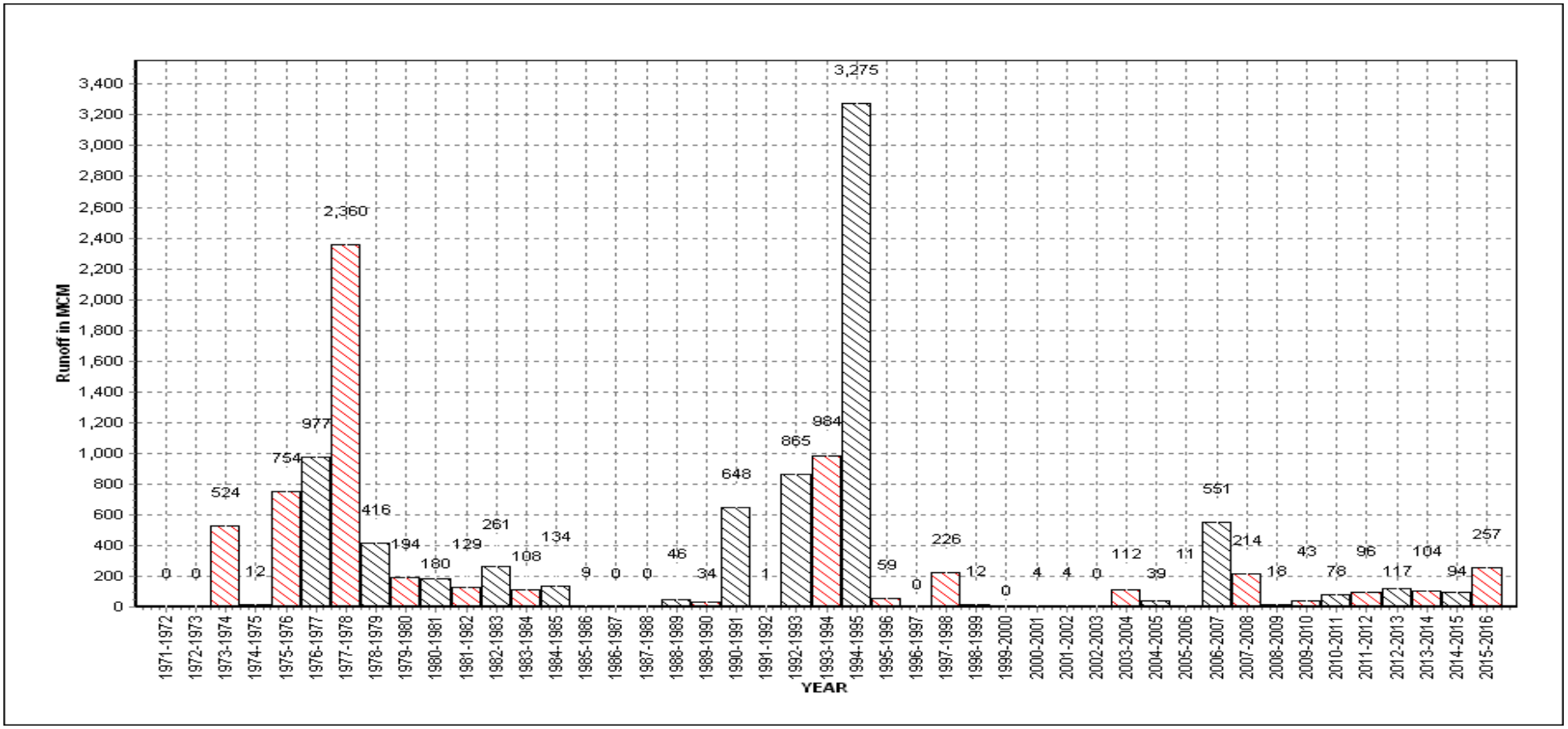
Histroical Flood Level-38.980m on 8.09.1992 at 1700 hrs

Note: HFL marked on graph denotes Maximum Water Level observed during the Water Year 2015-16

Annual Runoff Values for the period: 1971 - 2016

Station Name : Banas at Kamalpur (01 02 02 007) **Division : Mahi Division, Gandhinagar**

Local River : Banas **Sub-Division : B.L.Sub Divn, Palanpur**

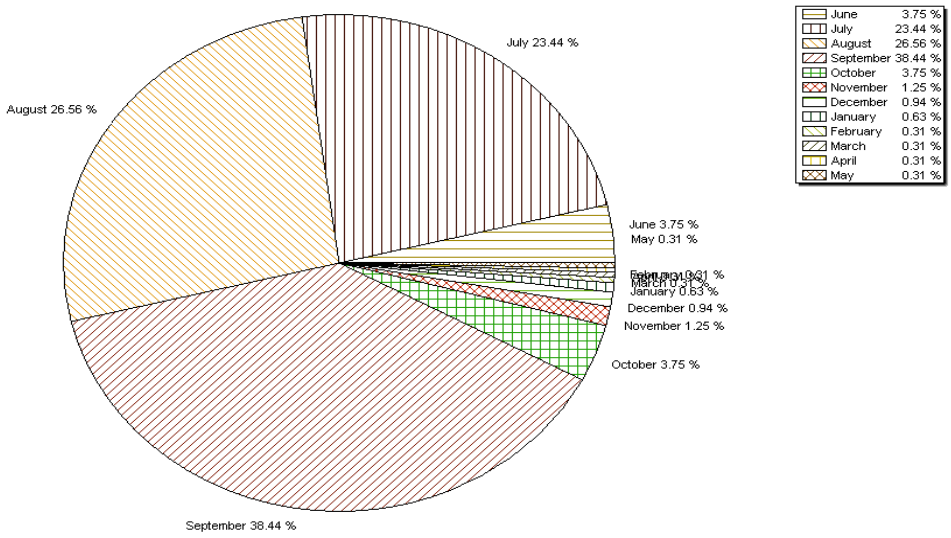


Note: Missing values have not been considered while arriving at Annual Runoff

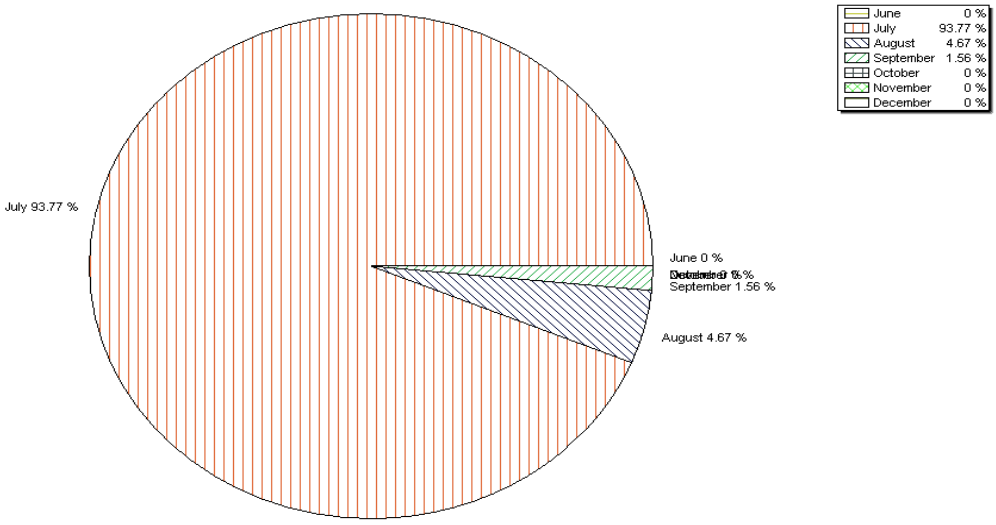
Station Name : Banas at Kamalpur (01 02 02 007) **Division : Mahi Division, Gandhinagar**

Local River : Banas **Sub-Division : B.L.Sub Divn, Palanpur**

Monthly Average Runoff based on period : 1971-2015



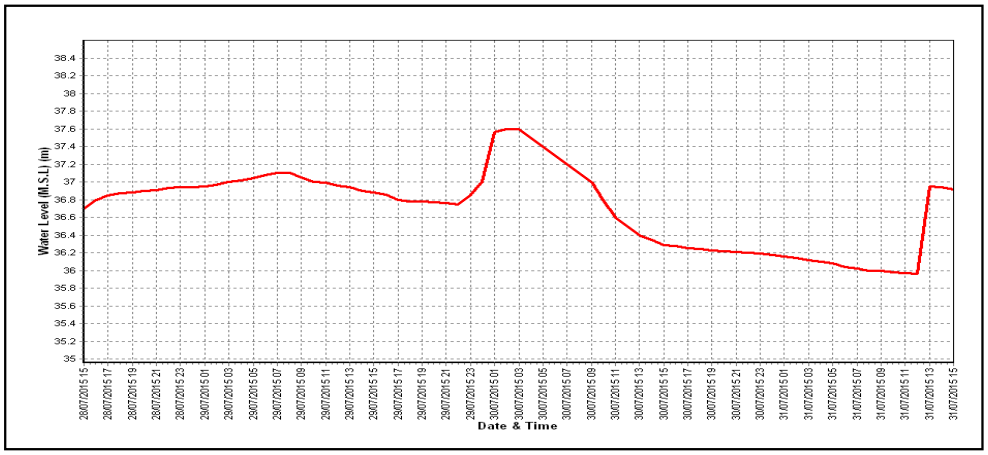
Monthly Runoff for the Year : 2015-2016



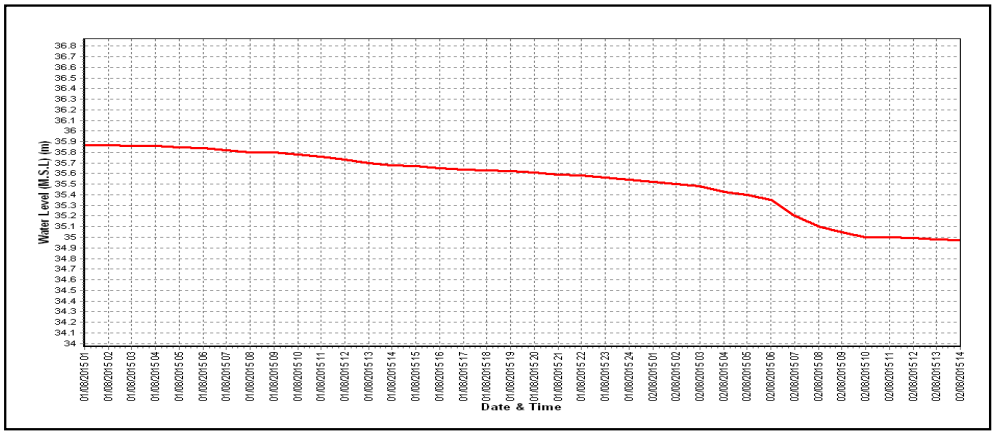
Station Name : Banas at Kamalpur (01 02 02 007) **Division : Mahi Division, Gandhinagar**

Local River : Banas **Sub-Division : B.L.Sub Divn, Palanpur**

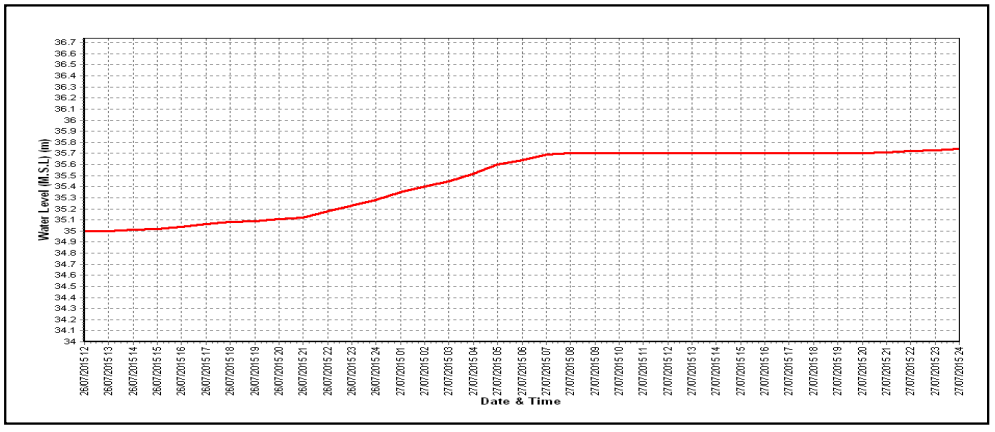
Water Level vs. Time - Graph of Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 2nd Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 3rd Highest Flood Peak during the Year : 2015-2016



Time Span: 72 Hrs

HISTORY SHEET

			Water Year	:	**2015-16**
Site	:	**Balaram at Chitrasani**	**Code**	:	**01 02 02 004**
State	:	Gujarat	District		Banaskantha
Basin	:	WFR of Kach.-Saur. & Luni	Independent River	:	Banas
Tributary	:	Balaram	Sub Tributary	:	
Sub-Sub Tributary	:		Local River	:	Balaram
Division	:	Mahi Division, Gandhinagar	Sub-Division	:	B.L.Sub Divn, Palanpur
Drainage Area	:	345 Sq. Km.	Bank	:	Left
Latitude	:	24°17'20" N	Longitude	:	72°29'54" E
Zero of Gauge (m)	:	184 (m.s.l)	01/01/85	-	
		Opening Date	Closing Date		
Gauge	:	08/05/78			
Discharge	:	01/06/90			
Sediment	:	--			
Water Quality	:	15/07/88			

Annual Maximum / Minimum discharge with corresponding Water Level (m.s.l)

	Maximum			Minimum		
Year	**Q (cumecs)**	**WL (m)**	**Date**	**Q (cumecs)**	**WL (m)**	**Date**
1990-1991	129.5	185.700	04/07/90	0.000	River Dry	12/01/91
1991-1992	17.13	185.150	31/07/91	0.000	River Dry	13/02/92
1992-1993	274.8	186.750	08/09/92	0.000	River Dry	15/01/93
1993-1994	99.91	185.264	10/07/93	0.000	River Dry	30/12/93
1994-1995	119.3	185.725	20/08/94	0.000	184.070	16/05/95
1995-1996	156.7	185.510	27/08/95	0.000	184.430	26/01/96
1996-1997	10.01	185.000	29/07/96	0.000	184.050	25/01/97
1997-1998	17.22	185.300	11/09/97	0.000	184.180	25/01/98
1998-1999	9.500	185.325	29/08/98	0.000	184.350	05/12/98
1999-2000	2.508	184.940	03/10/99	0.000	River Dry	05/12/99
2000-2001	1.100	184.500	16/07/00	0.000	River Dry	08/11/00
2001-2002	20.90	185.230	24/07/01	0.000	184.350	10/11/01
2002-2003	2.103	184.690	29/06/02	0.000	River Dry	25/05/03
2003-2004	10.50	185.000	10/07/03	0.000	River Dry	04/02/04
2004-2005	1.581	185.580	12/08/04	0.000	River Dry	14/02/05
2005-2006	8.668	185.720	16/09/05	0.000	River Dry	01/06/05
2006-2007	81.56	186.450	16/08/06	0.000	River Dry	01/06/06
2007-2008	40.71	186.285	05/08/07	0.000	River Dry	01/06/07
2008-2009	6.999	185.980	15/08/08	0.000	River Dry	01/06/08
2009-2010	30.4	186.335	23/07/09	0.000	River Dry	01/06/09
2010-2011	23.48	186.460	25/07/10	0.000	River Dry	01/06/10
2011-2012	268.557	187.120	12/09/11	0.000	185.690	28/12/11
2012-2013	7.5	186.100	11/07/12	0.000	River Dry	01/06/12
2013-2014	39.62	186.365	29/09/13	0.000	River Dry	01/06/13
2014-2015	9.33	186.1	12/09/14	0.000	River Dry	01/06/14
2015-2016	625.5	188.1	29/07/15	0	185.55	18/10/15

Stage-Discharge Data for the period 2015 - 2016

Station Name : Balaram at Chitrasani (01 02 02 004) **Division : Mahi Division, Gandhinagar**

Local River : Balaram **Sub-Division : B.L.Sub Divn, Palanpur**

Day	Jun		Jul		Aug		Sep		Oct		Nov	
	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q
1	R.dry	0.000	R.dry	0.000	185.780	19.06 #	185.610	2.120	185.595	1.311	185.340	0.000
2	R.dry	0.000	R.dry	0.000	185.780	19.06 #	185.610	2.067	185.590	1.010	185.340	0.000
3	R.dry	0.000	R.dry	0.000	185.770	17.85 #	185.610	2.009	185.590	1.043	185.340	0.000
4	R.dry	0.000	R.dry	0.000	185.710	11.16 #	185.610	2.046	185.590	1.012	185.340	0.000
5	R.dry	0.000	R.dry	0.000	185.700	12.47	185.600	1.950	185.585	0.830	185.340	0.000
6	R.dry	0.000	R.dry	0.000	185.690	10.59	185.595	1.946	185.585	0.811	185.340	0.000
7	R.dry	0.000	R.dry	0.000	185.690	10.25	185.595	1.816	185.580	0.267	185.340	0.000
8	R.dry	0.000	R.dry	0.000	185.680	9.984	185.595	1.822	185.575	0.237	185.340	0.000
9	R.dry	0.000	R.dry	0.000	185.680	7.972	185.595	1.795	185.570	0.202	185.340	0.000
10	R.dry	0.000	R.dry	0.000	185.680	9.942	185.590	1.711	185.570	0.198	185.340	0.000
11	R.dry	0.000	R.dry	0.000	185.670	9.544	185.590	1.663	185.565	0.187	185.340	0.000
12	R.dry	0.000	R.dry	0.000	185.670	9.264	185.590	1.606	185.565	0.170	185.330	0.000
13	R.dry	0.000	R.dry	0.000	185.690	10.95	185.590	1.504	185.565	0.136	185.330	0.000
14	R.dry	0.000	R.dry	0.000	185.764	19.17	185.590	1.457	185.560	0.135	185.330	0.000
15	R.dry	0.000	R.dry	0.000	185.720	16.60	185.585	1.221	185.560	0.117	185.330	0.000
16	R.dry	0.000	R.dry	0.000	185.690	13.83	185.585	1.166	185.560	0.107	185.330	0.000
17	R.dry	0.000	R.dry	0.000	185.690	10.98	185.585	1.160	185.555	0.066	185.330	0.000
18	R.dry	0.000	R.dry	0.000	185.690	10.67	185.585	1.045	185.550	0.000	185.330	0.000
19	R.dry	0.000	R.dry	0.000	185.680	9.930	185.585	0.937	185.550	0.000	185.330	0.000
20	R.dry	0.000	R.dry	0.000	185.680	9.659	185.585	0.935	185.525	0.000	185.330	0.000
21	R.dry	0.000	R.dry	0.000	185.670	9.121	185.585	0.879	185.510	0.000	185.330	0.000
22	R.dry	0.000	R.dry	0.000	185.660	4.224	185.600	1.758	185.500	0.000	185.330	0.000
23	R.dry	0.000	R.dry	0.000	185.660	4.086	185.610	2.231	185.480	0.000	185.330	0.000
24	R.dry	0.000	R.dry	0.000	185.640	3.556	185.610	2.096	185.470	0.000	185.330	0.000
25	R.dry	0.000	R.dry	0.000	185.640	3.497	185.605	2.130	185.440	0.000	185.330	0.000
26	R.dry	0.000	R.dry	0.000	185.630	3.375	185.605	2.062	185.410	0.000	185.330	0.000
27	R.dry	0.000	186.105	50.90	185.630	3.170	185.605	1.950	185.400	0.000	185.320	0.000
28	R.dry	0.000	187.100	302.4 #	185.630	3.024	185.600	1.693	185.380	0.000	185.320	0.000
29	R.dry	0.000	188.100	625.5	185.620	2.916	185.600	1.663	185.360	0.000	185.320	0.000
30	R.dry	0.000	186.065	45.13	185.620	2.727	185.595	1.565	185.350	0.000	185.320	0.000
31			185.800	21.53 #	185.620	2.651			185.340	0.000		
Ten-Daily Mean												
I Ten-Daily	R.dry	0.000	R.dry	0.000	185.716	12.83	185.601	1.928	185.583	0.692	185.340	0.000
II Ten-Daily	R.dry	0.000	R.dry	0.000	185.694	12.06	185.587	1.270	185.556	0.092	185.331	0.000
III Ten-Daily	R.dry	0.000	186.634	95.04	185.638	3.850	185.601	1.803	185.422	0.000	185.326	0.000
Monthly												
Min.	R.dry	0.000	185.800	0.000	185.620	2.651	185.585	0.879	185.340	0.000	185.320	0.000
Max.	R.dry	0.000	188.100	625.5	185.780	19.17	185.610	2.231	185.595	1.311	185.340	0.000
Mean	R.dry	0.000	186.634	33.72	185.681	9.396	185.596	1.667	185.517	0.253	185.332	0.000

Annual Runoff in MCM = 120 Annual Runoff in mm = 349

Peak Observed Discharge = 625.5 cumecs on 29/07/2015 Corres. Water Level :188.1 m

Lowest Observed Discharge = 0.000 cumecs on 01/06/2015

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff

Stage-Discharge Data for the period 2015 - 2016

Station Name : Balaram at Chitrasani (01 02 02 004) **Division : Mahi Division, Gandhinagar**

Local River : Balaram **Sub-Division : B.L.Sub Divn, Palanpur**

Day	Dec		Jan		Feb		Mar		Apr		May	
	W.L	Q	WL	Q	WL	Q	WL	Q	WL	Q	WL	Q
1	185.320	0.000	185.210	0.000	185.170	0.000	185.120	0.000	185.020	0.000	R.dry	0.000
2	185.320	0.000	185.210	0.000	185.170	0.000	185.120	0.000	185.010	0.000	R.dry	0.000
3	185.320	0.000	185.200	0.000	185.160	0.000	185.110	0.000	185.010	0.000	R.dry	0.000
4	185.320	0.000	185.200	0.000	185.160	0.000	185.110	0.000	185.010	0.000	R.dry	0.000
5	185.320	0.000	185.200	0.000	185.160	0.000	185.110	0.000	185.000	0.000	R.dry	0.000
6	185.320	0.000	185.200	0.000	185.160	0.000	185.110	0.000	184.970	0.000	R.dry	0.000
7	185.320	0.000	185.190	0.000	185.150	0.000	185.110	0.000	184.920	0.000	R.dry	0.000
8	185.320	0.000	185.190	0.000	185.150	0.000	185.110	0.000	184.860	0.000	R.dry	0.000
9	185.320	0.000	185.190	0.000	185.150	0.000	185.110	0.000	184.820	0.000	R.dry	0.000
10	185.320	0.000	185.190	0.000	185.150	0.000	185.100	0.000	184.780	0.000	R.dry	0.000
11	185.310	0.000	185.190	0.000	185.140	0.000	185.100	0.000	184.750	0.000	R.dry	0.000
12	185.310	0.000	185.190	0.000	185.140	0.000	185.100	0.000	184.730	0.000	R.dry	0.000
13	185.310	0.000	185.190	0.000	185.140	0.000	185.100	0.000	184.710	0.000	R.dry	0.000
14	185.310	0.000	185.190	0.000	185.140	0.000	185.100	0.000	184.690	0.000	R.dry	0.000
15	185.310	0.000	185.190	0.000	185.140	0.000	185.100	0.000	184.680	0.000	R.dry	0.000
16	185.310	0.000	185.180	0.000	185.140	0.000	185.090	0.000	184.660	0.000	R.dry	0.000
17	185.310	0.000	185.180	0.000	185.130	0.000	185.090	0.000	184.640	0.000	R.dry	0.000
18	185.300	0.000	185.180	0.000	185.130	0.000	185.090	0.000	R.dry	0.000	R.dry	0.000
19	185.300	0.000	185.180	0.000	185.130	0.000	185.090	0.000	R.dry	0.000	R.dry	0.000
20	185.300	0.000	185.180	0.000	185.130	0.000	185.090	0.000	R.dry	0.000	R.dry	0.000
21	185.300	0.000	185.180	0.000	185.130	0.000	185.090	0.000	R.dry	0.000	R.dry	0.000
22	185.300	0.000	185.180	0.000	185.130	0.000	185.070	0.000	R.dry	0.000	R.dry	0.000
23	185.300	0.000	185.180	0.000	185.130	0.000	185.060	0.000	R.dry	0.000	R.dry	0.000
24	185.290	0.000	185.170	0.000	185.120	0.000	185.050	0.000	R.dry	0.000	R.dry	0.000
25	185.290	0.000	185.170	0.000	185.120	0.000	185.050	0.000	R.dry	0.000	R.dry	0.000
26	185.280	0.000	185.170	0.000	185.120	0.000	185.040	0.000	R.dry	0.000	R.dry	0.000
27	185.260	0.000	185.170	0.000	185.120	0.000	185.040	0.000	R.dry	0.000	R.dry	0.000
28	185.240	0.000	185.170	0.000	185.120	0.000	185.030	0.000	R.dry	0.000	R.dry	0.000
29	185.220	0.000	185.170	0.000	185.120	0.000	185.030	0.000	R.dry	0.000	R.dry	0.000
30	185.220	0.000	185.170	0.000			185.020	0.000	R.dry	0.000	R.dry	0.000
31	185.210	0.000	185.170	0.000			185.020	0.000			R.dry	0.000
Ten-Daily Mean												
I Ten-Daily	185.320	0.000	185.198	0.000	185.158	0.000	185.111	0.000	184.940	0.000	R.dry	0.000
II Ten-Daily	185.307	0.000	185.185	0.000	185.136	0.000	185.095	0.000	184.694	0.000	R.dry	0.000
III Ten-Daily	185.265	0.000	185.173	0.000	185.123	0.000	185.045	0.000	R.dry	0.000	R.dry	0.000
Monthly												
Min.	185.210	0.000	185.170	0.000	185.120	0.000	185.020	0.000	184.640	0.000	R.dry	0.000
Max.	185.320	0.000	185.210	0.000	185.170	0.000	185.120	0.000	185.020	0.000	R.dry	0.000
Mean	185.296	0.000	185.185	0.000	185.140	0.000	185.083	0.000	184.839	0.000	R.dry	0.000

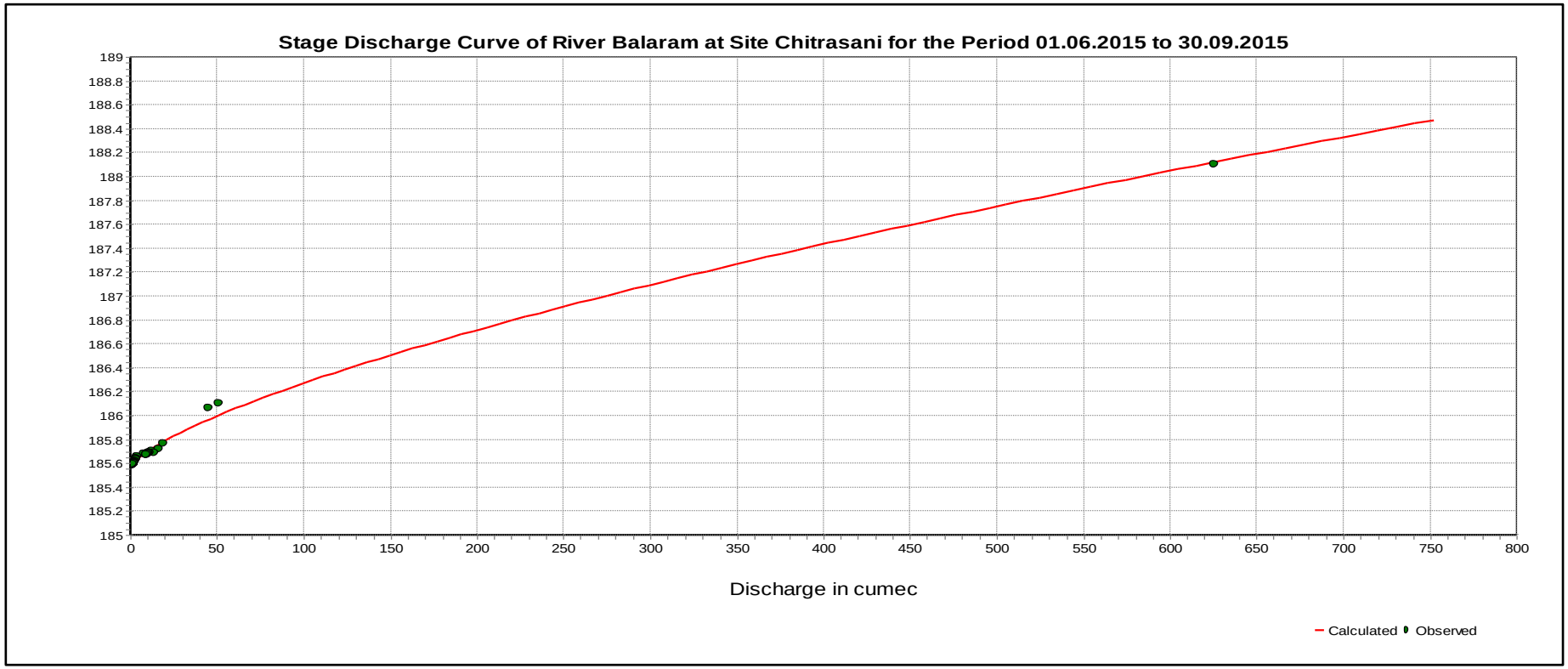
Peak Computed Discharge = 0.000 cumecs on 18/10/2015 Corres. Water Level :185.55 m

Lowest Computed Discharge = 0.000 cumecs on 18/10/2015 Corres. Water Level :185.55 m

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff



Procedure - Standard

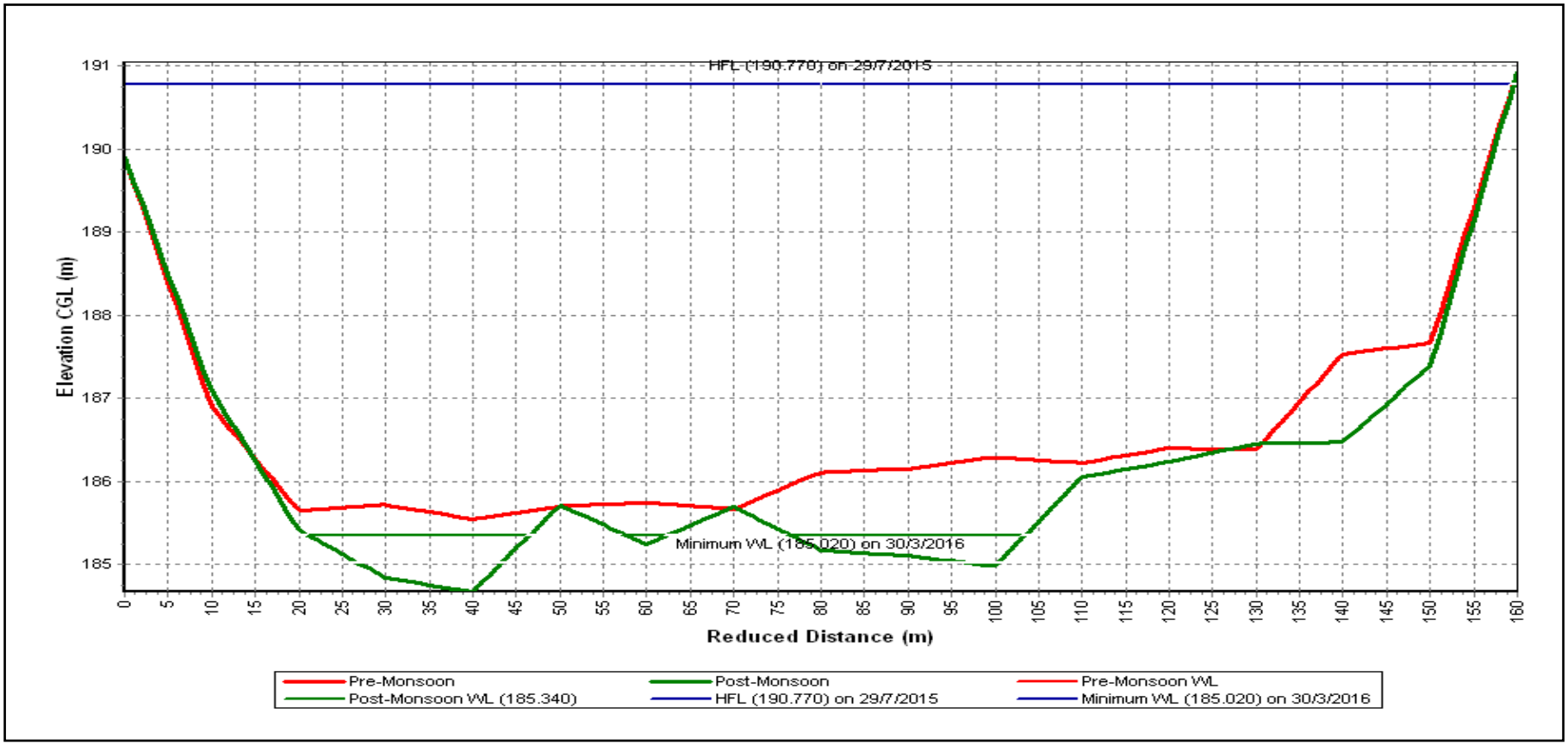
Equation Type - Power Q=c*(h+a)b

LB	UB	a	b	c
185.56	188.5	-185.555	1.4347	161.99

Pre-Monsoon & Post-Monsoon X-Section for Water Year : 2015-2016

Station Name : Balaram at Chitrasani (01 02 02 004) **Division : Mahi Division, Gandhinagar**

Local River : Balaram **Sub-Division : B.L.Sub Divn, Palanpur**



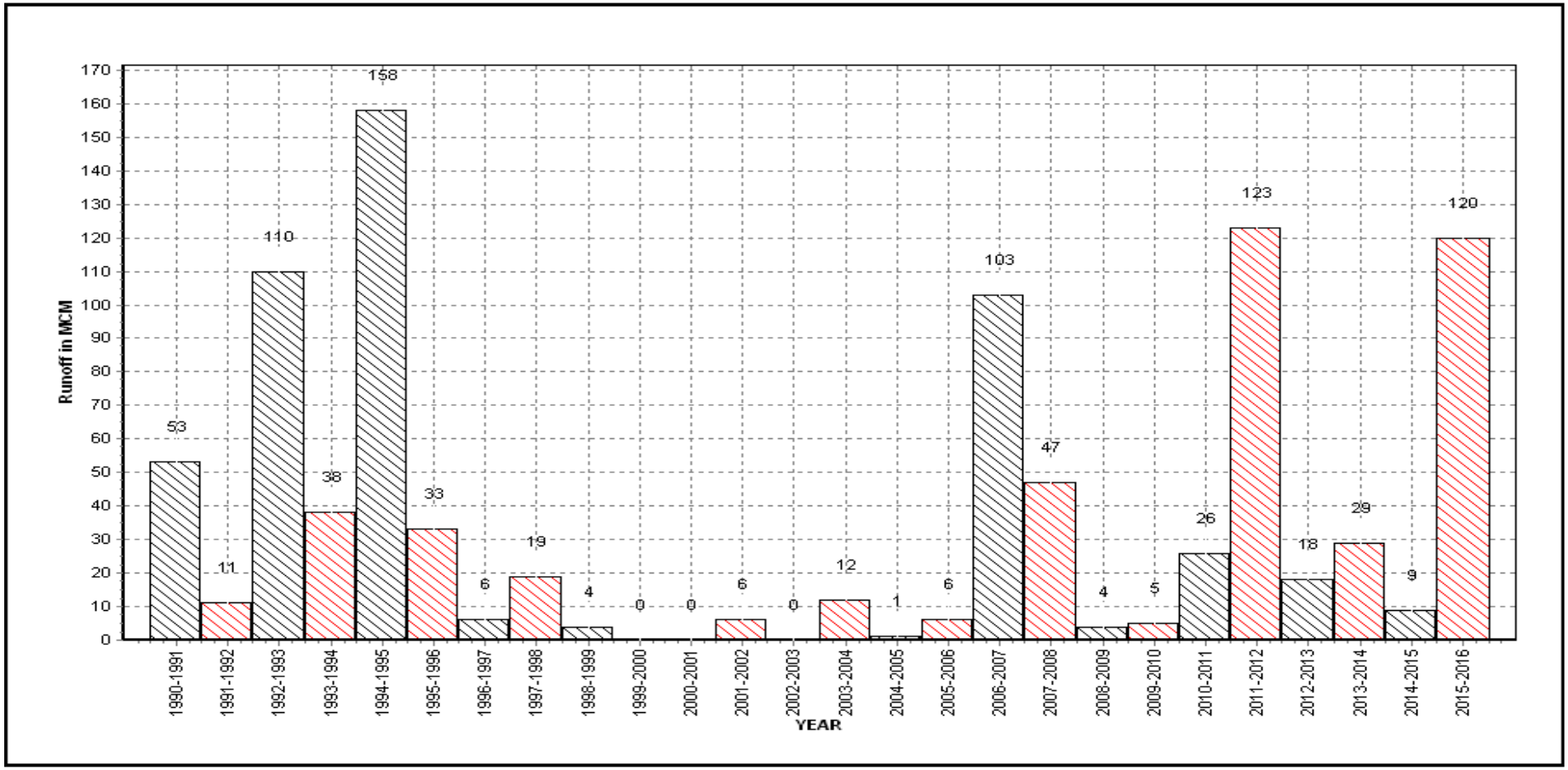
Historic Flood Level-188.200m on 19.08.2006 at 1100 hrs

Note: HFL marked on graph denotes Maximum Water Level observed during the Water Year 2015-16

Annual Runoff Values for the period: 1990 - 2016

Station Name : Balaram at Chitrasani (01 02 02 004) **Division : Mahi Division, Gandhinagar**

Local River : Balaram **Sub-Division : B.L.Sub Divn, Palanpur**

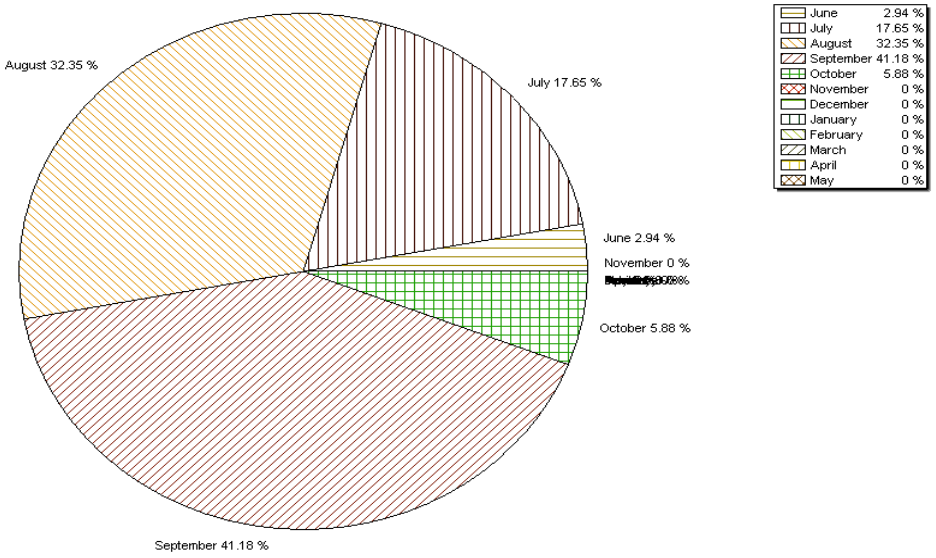


Note: Missing values have not been considered while arriving at Annual Runoff

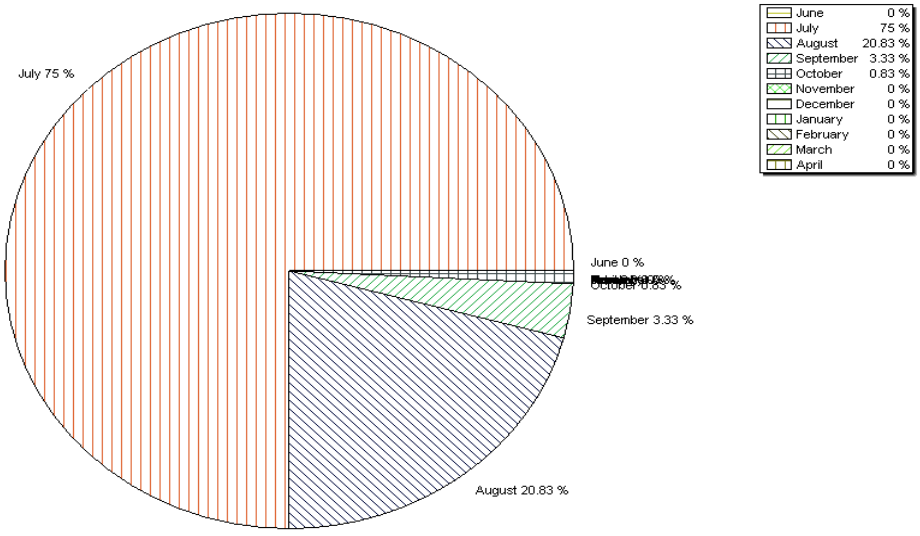
Station Name : Balaram at Chitrasani (01 02 02 004) **Division : Mahi Division, Gandhinagar**

Local River : Balaram **Sub-Division : B.L.Sub Divn, Palanpur**

Monthly Average Runoff based on period : 1990-2015



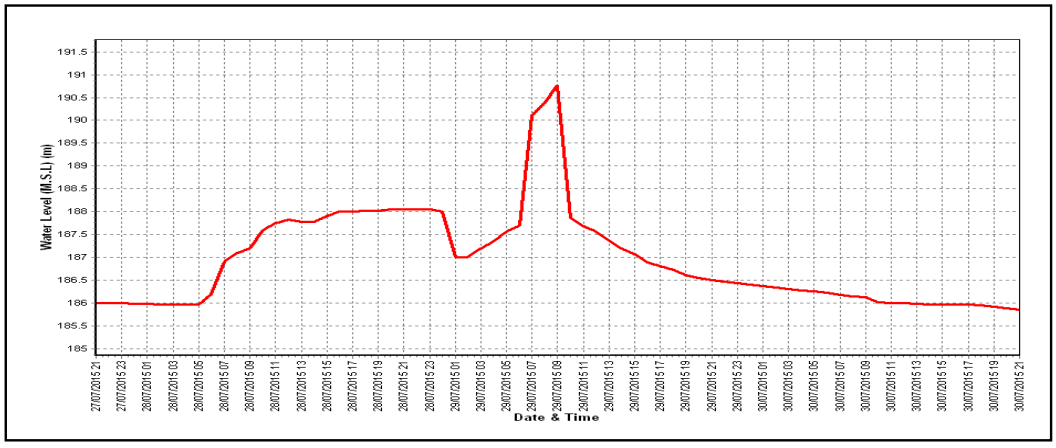
Monthly Runoff for the Year : 2015-2016



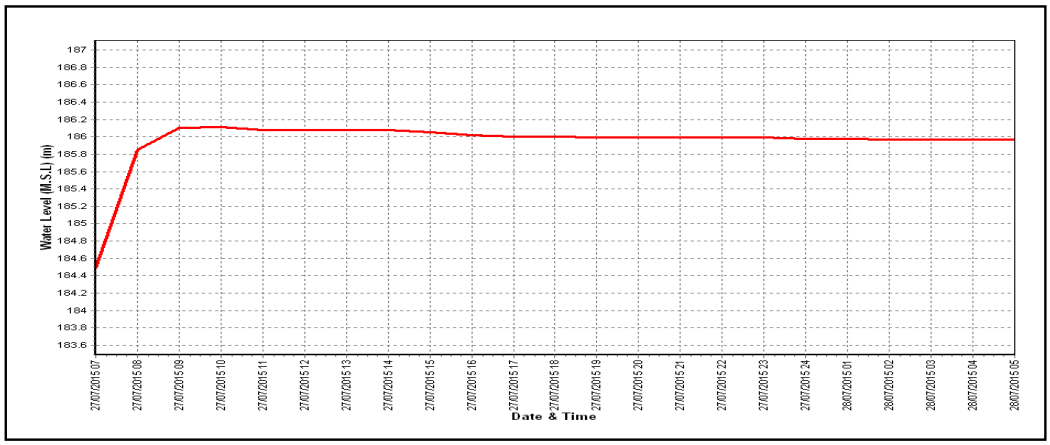
Station Name : Balaram at Chitrasani (01 02 02 004) **Division : Mahi Division, Gandhinagar**

Local River : Balaram **Sub-Division : B.L.Sub Divn, Palanpur**

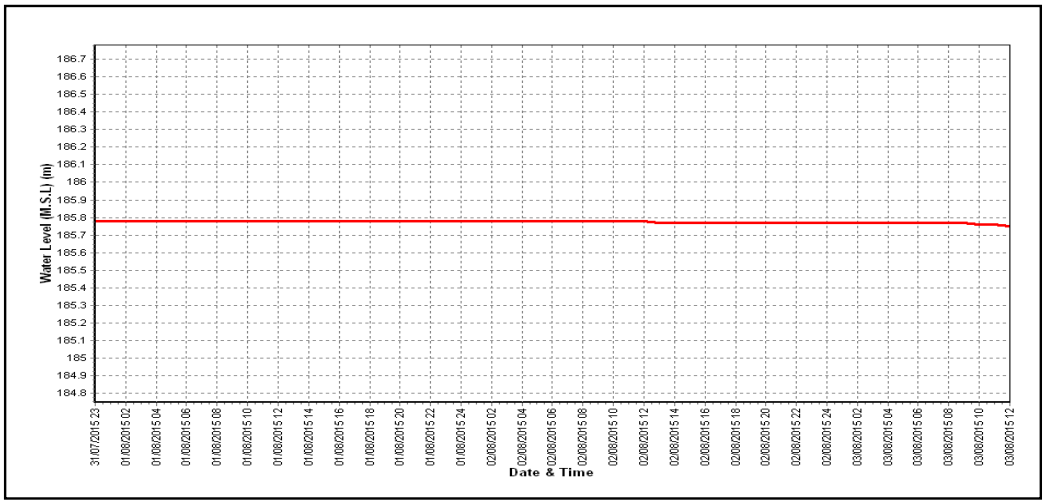
Water Level vs. Time - Graph of Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 2nd Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 3rd Highest Flood Peak during the Year : 2015-2016



Time Span: 72 Hrs

HISTORY SHEET

Water Year : 2015-16

Site	:	**Banas at Sarotry**	**Code**	:	**01 02 02 003**
State	:	Gujarat	District		Banaskantha
Basin	:	WFR of Kach.-Saur. & Luni	Independent River	:	Banas
Tributary	:	-	Sub Tributary	:	
Sub-Sub Tributary	:		Local River	:	Banas
Division	:	Mahi Division, Gandhinagar	Sub-Division	:	B.L.Sub Divn, Palanpur
Drainage Area	:	2200 Sq. Km.	Bank	:	Left
Latitude	:	24°22'04" N	Longitude	:	72°32'48" E
Zero of Gauge (m)	:	184 (m.s.l) 186 (m.s.l)	01/06/80 01/08/89	-	01/07/89 -
		Opening Date	Closing Date		
Gauge	:	12/06/80			
Discharge	:	01/06/90			
Sediment	:	---			
Water Quality	:	--			

Annual Maximum / Minimum discharge with corresponding Water Level (m.s.l)

	Maximum			Minimum		
Year	**Q (cumecs)**	**WL (m)**	**Date**	**Q (cumecs)**	**WL (m)**	**Date**
1989-1990	113.8	187.220	03/07/89	0.000	River Dry	03/01/90
1990-1991	1027	188.225	04/07/90	0.000	River Dry	30/04/91
1991-1992	194.4	187.305	23/07/91	0.000	River Dry	17/06/91
1992-1993	2672	190.780	08/09/92	0.000	River Dry	02/07/92
1993-1994	558.0	187.672	18/07/93	0.000	River Dry	07/05/94
1994-1995	1324	189.025	08/09/94	0.000	River Dry	09/06/94
1995-1996	339.3	188.220	25/07/95	0.000	186.600	09/03/96
1996-1997	44.34	187.565	29/07/96	0.000	186.670	08/11/96
1997-1998	360.0	188.325	14/09/97	0.000	186.810	23/01/98
1998-1999	111.0	187.700	18/10/98	0.000	186.750	04/12/98
1999-2000	154.0	187.910	22/06/99	0.000	River Dry	08/11/99
2000-2001	20.44	187.200	16/07/00	0.000	River Dry	26/01/01
2001-2002	26.27	187.200	15/06/01	0.000	River Dry	23/11/01
2002-2003	22.57	187.100	29/06/02	0.000	River Dry	25/01/03
2003-2004	244.0	187.950	19/06/03	0.000	River Dry	31/12/03
2004-2005	51.89	187.650	02/08/04	0.000	River Dry	25/01/05
2005-2006	213.0	188.050	19/09/05	0.000	River Dry	01/06/05
2006-2007	1008	188.750	07/09/06	0.000	River Dry	01/06/06
2007-2008	1158	186.010	04/07/07	0.000	River Dry	01/06/07
2008-2009	28.71	187.015	14/08/08	0.000	River Dry	01/06/08
2009-2010	14.03	186.860	24/07/09	0.000	River Dry	01/06/09
2010-2011	209.6	187.550	06/08/10	0.000	River Dry	01/06/10
2011-2012	1022.9	189.575	12/09/11	0.000	River Dry	07/05/12
2012-2013	882.0	188.900	11/07/12	0.000	River Dry	01/06/12
2013-2014	212.7	187.64	29/09/13	0.000	River Dry	01/06/13
2014-2015	61.16	187.25	30/07/14	0.000	River Dry	01/06/14
2015-2016	750.5	190.25	29/07/15	0.000	186.150	27/10/15

Stage-Discharge Data for the period 2015 - 2016

Station Name : Banas at Sarotry (01 02 02 003) **Division : Mahi Division, Gandhinagar**

Local River : Banas **Sub-Division : B.L.Sub Divn, Palanpur**

Day	Jun		Jul		Aug		Sep		Oct		Nov	
	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q
1	R Dry	0.000	186.650	38.96 *	186.900	84.22	186.390	12.85	186.260	3.323	186.120	0.000
2	R Dry	0.000	186.610	34.60 *	186.770	73.36	186.380	12.02	186.250	3.102	186.120	0.000
3	R Dry	0.000	186.590	32.50 *	186.670	60.54	186.350	11.43	186.230	2.452	186.120	0.000
4	R Dry	0.000	186.570	30.00 *	186.580	47.05	186.340	10.12	186.230	2.620 *	186.120	0.000
5	R Dry	0.000	186.560	29.00 *	186.570	39.92	186.335	8.799	186.230	2.972	186.120	0.000
6	R Dry	0.000	186.550	28.40 *	186.560	34.82	186.330	8.970 *	186.230	2.398	186.120	0.000
7	R Dry	0.000	186.550	28.40 *	186.540	27.76	186.320	7.803	186.230	2.295	186.110	0.000
8	R Dry	0.000	186.550	28.40 *	186.530	24.22	186.320	7.573	186.220	2.138	186.110	0.000
9	R Dry	0.000	R Dry	0.000	186.500	18.01	186.320	7.238	186.220	2.123	186.110	0.000
10	R Dry	0.000	R Dry	0.000	186.490	17.63	186.310	6.829	186.210	1.906	186.110	0.000
11	R Dry	0.000	R Dry	0.000	186.490	17.49	186.310	6.647	186.200	1.210 *	186.110	0.000
12	R Dry	0.000	R Dry	0.000	186.530	24.26	186.300	6.078	186.200	1.664	186.110	0.000
13	R Dry	0.000	R Dry	0.000	187.000	92.61	186.290	6.180 *	186.200	1.631	186.110	0.000
14	R Dry	0.000	R Dry	0.000	186.900	83.26	186.280	5.317	186.200	1.567	186.110	0.000
15	R Dry	0.000	R Dry	0.000	186.810	68.63	186.280	4.608	186.200	1.526	186.110	0.000
16	R Dry	0.000	R Dry	0.000	186.630	54.03	186.270	4.558	186.200	1.510	186.100	0.000
17	R Dry	0.000	R Dry	0.000	186.600	50.08	186.260	4.904	186.200	1.519	186.100	0.000
18	R Dry	0.000	R Dry	0.000	186.700	44.58 #	186.260	4.702	186.200	1.210 *	186.100	0.000
19	R Dry	0.000	R Dry	0.000	186.680	57.32	186.250	4.432	186.180	0.687	186.090	0.000
20	R Dry	0.000	R Dry	0.000	186.640	29.08	186.250	3.710 *	186.180	0.460 *	186.090	0.000
21	R Dry	0.000	R Dry	0.000	186.590	26.09	186.290	5.444	186.180	0.460 *	186.060	0.000
22	R Dry	0.000	R Dry	0.000	186.560	24.71	186.300	6.086	186.180	0.460 *	186.060	0.000
23	R Dry	0.000	R Dry	0.000	186.540	23.52	186.300	6.181	186.180	0.460 *	186.060	0.000
24	R Dry	0.000	R Dry	0.000	186.520	20.60	186.350	11.40	186.180	0.460 *	186.060	0.000
25	186.400	14.47 #	R Dry	0.000	186.500	18.86	186.350	11.33	186.180	0.460 *	186.060	0.000
26	187.000	82.29 #	186.800	56.43 #	186.490	17.20	186.340	10.06	186.180	0.460 *	186.060	0.000
27	186.850	62.64 #	188.200	367.3	186.470	16.72	186.320	8.250 *	186.150	0.000	186.060	0.000
28	186.750	50.41 #	189.900	606.4	186.450	14.27	186.310	4.342	186.140	0.000	186.050	0.000
29	186.700	44.58 *	190.250	750.5	186.440	14.59	186.290	4.061	186.140	0.000	186.050	0.000
30	186.680	42.31 *	188.275	375.1	186.440	14.72	186.280	3.728	186.140	0.000	186.050	0.000
31			187.690	216.2	186.410	13.56			186.120	0.000		
Ten-Daily Mean												
I Ten-Daily	R Dry	0.000	186.579	25.03	186.611	42.75	186.340	9.363	186.231	2.533	186.116	0.000
II Ten-Daily	R Dry	0.000	R Dry	0.000	186.698	52.13	186.275	5.114	186.196	1.298	186.103	0.000
III Ten-Daily	186.730	49.45	188.519	215.6	186.492	18.62	186.313	7.088	186.161	0.251	186.057	0.000
Monthly												
Min.	186.400	14.47	186.550	0.000	186.410	13.56	186.250	3.710	186.120	0.000	186.050	0.000
Max.	187.000	82.29	190.250	750.5	187.000	92.61	186.390	12.85	186.260	3.323	186.120	0.000
Mean	186.730	49.45	187.410	84.59	186.597	37.22	186.309	7.188	186.195	1.325	186.092	0

Annual Runoff in MCM = 374 Annual Runoff in mm = 170

Peak Observed Discharge = 750.5 cumecs on 29/07/2015 Corres. Water Level :190.25 m

Lowest Observed Discharge = 0.000 cumecs on 09/07/2015

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff

Stage-Discharge Data for the period 2015 - 2016

Station Name : Banas at Sarotry (01 02 02 003) **Division : Mahi Division, Gandhinagar**

Local River : Banas **Sub-Division : B.L.Sub Divn, Palanpur**

Day	Dec		Jan		Feb		Mar		Apr		May	
	W.L	Q	WL	Q	WL	Q	WL	Q	WL	Q	WL	Q
1	186.040	0.000	186.010	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
2	186.040	0.000	186.010	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
3	186.030	0.000	186.010	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
4	186.030	0.000	186.010	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
5	186.030	0.000	186.010	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
6	186.030	0.000	186.010	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
7	186.030	0.000	186.010	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
8	186.030	0.000	186.010	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
9	186.020	0.000	186.010	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
10	186.020	0.000	186.010	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
11	186.020	0.000	186.010	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
12	186.020	0.000	186.010	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
13	186.020	0.000	186.010	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
14	186.020	0.000	186.010	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
15	186.020	0.000	186.010	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
16	186.020	0.000	186.010	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
17	186.020	0.000	186.010	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
18	186.020	0.000	186.010	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
19	186.020	0.000	186.010	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
20	186.020	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
21	186.010	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
22	186.010	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
23	186.010	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
24	186.010	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
25	186.010	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
26	186.010	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
27	186.010	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
28	186.010	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
29	186.010	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
30	186.010	0.000	R Dry	0.000			R Dry	0.000	R Dry	0.000	R Dry	0.000
31	186.010	0.000	R Dry	0.000			R Dry	0.000			R Dry	0.000
Ten-Daily Mean												
I Ten-Daily	186.030	0.000	186.010	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
II Ten-Daily	186.020	0.000	186.010	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
III Ten-Daily	186.010	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
Monthly												
Min.	186.010	0.000	186.010	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
Max.	186.040	0.000	186.010	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
Mean	186.020	0	R Dry	0	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000

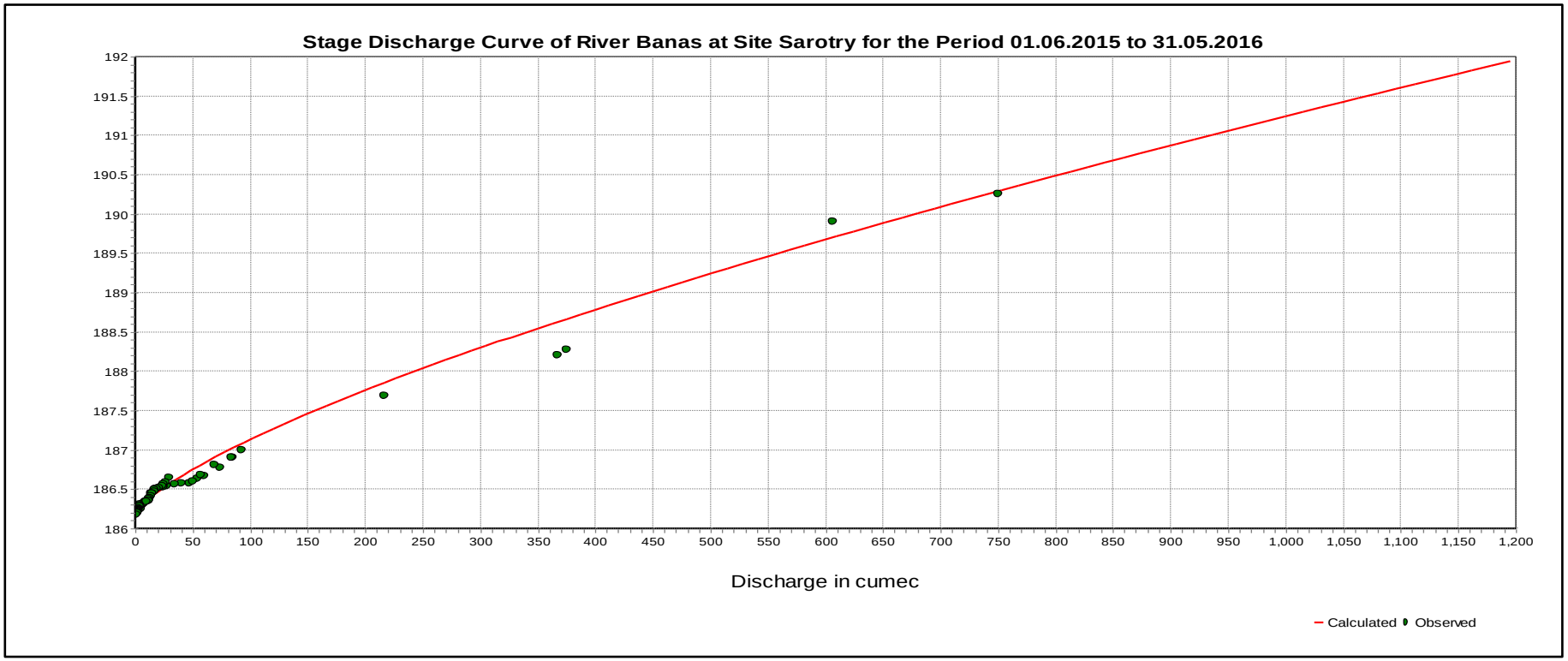
Peak Computed Discharge = 44.58 cumecs on 29/06/2015 Corres. Water Level :186.7 m

Lowest Computed Discharge = 0.460 cumecs on 20/10/2015 Corres. Water Level :186.18 m

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff



Procedure - Standard

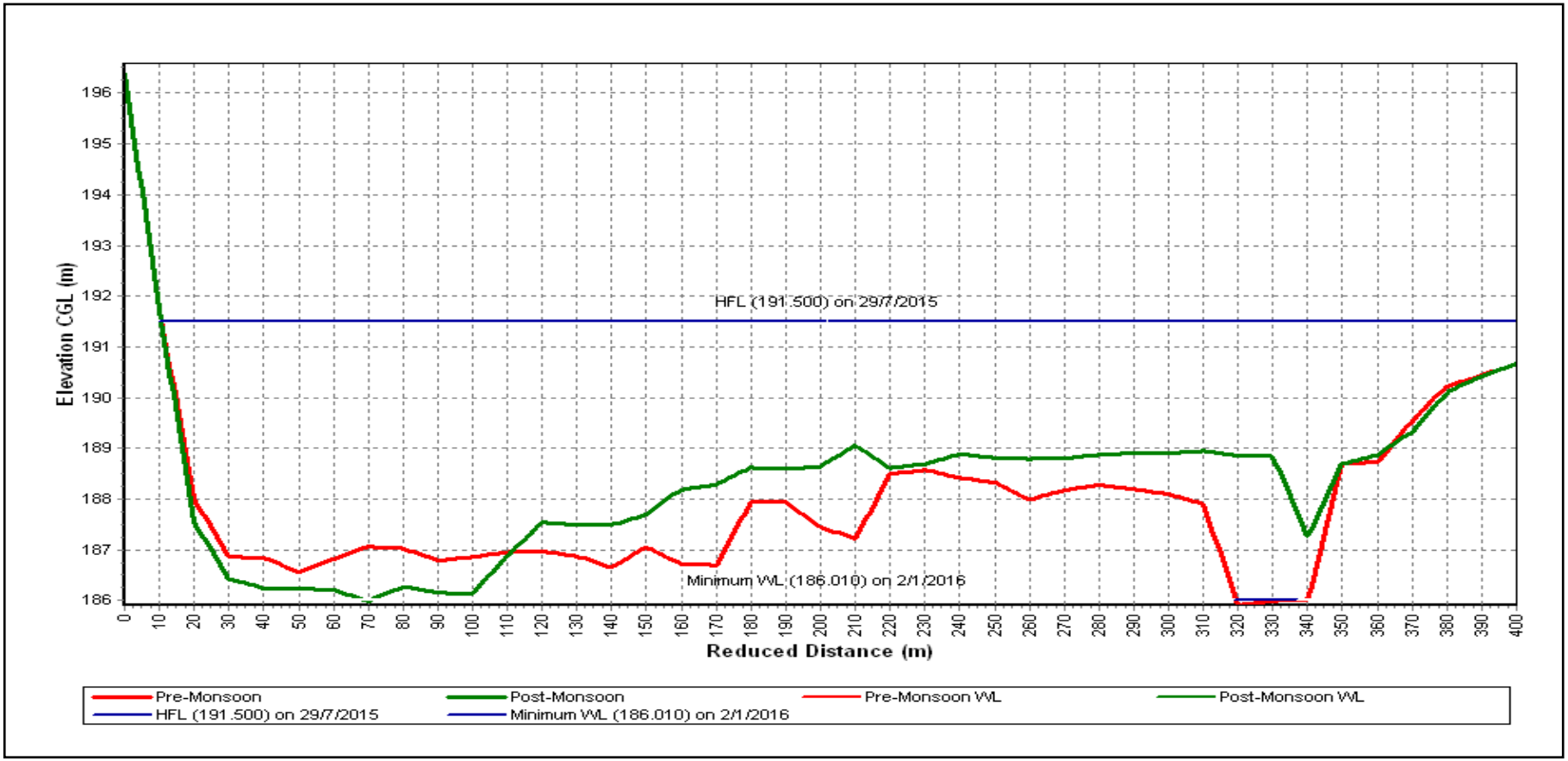
Equation Type - Power $Q=c*(h+a)^b$

LB	UB	a	b	c
186.15	192	-186.16	1.3873	104.81

Pre-Monsoon & Post-Monsoon X-Section for Water Year : 2015-2016

Station Name : Banas at Sarotry (01 02 02 003) **Division : Mahi Division, Gandhinagar**

Local River : Banas **Sub-Division : B.L.Sub Divn, Palanpur**



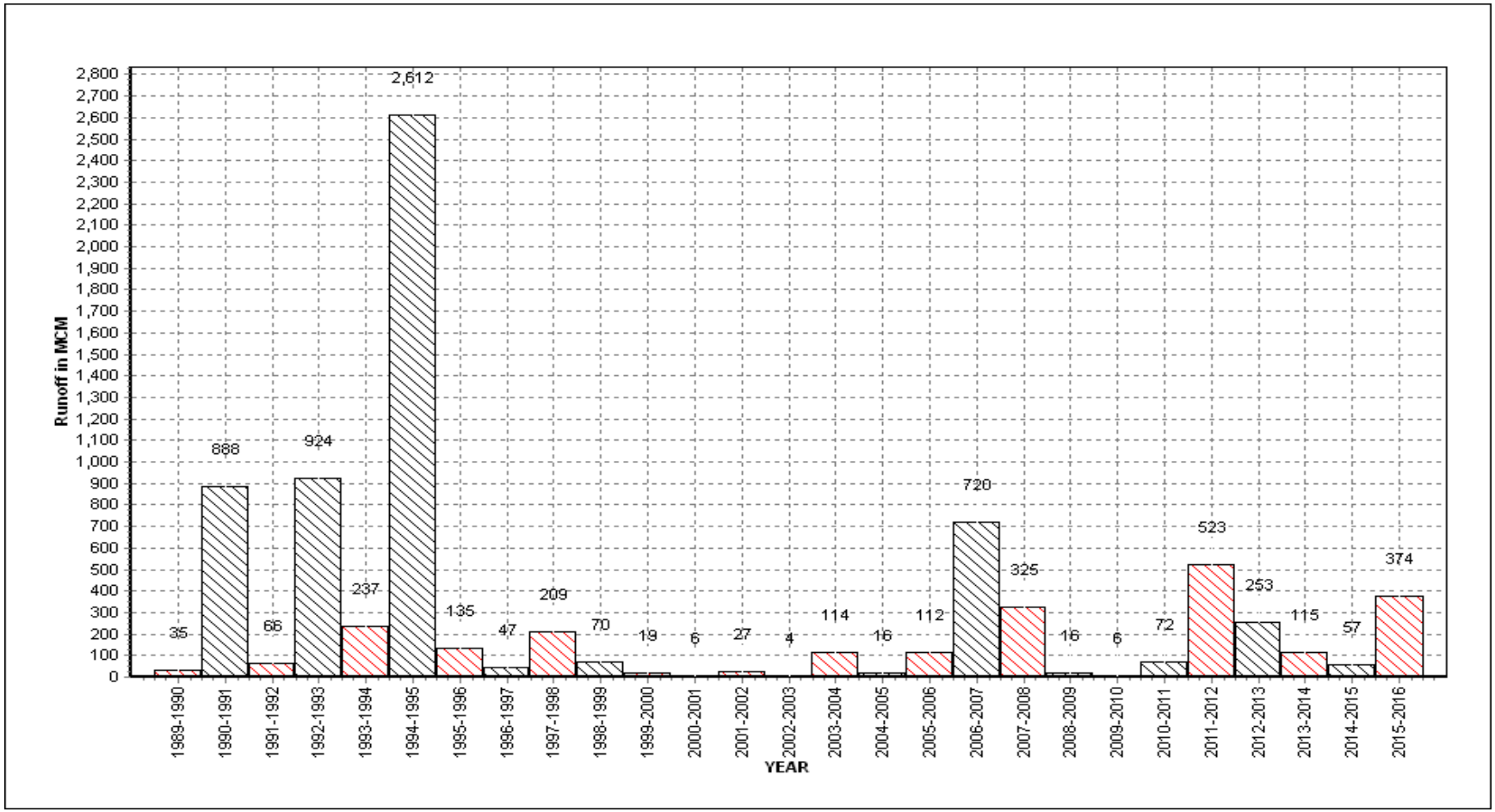
Historical Flood Level-194.31 m on 01.09.1973

Note: HFL marked on graph denotes Maximum Water Level observed during the Water Year 2015-16

Annual Runoff Values for the period: 1989 - 2016

Station Name : Banas at Sarotry (01 02 02 003) **Division : Mahi Division, Gandhinagar**

Local River : Banas **Sub-Division : B.L.Sub Divn, Palanpur**

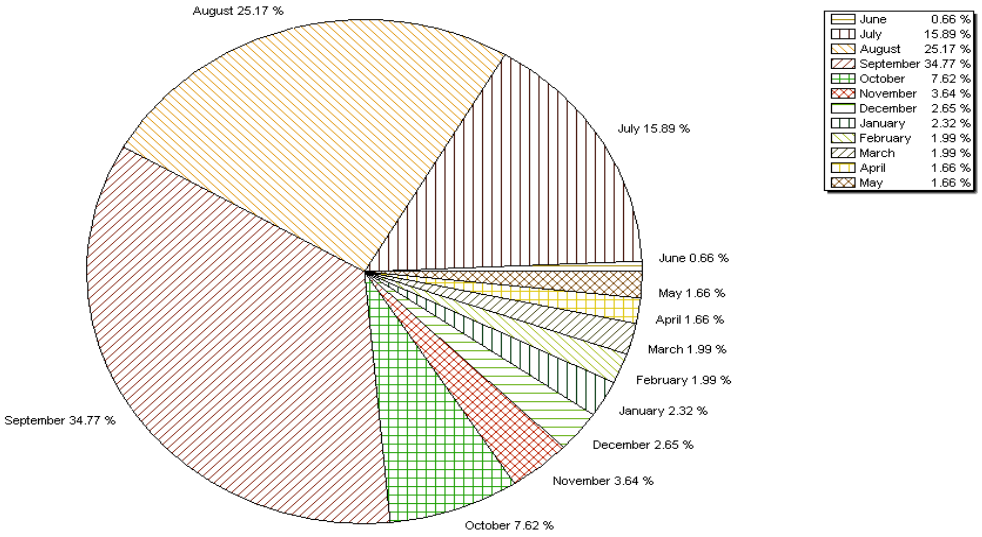


Note: Missing values have not been considered while arriving at Annual Runoff

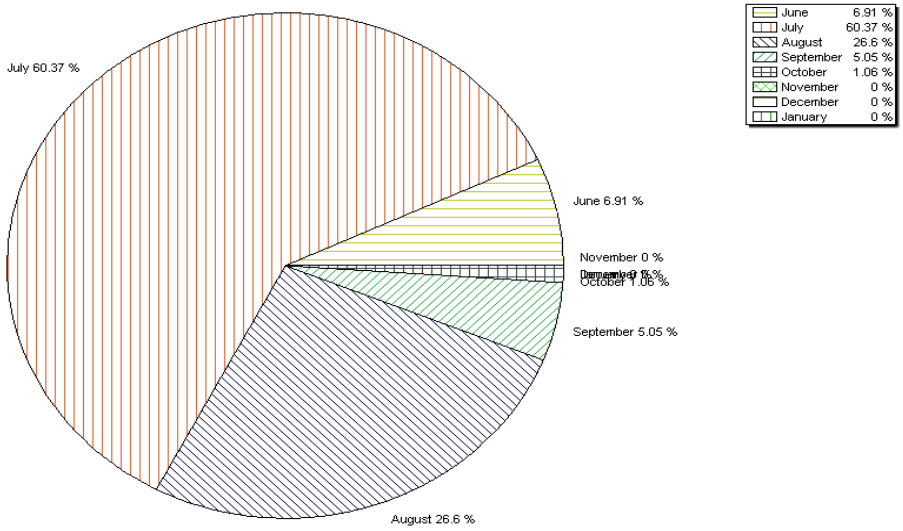
Station Name : Banas at Sarotry (01 02 02 003) **Division : Mahi Division, Gandhinagar**

Local River : Banas **Sub-Division : B.L.Sub Divn, Palanpur**

Monthly Average Runoff based on period : 1989-2015



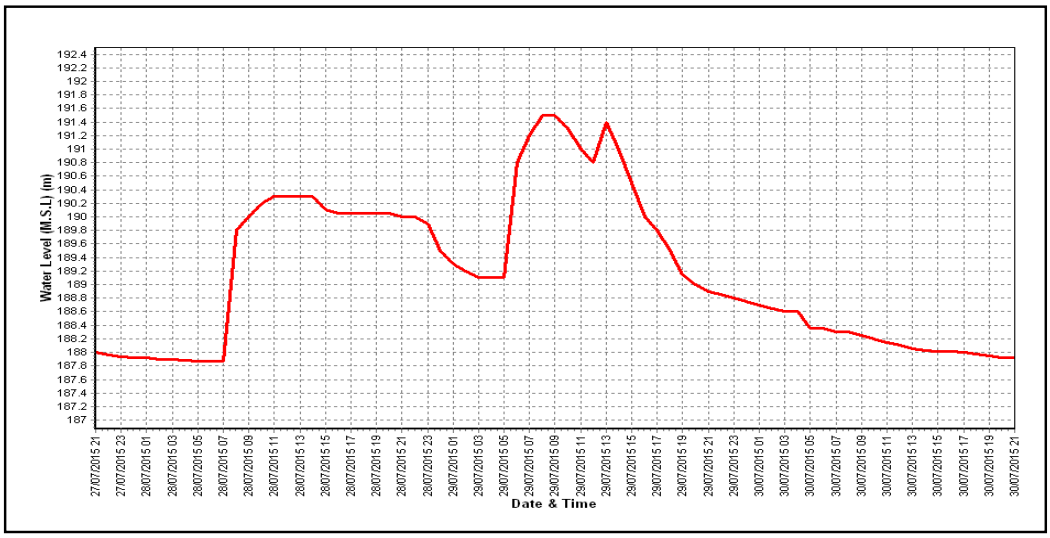
Monthly Runoff for the Year : 2015-2016



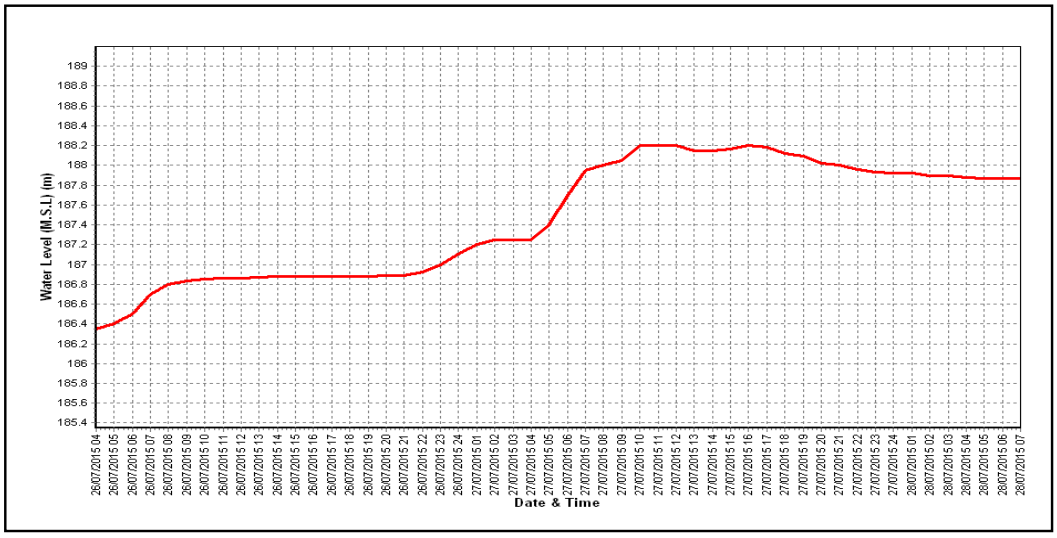
Station Name : Banas at Sarotry (01 02 02 003) **Division : Mahi Division, Gandhinagar**

Local River : Banas **Sub-Division : B.L.Sub Divn, Palanpur**

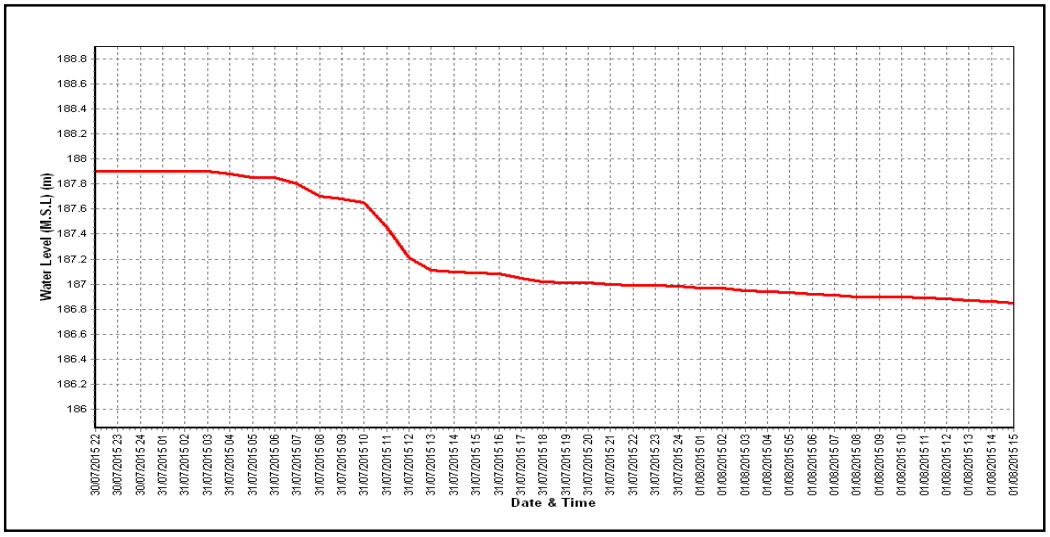
Water Level vs. Time - Graph of Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 2nd Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 3rd Highest Flood Peak during the Year : 2015-2016



Time Span: 72 Hrs

HISTORY SHEET

Site	:	**Banas at Abu Road**	**Water Year** **Code**	: :	**2015-16** **01 02 02 002**
State	:	Rajasthan	District		Sirohi
Basin	:	WFR of Kach.-Saur. & Luni	Independent River	:	Banas
Tributary	:	-	Sub Tributary	:	
Sub-Sub Tributary	:		Local River	:	Banas
Division	:	Mahi Division, Gandhinagar	Sub-Division	:	B.L.Sub Divn, Palanpur
Drainage Area	:	1600 Sq. Km.	Bank	:	Right
Latitude	:	24°29'38" N	Longitude	:	72°47'30" E
Zero of Gauge (m)	:	254.85 (m.s.l)	10/05/78		
		Opening Date	Closing Date		
Gauge	:	10/05/78			
Discharge	:	01/06/90			
Sediment	:	--			
Water Quality	:	01/07/88			

Annual Maximum / Minimum discharge with corresponding Water Level (m.s.l)

	Maximum			Minimum		
Year	**Q (cumecs)**	**WL (m)**	**Date**	**Q (cumecs)**	**WL (m)**	**Date**
1989-1990	53.42	255.918	26/08/89	0.000	River Dry	25/01/90
1990-1991	526.9	257.712	05/08/90	0.000	River Dry	05/06/90
1991-1992	38.71	256.890	26/07/91	0.000	River Dry	26/01/92
1992-1993	1164	258.397	08/09/92	0.000	River Dry	25/06/92
1993-1994	170.4	256.519	18/07/93	0.000	River Dry	07/05/94
1994-1995	1030	257.490	20/08/94	0.000	River Dry	12/06/94
1995-1996	327.0	256.450	25/07/95	0.000	River Dry	26/01/96
1996-1997	56.52	255.870	29/07/96	0.000	River Dry	04/12/96
1997-1998	96.00	256.150	02/08/97	0.000	River Dry	27/01/98
1998-1999	93.00	255.900	17/10/98	0.000	River Dry	25/01/99
1999-2000	34.55	255.265	22/06/99	0.000	River Dry	03/02/00
2000-2001	32.29	255.725	16/07/00	0.000	River Dry	25/01/01
2001-2002	46.77	255.675	04/07/01	0.000	River Dry	05/12/01
2002-2003	4.243	254.785	09/08/02	0.000	River Dry	25/01/03
2003-2004	72.55	255.590	29/07/03	0.000	254.360	27/10/03
2004-2005	20.38	255.000	02/08/04	0.000	River Dry	30/05/05
2005-2006	149.5	255.670	19/09/05	0.000	River Dry	01/06/05
2006-2007	585.8	256.985	20/08/06	0.000	River Dry	01/06/06
2007-2008	471.3	256.650	04/07/07	0.000	253.780	01/06/07
2008-2009	13.92	254.640	14/08/08	0.000	River Dry	01/06/08
2009-2010	11.57	254.640	14/08/08	0.000	River Dry	01/06/09
2010-2011	40.87	254.600	13/09/10	0.000	River Dry	01/06/10
2011-2012	338.2	258.200	09/08/11	0.000	253.500	26/05/12
2012-2013	347.5	257.750	08/09/12	0.000	253.500	31/05/13
2013-2014	118.1	255.35	29/09/13	0.000	River Dry	01/06/13
2014-2015	7.346	254.15	16/07/14	0.000	River Dry	01/06/14
2015-2016	29.38	254.56	25/06/15	0.000	253.650	01/11/15

Stage-Discharge Data for the period 2015 - 2016

Station Name : Banas at Abu Road (01 02 02 002) **Division : Mahi Division, Gandhinagar**

Local River : Banas **Sub-Division : B.L.Sub Divn, Palanpur**

Day	Jun		Jul		Aug		Sep		Oct		Nov	
	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q
1	R.dry	0.000	253.620	0.000	254.800	0.000	254.010	4.208	253.840	1.516	253.650	0.000
2	R.dry	0.000	253.600	0.000	254.600	0.000	253.990	3.942	253.820	1.193	253.650	0.000
3	R.dry	0.000	253.590	0.000	254.520	0.000	253.970	3.029	253.800	1.042	253.650	0.000
4	R.dry	0.000	253.590	0.000	254.430	0.000	253.950	2.811	253.780	0.922	253.650	0.000
5	R.dry	0.000	253.590	0.000	254.320	15.35 #	253.930	3.089	253.760	0.577	253.640	0.000
6	R.dry	0.000	253.580	0.000	254.270	11.70	253.910	2.877	253.740	0.531	253.640	0.000
7	R.dry	0.000	253.580	0.000	254.220	9.276	253.890	2.512	253.720	0.491	253.640	0.000
8	R.dry	0.000	253.580	0.000	254.170	9.030	253.870	2.403	253.720	0.508	253.620	0.000
9	R.dry	0.000	253.580	0.000	254.150	8.490	253.850	2.518	253.720	0.473	253.610	0.000
10	R.dry	0.000	253.580	0.000	254.140	8.815	253.840	2.281	253.710	0.427	253.610	0.000
11	R.dry	0.000	253.580	0.000	254.130	6.801	253.830	1.880	253.710	0.420	253.600	0.000
12	R.dry	0.000	253.580	0.000	254.220	9.711	253.820	1.899	253.700	0.435	253.590	0.000
13	R.dry	0.000	253.580	0.000	254.680	38.50 *	253.810	1.709	253.700	0.413	253.580	0.000
14	R.dry	0.000	253.580	0.000	254.640	35.30 *	253.800	1.648	253.700	0.394	253.580	0.000
15	R.dry	0.000	253.580	0.000	254.450	22.28 *	253.800	1.582	253.690	0.391	253.580	0.000
16	R.dry	0.000	253.580	0.000	254.360	17.32 *	253.795	1.388	253.680	0.293	253.580	0.000
17	R.dry	0.000	253.580	0.000	254.490	24.73 *	253.790	1.351	253.680	0.294	253.580	0.000
18	R.dry	0.000	253.580	0.000	254.490	24.73 *	253.784	1.261	253.675	0.237	253.570	0.000
19	R.dry	0.000	253.580	0.000	254.380	18.36 *	253.780	1.107	253.675	0.219	253.570	0.000
20	R.dry	0.000	253.580	0.000	254.280	13.52 *	253.790	1.233	253.670	0.208	253.570	0.000
21	R.dry	0.000	253.580	0.000	254.250	10.28	253.850	1.769	253.665	0.197	253.570	0.000
22	R.dry	0.000	253.900	0.000	254.230	9.774	253.957	3.098	253.660	0.184	253.570	0.000
23	R.dry	0.000	253.720	0.000	254.200	10.49	254.070	5.182	253.660	0.182	253.570	0.000
24	R.dry	0.000	253.670	0.000	254.165	10.14	254.020	4.042	253.660	0.177	253.560	0.000
25	254.560	29.38 #	253.800	0.000	254.150	10.02	253.980	3.459	253.655	0.162	253.550	0.000
26	254.242	10.04	253.790	0.000	254.130	9.014	253.940	3.456	253.655	0.141	253.550	0.000
27	253.940	3.120 #	256.850	0.000	254.110	8.885	253.930	3.007	253.650	0.129	253.550	0.000
28	253.800	1.140 #	257.300	0.000	254.090	5.273	253.900	2.812	253.650	0.170 *	253.550	0.000
29	253.700	0.380 *	257.900	0.000	254.070	5.087	253.880	2.379	253.650	0.170 *	253.550	0.000
30	253.630	0.100 #	256.600	0.000	254.050	4.675	253.860	1.550	253.650	0.170 *	253.550	0.000
31			255.350	0.000	254.030	4.448			253.650	0.170 *		
Ten-Daily Mean												
I Ten-Daily	R.dry	0.000	253.589	0.000	254.362	6.266	253.921	2.967	253.761	0.768	253.636	0.000
II Ten-Daily	R.dry	0.000	253.580	0.000	254.412	21.13	253.800	1.506	253.688	0.330	253.580	0.000
III Ten-Daily	253.979	4.416	255.133	0.000	254.134	8.008	253.939	3.075	253.655	0.169	253.557	0.000
Monthly												
Min.	253.630	0.000	253.580	0.000	254.030	0.000	253.780	1.107	253.650	0.129	253.550	0.000
Max.	254.560	29.38	257.900	0.000	254.800	38.50	254.070	5.182	253.840	1.516	253.650	0.000
Mean	253.979	1.472	254.134	0.000	254.297	11.68	253.887	2.516	253.700	0.414	253.591	0.000

Annual Runoff in MCM = 43 Annual Runoff in mm = 27

Peak Observed Discharge = 29.38 cumecs on 25/06/2015 Corres. Water Level :254.56 m

Lowest Observed Discharge = 0.000 cumecs on 01/06/2015

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff

Stage-Discharge Data for the period 2015 - 2016

Station Name : Banas at Abu Road (01 02 02 002) **Division : Mahi Division, Gandhinagar**

Local River : Banas **Sub-Division : B.L.Sub Divn, Palanpur**

Day	Dec		Jan		Feb		Mar		Apr		May	
	W.L	Q	WL	Q	WL	Q	WL	Q	WL	Q	WL	Q
1	253.540	0.000	253.530	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
2	253.540	0.000	253.530	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
3	253.540	0.000	253.530	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
4	253.540	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
5	253.540	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
6	253.540	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
7	253.540	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
8	253.540	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
9	253.530	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
10	253.530	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
11	253.530	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
12	253.530	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
13	253.530	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
14	253.530	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
15	253.530	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
16	253.530	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
17	253.530	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
18	253.530	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
19	253.530	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
20	253.530	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
21	253.530	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
22	253.530	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
23	253.530	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
24	253.530	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
25	253.530	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
26	253.530	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
27	253.530	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
28	253.530	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
29	253.530	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
30	253.530	0.000			R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
31	253.530	0.000			R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
Ten-Daily Mean												
I Ten-Daily	253.538	0.000	253.530	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
II Ten-Daily	253.530	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
III Ten-Daily	253.530	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
Monthly												
Min.	253.530	0.000	253.530	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
Max.	253.540	0.000	253.530	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
Mean	253.533	0.000	253.530	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000

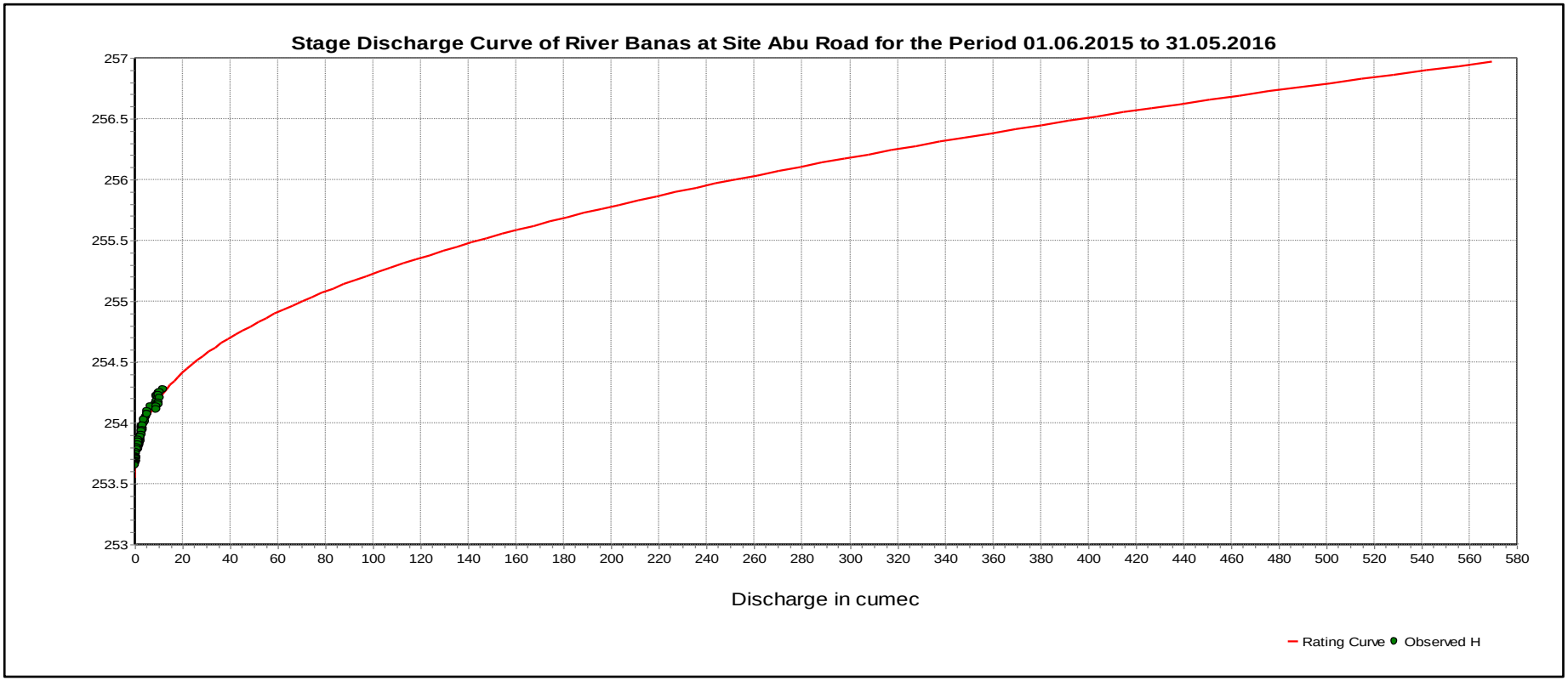
Peak Computed Discharge = 38.50 cumecs on 13/08/2015 Corres. Water Level :254.68 m

Lowest Computed Discharge = 0.000 cumecs on 01/07/2015 Corres. Water Level :253.62 m

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff



Procedure - Standard

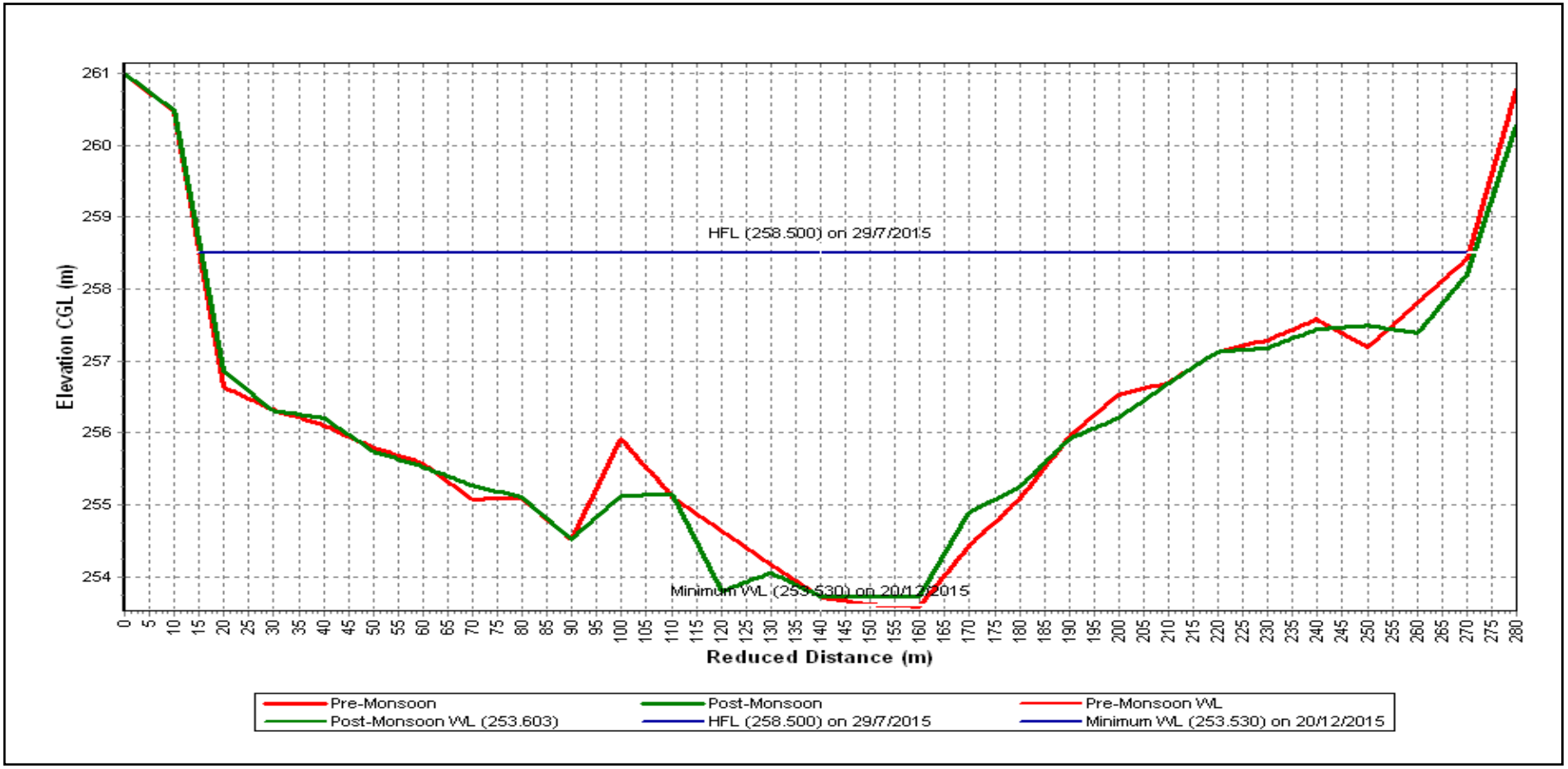
Equation Type - Power $Q=c*(h+a)^b$

LB	UB	a	b	c
253.55	257	-253.52	2.475	26.664

Pre-Monsoon & Post-Monsoon X-Section for Water Year : 2015-2016

Station Name : Banas at Abu Road (01 02 02 002) **Division : Mahi Division, Gandhinagar**

Local River : Banas **Sub-Division : B.L.Sub Divn, Palanpur**



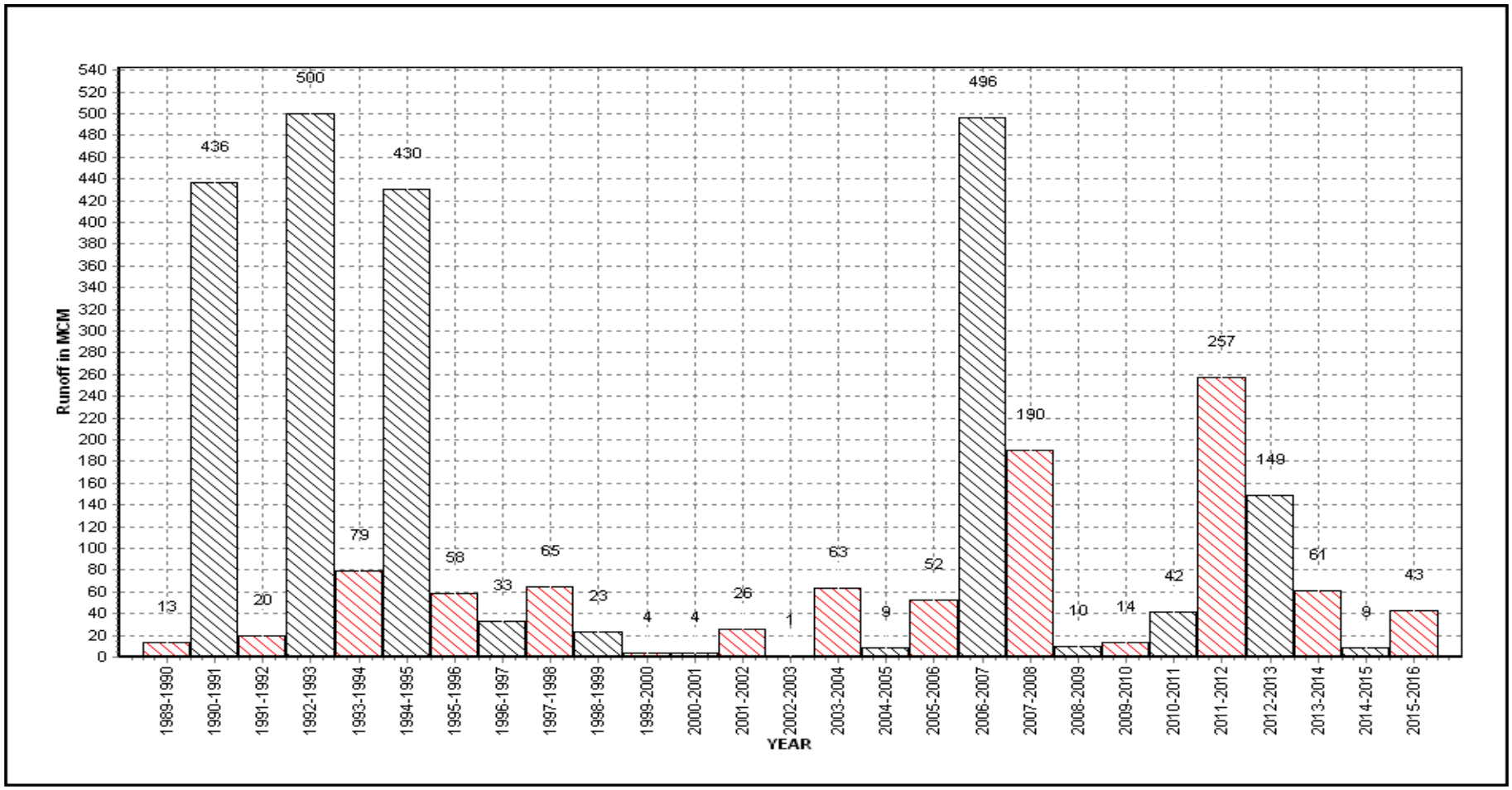
Historic Flood Level -265.400m on 31.08.1973

Note: HFL marked on graph denotes Max Water Level observed during the Water Year 2015-16

Annual Runoff Values for the period: 1989 - 2016

Station Name : Banas at Abu Road (01 02 02 002) **Division : Mahi Division, Gandhinagar**

Local River : Banas **Sub-Division : B.L.Sub Divn, Palanpur**

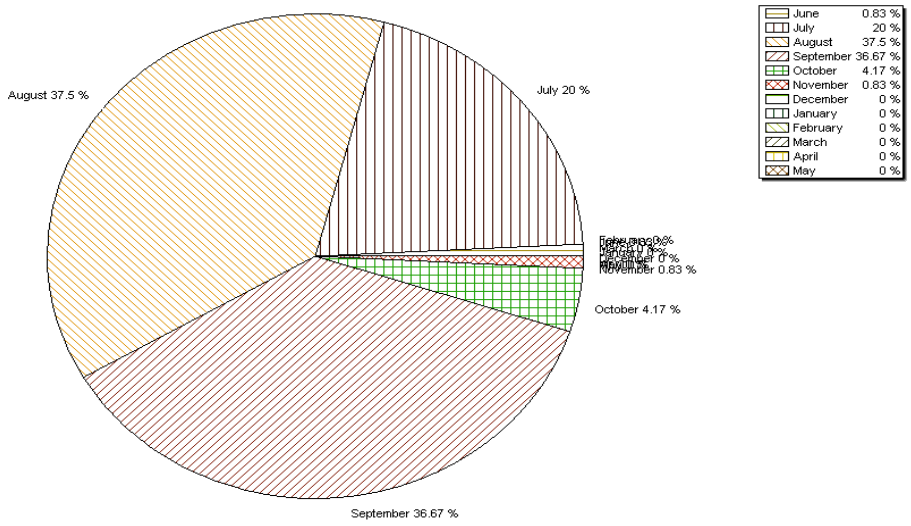


Note: Missing values have not been considered while arriving at Annual Runoff

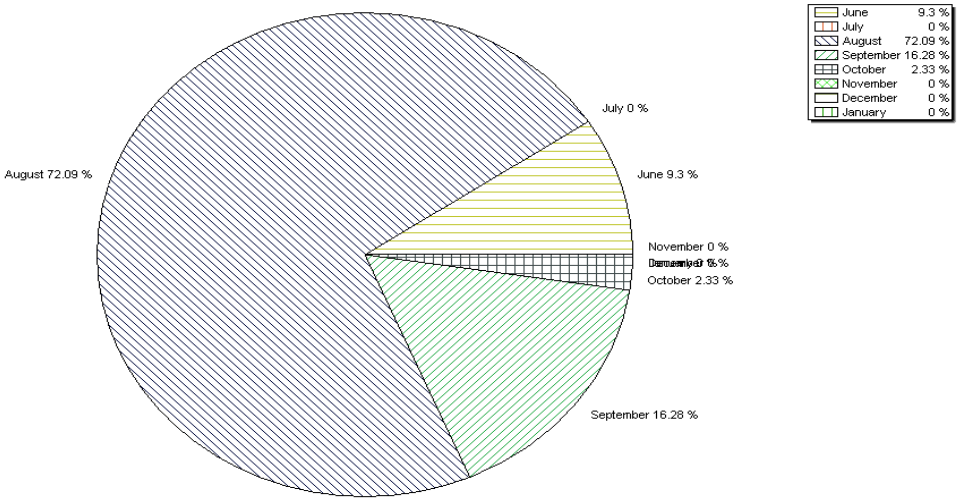
Station Name : Banas at Abu Road (01 02 02 002) **Division : Mahi Division, Gandhinagar**

Local River : Banas **Sub-Division : B.L.Sub Divn, Palanpur**

Monthly Average Runoff based on period : 1989-2015



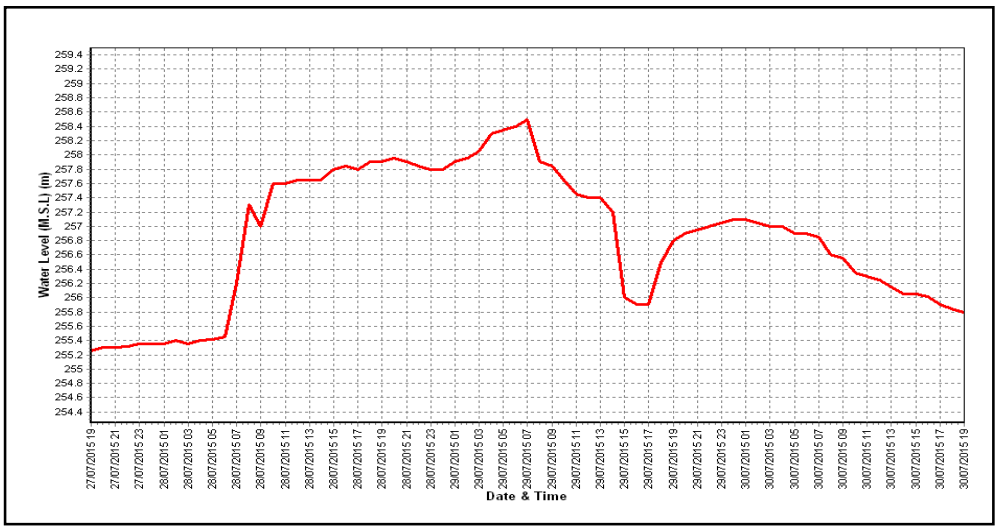
Monthly Runoff for the Year : 2015-2016



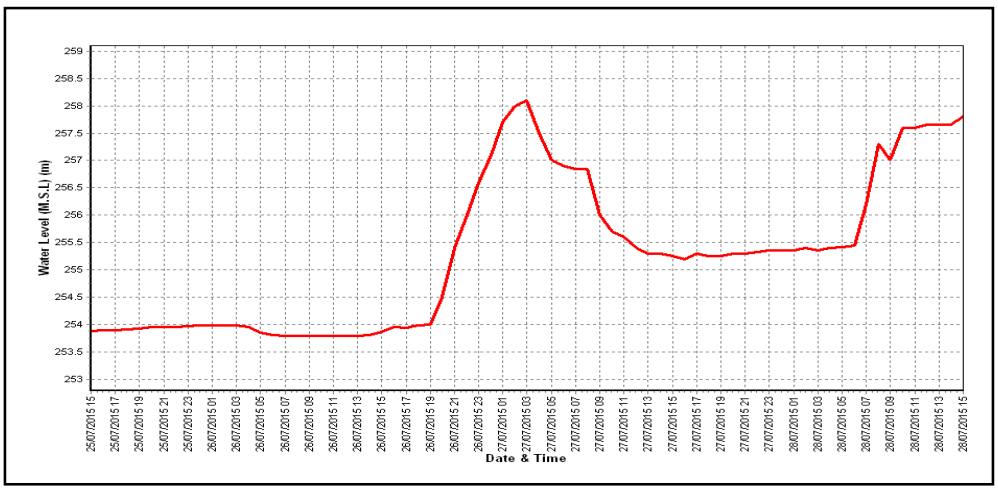
Station Name : Banas at Abu Road (01 02 02 002) **Division : Mahi Division, Gandhinagar**

Local River : Banas **Sub-Division : B.L.Sub Divn, Palanpur**

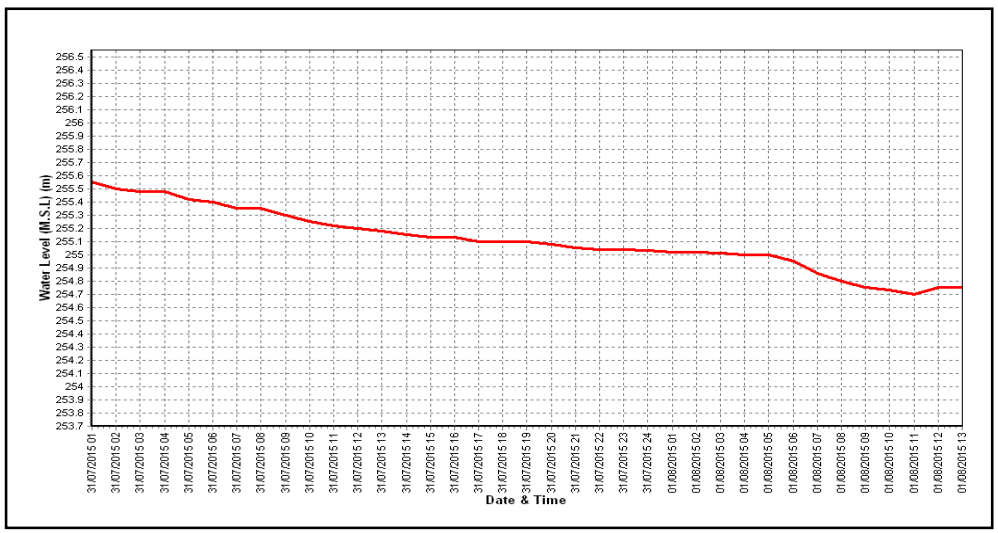
Water Level vs. Time - Graph of Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 2nd Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 3rd Highest Flood Peak during the Year : 2015-2016



Time Span: 72 Hrs

HISTORY SHEET

Water Year : 2015-16

Site : Shetrunji at Lowara

Code : 01 02 09 001

State : Gujarat

District : Bhavnagar

Basin : WFR of Kach.-Saur. & Luni

Independent River : Shetrunji

Tributary : Shetrunji

Sub Tributary :

Sub-Sub Tributary :

Local River : Shetrunji

Division : Mahi Division, Gandhinagar

Sub-Division : Sabarmati Sub Divn., Ahmedabad

Drainage Area : 3953 Sq. Km.

Bank : Left

Latitude : 21°26'36" N

Longitude : 71°33'42" E

Zero of Gauge (m) : 56 (m.s.l)

01/02/91 - -

Opening Date

Closing Date

Gauge : 29/11/70
Discharge : 29/11/70
Sediment : 25/07/73
Water Quality : 01/07/77

Annual Maximum / Minimum discharge with corresponding Water Level (m.s.l)

	Maximum			Minimum		
Year	**Q (cumecs)**	**WL (m)**	**Date**	**Q (cumecs)**	**WL (m)**	**Date**
1971-1972	660.0	61.740	01/09/71	0.000	57.240	15/06/71
1972-1973	0.000	57.325	24/06/72	0.000	River Dry	20/01/73
1973-1974	620.0	62.980	27/09/73	0.000	River Dry	10/05/74
1974-1975	587.4	62.150	06/07/74	0.000	River Dry	25/01/75
1975-1976	169.7	60.350	02/08/75	0.000	River Dry	29/01/76
1976-1977	151.9	60.410	18/07/76	0.000	River Dry	21/06/76
1977-1978	352.1	61.400	03/09/77	0.000	River Dry	09/04/78
1978-1979	76.40	58.553	30/08/78	0.000	River Dry	12/06/78
1979-1980	710.0	65.225	11/08/79	0.000	57.040	10/02/80
1980-1981	610.0	64.150	03/07/80	0.000	River Dry	23/01/81
1981-1982	472.0	62.800	24/07/81	0.000	River Dry	22/05/82
1982-1983	880.0	66.930	09/11/82	0.000	River Dry	07/04/83
1983-1984	932.0	66.630	20/07/83	0.000	River Dry	19/06/83
1984-1985	76.50	58.455	15/09/84	0.000	River Dry	21/03/85
1985-1986	82.40	58.635	19/07/85	0.000	River Dry	12/01/86
1986-1987	615.0	62.110	25/06/86	0.000	River Dry	30/12/86
1987-1988	167.9	59.450	21/08/87	0.000	River Dry	31/12/87
1988-1989	870.0	64.020	28/07/88	0.000	River Dry	05/12/88
1989-1990	900.0	62.930	24/07/89	0.000	River Dry	11/03/90
1990-1991	407.1	61.630	17/08/90	0.000	River Dry	25/04/91
1991-1992	446.2	59.660	28/07/91	0.000	River Dry	16/12/91
1992-1993	268.4	59.550	04/09/92	0.000	River Dry	04/02/93

1993-1994	476.2	61.360	25/09/93	0.000	River Dry	01/12/93
1994-1995	722.7	62.298	31/08/94	0.000	56.690	12/02/95
1995-1996	185.9	59.110	02/09/95	0.000	River Dry	08/04/96
1996-1997	442.0	62.600	20/06/96	0.000	River Dry	05/03/97
1997-1998	77.00	58.440	04/07/97	0.000	River Dry	24/11/97
1998-1999	546.0	63.000	28/08/98	0.000	River Dry	25/01/99
1999-2000	84.00	58.100	03/10/99	0.000	River Dry	13/01/00
2000-2001	5.500	57.025	24/08/00	0.000	River Dry	25/01/01
2001-2002	602.0	60.425	17/06/01	0.000	River Dry	25/01/02
2002-2003	2075	64.080	29/06/02	0.000	River Dry	25/01/03
2003-2004	554.9	60.240	07/08/03	0.000	River Dry	02/02/04
2004-2005	1010	61.440	06/08/04	0.000	River Dry	11/02/05
2005-2006	2441	64.350	29/06/05	0.000	River Dry	01/06/05
2006-2007	880.9	60.800	30/07/06	0.000	River Dry	01/06/06
2007-2008	809.4	60.900	26/09/07	0.000	River Dry	01/06/07
2008-2009	1027	61.120	29/07/08	0.000	River Dry	01/06/08
2009-2010	417	60.150	18/07/09	0.000	River Dry	01/06/09
2010-2011	713.5	60.300	01/09/10	0.000	River Dry	01/06/10
2011-2012	854.8	61.380	18/07/11	0.000	River Dry	08/07/11
2012-2013	220.0	58.690	03/09/12	0.000	River Dry	25/06/12
2013-2014	1759	63.1	03/08/13	0.000	River Dry	01/06/13
2014-2015	340.9	59.18	02/09/14	0.000	River Dry	01/06/14
2015-2016	407.4	59.475	24/06/15	0.000	River Dry	01/06/15

Stage-Discharge Data for the period 2015 - 2016

Station Name : Shetrunji at Lowara (01 02 09 001) **Division : Mahi Division, Gandhinagar**

Local River : Shetrunji **Sub-Division : Sabarmati Sub Divn., Ahmedabad**

Day	Jun		Jul		Aug		Sep		Oct		Nov	
	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q
1	R Dry	0.000	56.490	1.218	56.610	2.494	56.460	0.719	56.550	1.556	56.415	0.360 *
2	R Dry	0.000	56.460	0.896	56.570	2.210 *	56.445	0.615	56.535	1.640 *	56.410	0.402
3	R Dry	0.000	56.490	0.775	56.540	1.468	56.440	0.573	56.525	1.500 *	56.420	0.442
4	R Dry	0.000	56.480	0.714	56.525	1.351	56.430	0.519	56.520	1.430 *	56.415	0.419
5	R Dry	0.000	56.470	0.830 *	56.510	1.195	56.425	0.505	56.515	1.394	56.415	0.414
6	R Dry	0.000	56.460	0.565	56.505	1.145	56.420	0.390 *	56.510	1.308	56.410	0.400
7	R Dry	0.000	56.450	0.545	56.495	1.086	56.415	0.385	56.495	1.168	56.410	0.394
8	R Dry	0.000	56.450	0.542	56.495	1.101	56.410	0.374	56.490	1.060	56.410	0.330 *
9	R Dry	0.000	56.450	0.523	56.495	1.110 *	56.410	0.377	56.485	1.036	56.395	0.342
10	R Dry	0.000	56.450	0.547	56.485	0.989	56.400	0.357	56.480	0.993	56.390	0.299
11	R Dry	0.000	56.440	0.484	56.480	0.959	56.635	2.892	56.480	0.930 *	56.390	0.214 *
12	56.890	11.57 *	56.440	0.550 *	56.480	0.942	56.470	0.738	56.480	0.941	56.385	0.190 *
13	56.400	0.270 *	56.430	0.415	56.480	0.942	57.205	35.90	56.475	0.906	56.385	0.190 *
14	57.740	76.81 *	56.430	0.411	56.495	1.177	57.165	26.06	56.470	0.900	56.385	0.190 *
15	56.720	5.630 *	56.420	0.379	57.020	35.28	56.685	3.783	56.470	0.860	56.385	0.190 *
16	57.295	44.95	56.420	0.374	56.810	8.500 *	56.565	1.693	56.465	0.809	56.385	0.190 *
17	56.850	9.970 *	56.410	0.317	56.630	2.871	56.520	1.430 *	56.465	0.801	56.385	0.190 *
18	56.710	6.683	56.410	0.330 *	56.555	1.635	56.485	0.897	56.460	0.730 *	56.390	0.214 *
19	56.440	1.429	56.410	0.330 *	56.520	1.337	56.575	1.786	56.455	0.770	56.390	0.214 *
20	56.350	0.060 *	56.410	0.313	56.500	1.133	62.250	1557 *	56.455	0.754	56.390	0.214 *
21	56.310	0.000 *	56.405	0.282	56.490	1.074	57.550	75.80	56.450	0.582	56.385	0.190 *
22	56.280	0.000 *	56.405	0.281	56.485	0.920	56.913	11.12	56.450	0.630 *	56.380	0.167 *
23	56.395	0.240 *	58.280	190.6	56.485	0.990 *	56.753	4.862	56.450	0.576	56.375	0.140 *
24	59.475	407.4	56.860	6.850	56.475	0.848	56.678	3.287	56.440	0.550 *	56.370	0.120 *
25	63.330	2218 *	56.640	3.293	56.470	0.793	56.630	3.380 *	56.440	0.550 *	56.370	0.120 *
26	57.070	28.62	56.560	2.040 *	56.465	0.750	56.600	1.998	56.440	0.545	56.370	0.120 *
27	56.770	5.905	56.580	2.001	56.460	0.728	56.580	2.380 *	56.430	0.505	56.365	0.000
28	56.650	3.820 *	58.025	155.2	56.460	0.726	56.570	1.704	56.430	0.495	56.360	0.000
29	56.570	2.002	57.040	26.55	56.460	0.737	56.560	1.522	56.425	0.471	56.350	0.000
30	56.520	1.500	56.810	5.893	56.460	0.730 *	56.550	1.572	56.425	0.466	56.350	0.000
31			56.660	3.192	56.485	0.952			56.420	0.439		
Ten-Daily Mean												
I Ten-Daily	R Dry	0.000	56.465	0.715	56.523	1.415	56.425	0.481	56.510	1.309	56.409	0.380
II Ten-Daily	56.822	17.49	56.422	0.390	56.597	5.478	57.256	163.2	56.467	0.840	56.387	0.200
III Ten-Daily	57.537	266.7	56.933	36.02	56.472	0.841	56.738	10.76	56.436	0.528	56.368	0.086
Monthly												
Min.	56.280	0.000	56.405	0.281	56.460	0.726	56.400	0.357	56.420	0.439	56.350	0.000
Max.	63.330	2218	58.280	190.6	57.020	35.28	62.250	1557	56.550	1.640	56.420	0.442
Mean	57.198	148.7	56.617	13.14	56.529	2.522	56.806	58.15	56.470	0.881	56.388	0.222

Annual Runoff in MCM = 440 Annual Runoff in mm = 111

Peak Observed Discharge = 407.4 cumecs on 24/06/2015 Corres. Water Level :59.475 m

Lowest Observed Discharge = 0.000 cumecs on 27/11/2015 Corres. Water Level :56.365 m

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

Note:Missing values ignored while arriving at Annual Runoff

Stage-Discharge Data for the period 2015 - 2016

Station Name : Shetrunji at Lowara (01 02 09 001) **Division : Mahi Division, Gandhinagar**

Local River : Shetrunji **Sub-Division : Sabarmati Sub Divn., Ahmedabad**

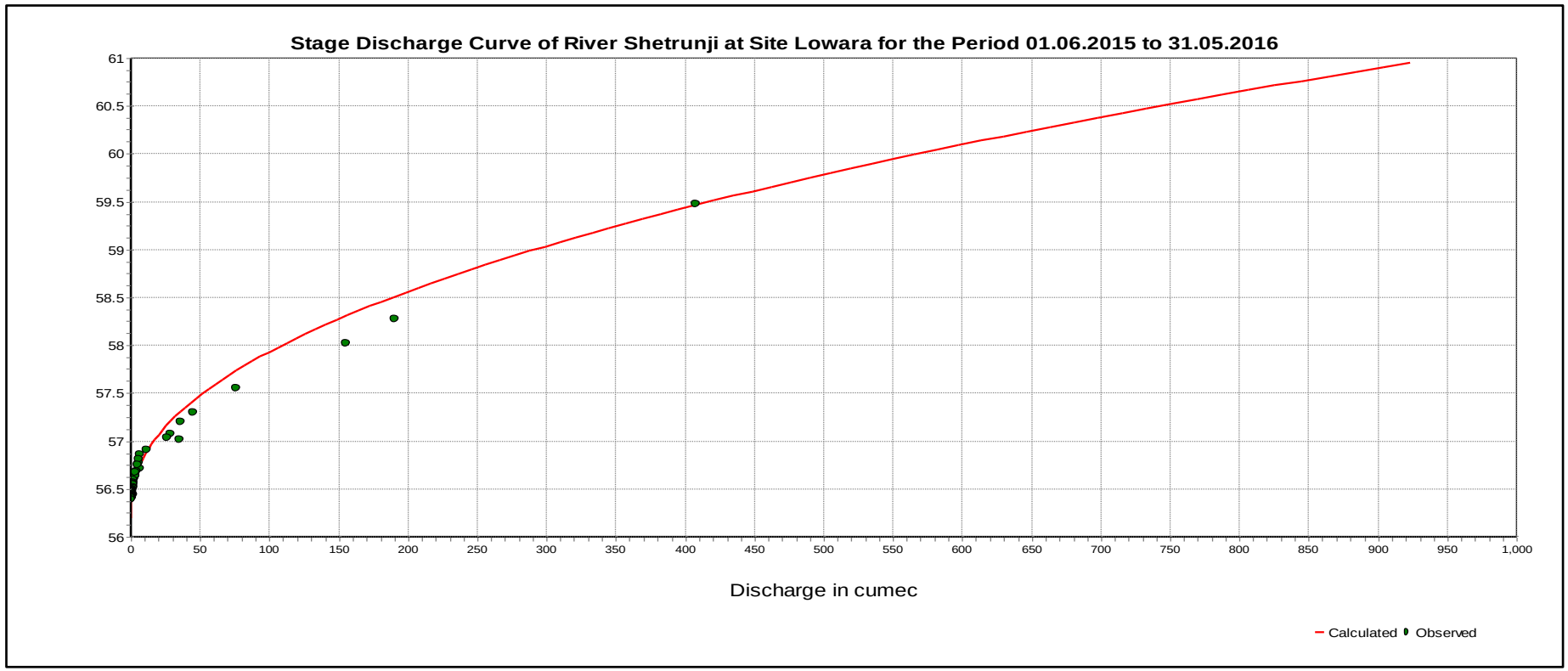
Day	Dec		Jan		Feb		Mar		Apr		May	
	W.L	Q	WL	Q	WL	Q	WL	Q	WL	Q	WL	Q
1	56.345	0.000	56.265	0.000	56.220	0.000	56.130	0.000	56.010	0.000	R Dry	0.000 *
2	56.340	0.000	56.265	0.000	56.220	0.000	56.120	0.000	56.010	0.000	R Dry	0.000
3	56.335	0.000	56.260	0.000	56.215	0.000	56.115	0.000	56.005	0.000	R Dry	0.000
4	56.330	0.000	56.260	0.000	56.215	0.000	56.110	0.000	R Dry	0.000	R Dry	0.000
5	56.330	0.000	56.260	0.000	56.210	0.000	56.105	0.000	R Dry	0.000	R Dry	0.000
6	56.325	0.000	56.260	0.000	56.210	0.000	56.095	0.000	R Dry	0.000	R Dry	0.000
7	56.325	0.000	56.260	0.000	56.210	0.000	56.090	0.000	R Dry	0.000	R Dry	0.000
8	56.320	0.000	56.260	0.000	56.205	0.000	56.085	0.000	R Dry	0.000	R Dry	0.000
9	56.315	0.000	56.255	0.000	56.205	0.000	56.085	0.000	R Dry	0.000	R Dry	0.000
10	56.315	0.000	56.255	0.000	56.205	0.000	56.080	0.000	R Dry	0.000	R Dry	0.000
11	56.310	0.000	56.255	0.000	56.200	0.000	56.075	0.000	R Dry	0.000	R Dry	0.000
12	56.305	0.000	56.255	0.000	56.200	0.000	56.075	0.000	R Dry	0.000	R Dry	0.000
13	56.305	0.000	56.255	0.000	56.195	0.000	56.070	0.000	R Dry	0.000	R Dry	0.000
14	56.300	0.000	56.255	0.000	56.195	0.000	56.070	0.000	R Dry	0.000	R Dry	0.000
15	56.295	0.000	56.250	0.000	56.190	0.000	56.070	0.000	R Dry	0.000	R Dry	0.000
16	56.290	0.000	56.250	0.000	56.180	0.000	56.065	0.000	R Dry	0.000	R Dry	0.000
17	56.285	0.000	56.250	0.000	56.170	0.000	56.060	0.000	R Dry	0.000	R Dry	0.000
18	56.280	0.000	56.250	0.000	56.165	0.000	56.055	0.000	R Dry	0.000	R Dry	0.000
19	56.275	0.000	56.250	0.000	56.165	0.000	56.055	0.000	R Dry	0.000	R Dry	0.000
20	56.275	0.000	56.250	0.000	56.160	0.000	56.050	0.000	R Dry	0.000	R Dry	0.000
21	56.270	0.000	56.230	0.000	56.160	0.000	56.050	0.000	R Dry	0.000	R Dry	0.000
22	56.270	0.000	56.230	0.000	56.160	0.000	56.045	0.000	R Dry	0.000	R Dry	0.000
23	56.270	0.000	56.230	0.000	56.155	0.000	56.040	0.000	R Dry	0.000	R Dry	0.000
24	56.270	0.000	56.230	0.000	56.155	0.000	56.035	0.000	R Dry	0.000	R Dry	0.000
25	56.270	0.000	56.225	0.000	56.150	0.000	56.030	0.000	R Dry	0.000	R Dry	0.000
26	56.265	0.000	56.225	0.000	56.145	0.000	56.025	0.000	R Dry	0.000	R Dry	0.000
27	56.265	0.000	56.225	0.000	56.145	0.000	56.020	0.000	R Dry	0.000	R Dry	0.000
28	56.265	0.000	56.225	0.000	56.145	0.000	56.015	0.000	R Dry	0.000	R Dry	0.000
29	56.265	0.000	56.225	0.000	56.140	0.000	56.015	0.000	R Dry	0.000	R Dry	0.000
30	56.265	0.000	56.225	0.000			56.010	0.000	R Dry	0.000	R Dry	0.000
31	56.265	0.000	56.225	0.000			56.010	0.000			R Dry	0.000
Ten-Daily Mean												
I Ten-Daily	56.328	0.000	56.260	0.000	56.211	0.000	56.102	0.000	56.008	0.000	R Dry	0.000
II Ten-Daily	56.292	0.000	56.252	0.000	56.182	0.000	56.065	0.000	R Dry	0.000	R Dry	0.000
III Ten-Daily	56.267	0.000	56.227	0.000	56.151	0.000	56.027	0.000	R Dry	0.000	R Dry	0.000
Monthly												
Min.	56.265	0.000	56.225	0.000	56.140	0.000	56.010	0.000	56.005	0.000	R Dry	0.000
Max.	56.345	0.000	56.265	0.000	56.220	0.000	56.130	0.000	56.010	0.000	R Dry	0.000
Mean	56.295	0	56.246	0	56.182	0	56.063	0	56.008	0	R Dry	0.000

Peak Computed Discharge = 2218 cumecs on 25/06/2015 Corres. Water Level :63.33 m

Lowest Computed Discharge = 0.000 cumecs on 21/06/2015 Corres. Water Level :56.31 m

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

Note:Missing values ignored while arriving at Annual Runoff



Procedure - Standard

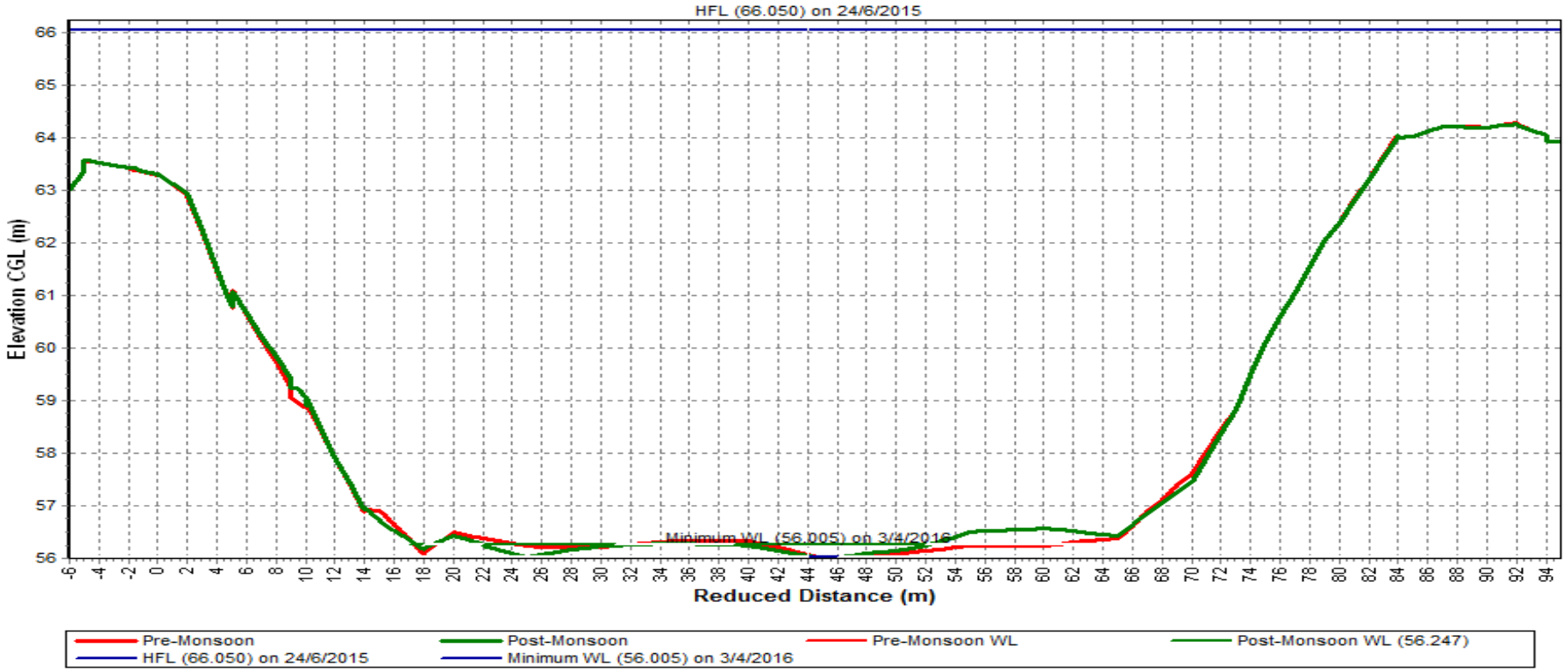
Equation Type - Power $Q=c*(h+a)^b$

LB	UB	a	b	c
56.2	61	-56.3	2.121	35.441

Premonsoon and Post Monsoon X- section for Water Year 2015-16

Station Name: Shetrunji at Lowara **Division : Mahi Division Gandhinagar**

Local River : Shetrunji **Sub Division : Sabarmati Sub Div Ahmedabad**



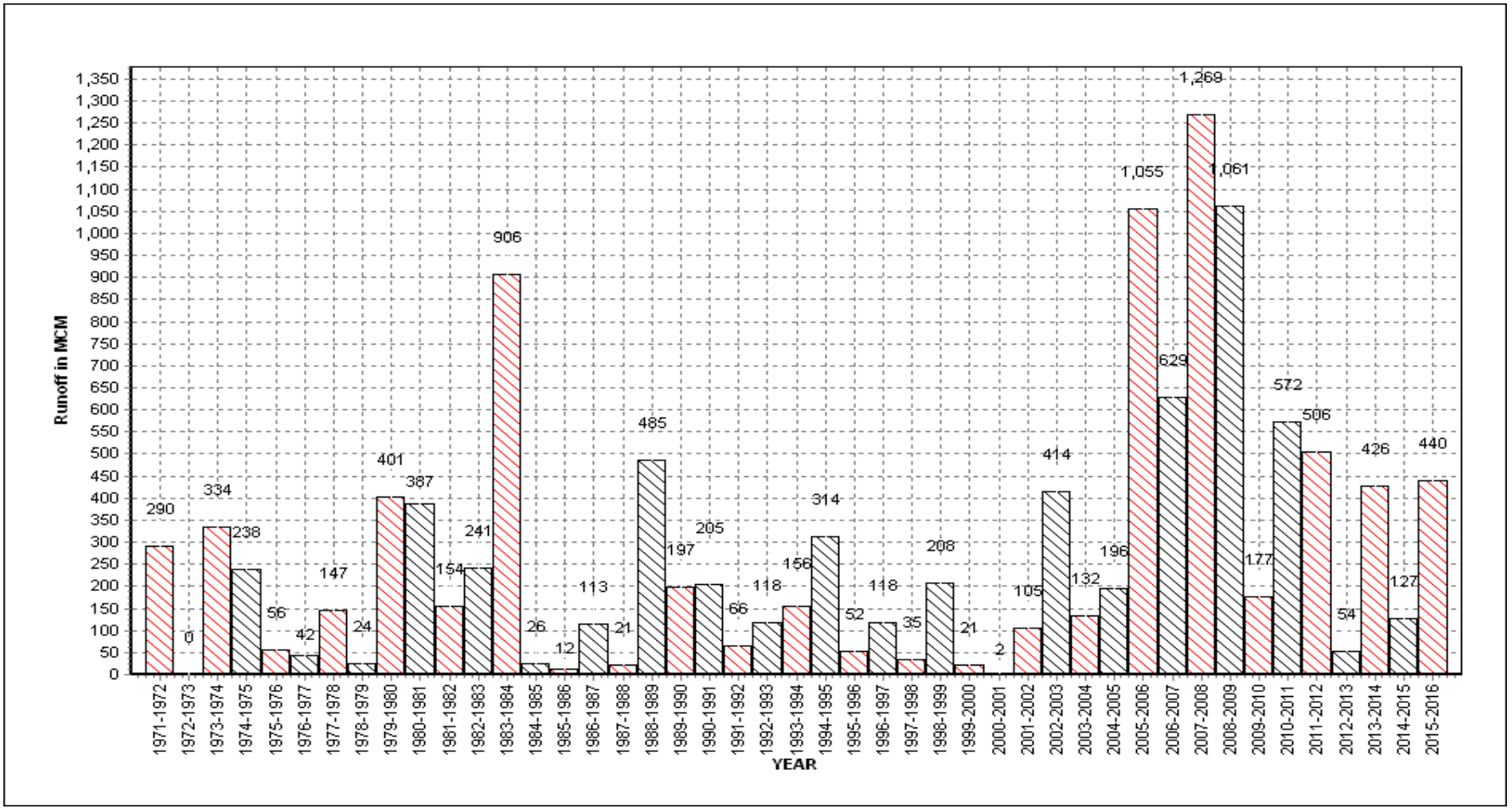
Historic Flood Level-66.93 m on 09.11.1982 at 0800hrs

Note: HFL marked on graph denotes Maximum Water Level observed during the Water Year 2015-16

Annual Runoff Values for the period: 1971 - 2016

Station Name : Shetrunji at Lowara (01 02 09 001) **Division : Mahi Division, Gandhinagar**

Local River : Shetrunji **Sub-Division : Sabarmati Sub Divn., Ahmedabad**

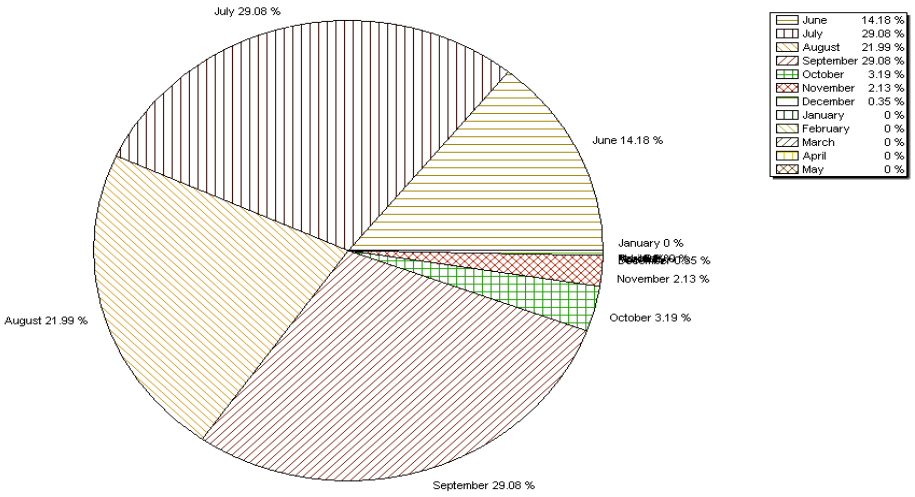


Note: Missing values have not been considered while arriving at Annual Runoff

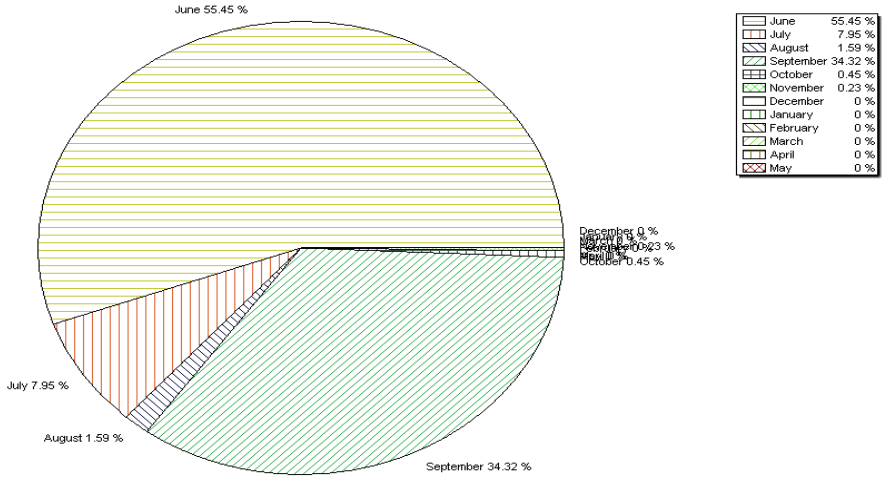
Station Name : Shetrunji at Lowara (01 02 09 001) **Division : Mahi Division, Gandhinagar**

Local River : Shetrunji **Sub-Division : Sabarmati Sub Divn., Ahmedabad**

Monthly Average Runoff based on period : 1971-2015



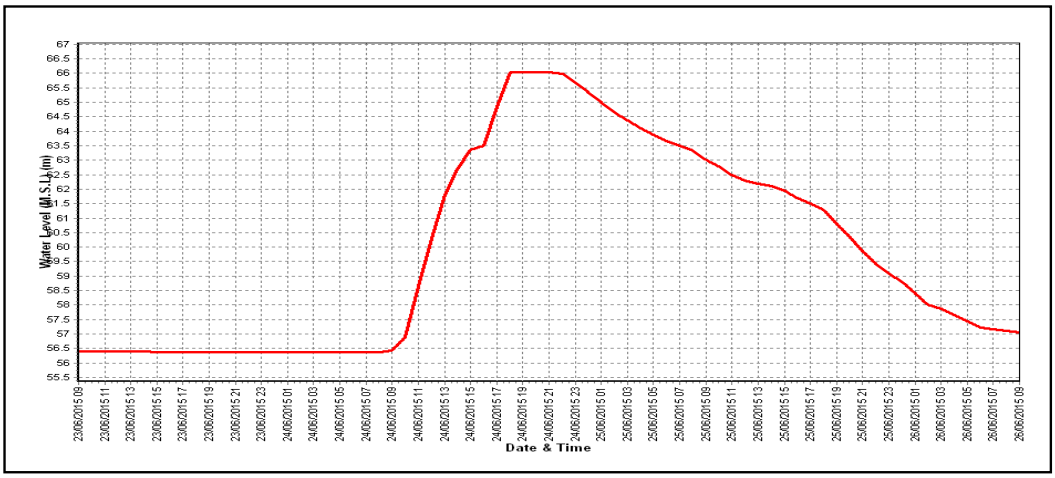
Monthly Runoff for the Year : 2015-2016



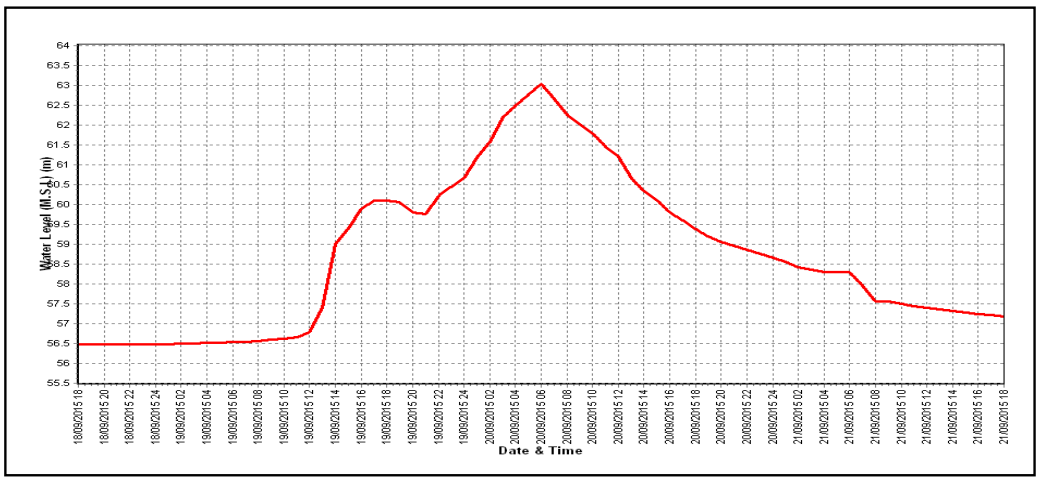
Station Name : Shetrunji at Lowara (01 02 09 001) **Division : Mahi Division, Gandhinagar**

Local River : Shetrunji **Sub-Division : Sabarmati Sub Divn., Ahmedabad**

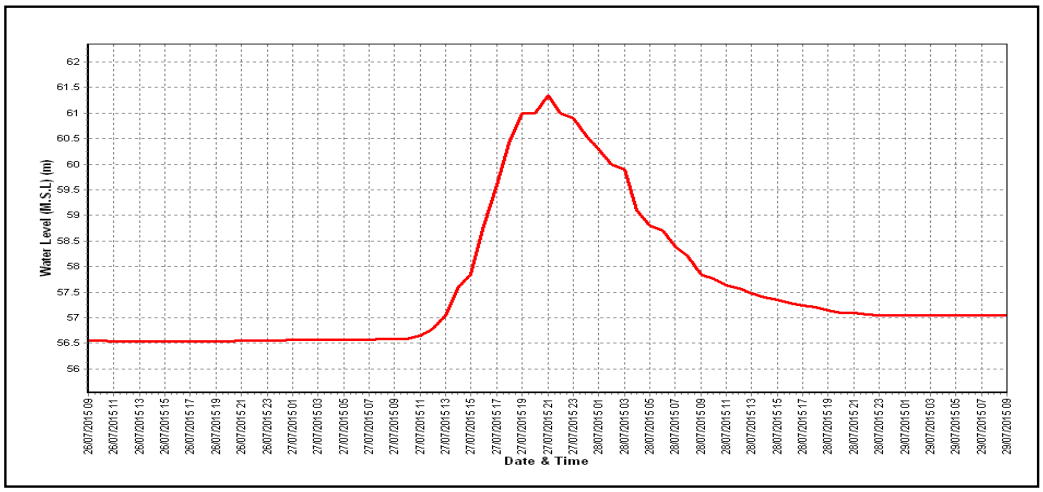
Water Level vs. Time - Graph of Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 2nd Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 3rd Highest Flood Peak during the Year : 2015-2016



Time Span: 72 Hrs

HISTORY SHEET

			Water Year	:	**2015-16**
Site	:	**Bhadar at Ganod**	**Code**	:	**01 02 07 001**
State	:	Gujarat	District		Rajkot
Basin	:	WFR of Kach.-Saur. & Luni	Independent River	:	Bhadar
Tributary	:	Bhadar	Sub Tributary	:	
Sub-Sub Tributary	:		Local River	:	Bhadar
Division	:	Mahi Division, Gandhinagar	Sub-Division	:	Sabarmati Sub Divn., Ahmedabad
Drainage Area	:	6266 Sq. Km.	Bank	:	Right
Latitude	:	21°39'53" N	Longitude	:	70°10'52" E
Zero of Gauge (m)	:	26 (m.s.l)	14/11/70		-
		Opening Date	Closing Date		
Gauge	:	14/11/70			
Discharge	:	14/11/70			
Sediment	:	07/07/73			
Water Quality	:	01/07/73			

Annual Maximum / Minimum discharge with corresponding Water Level (m.s.l)

	Maximum			Minimum		
Year	**Q (cumecs)**	**WL (m)**	**Date**	**Q (cumecs)**	**WL (m)**	**Date**
1971-1972	841.8	30.430	31/08/71	0.000	26.820	24/05/72
1972-1973	1230	31.600	30/06/72	0.000	River Dry	21/11/72
1973-1974	362.0	29.030	10/07/73	0.000	River Dry	25/01/74
1974-1975	229.3	28.300	30/09/74	0.000	River Dry	25/01/75
1975-1976	244.5	28.625	12/07/75	0.000	River Dry	04/02/76
1976-1977	1048	31.080	16/07/76	0.000	River Dry	05/06/76
1977-1978	526.0	30.400	04/09/77	0.000	River Dry	06/06/77
1978-1979	210.5	28.965	30/08/78	0.000	River Dry	27/04/79
1979-1980	4098	33.330	11/08/79	0.000	River Dry	25/07/79
1980-1981	2977	33.320	04/07/80	0.000	26.405	19/04/81
1981-1982	926.2	29.860	11/07/81	0.000	River Dry	18/06/81
1982-1983	380.0	29.400	09/11/82	0.000	River Dry	28/06/82
1983-1984	2750	34.100	22/06/83	0.000	River Dry	14/05/84
1984-1985	2315	32.110	14/09/84	0.000	River Dry	28/04/85
1985-1986	47.70	27.060	19/07/85	0.000	River Dry	25/01/86
1986-1987	192.3	27.630	08/08/86	0.000	River Dry	25/01/87
1987-1988	29.91	26.845	20/11/87	0.000	River Dry	09/05/88
1988-1989	4160	33.120	27/07/88	0.000	River Dry	11/03/89
1989-1990	751.5	29.125	25/07/89	0.000	River Dry	05/02/90
1990-1991	1016	30.190	18/08/90	0.000	River Dry	25/01/91
1991-1992	382.0	28.345	28/07/91	0.000	River Dry	26/01/92
1992-1993	699.3	31.500	30/07/92	0.000	River Dry	04/12/92
1993-1994	174.5	27.680	10/07/93	0.000	River Dry	21/11/93
1994-1995	2594	33.030	14/07/94	0.000	River Dry	07/02/95
1995-1996	70.52	27.190	31/07/95	0.000	River Dry	26/01/96
1996-1997	3526	33.000	20/06/96	0.000	River Dry	25/01/97

1997-1998	248.0	28.460	13/09/97	0.000	River Dry	25/01/98
1998-1999	75.40	27.410	29/06/98	0.000	River Dry	14/01/99
1999-2000	48.20	27.275	14/07/99	0.000	River Dry	26/01/00
2000-2001	36.79	26.960	26/08/00	0.000	River Dry	25/01/01
2001-2002	654.2	28.995	05/07/01	0.000	River Dry	29/01/02
2002-2003	734.0	30.095	29/06/02	0.000	River Dry	16/06/02
2003-2004	263.2	27.900	07/08/03	0.000	River Dry	02/02/04
2004-2005	75.36	27.007	11/08/04	0.000	River Dry	30/03/05
2005-2006	455.7	28.580	12/09/05	0.000	River Dry	01/06/05
2006-2007	2728	31.810	30/07/06	0.000	River Dry	01/06/06
2007-2008	3474	33.295	08/08/07	0.000	River Dry	01/06/07
2008-2009	1902	32.160	16/09/08	0.000	River Dry	01/06/08
2009-2010	1102	29.600	24/07/09	0.000	River Dry	01/06/09
2010-2011	1932	30.850	01/09/10	0.000	River Dry	01/06/10
2011-2012	97.6	26.010	13/09/11	0.000	River Dry	22/06/11
2012-2013	River Dry					
2013-2014	1477	30.05	27/09/13	0.000	River Dry	01/06/13
2014-2015	River Dry					
2015-2016	2030	29.95	25/06/15	0.000	River Dry	01/06/15

Stage-Discharge Data for the period 2015 - 2016

Station Name : Bhadar at Ganod (01 02 07 001) **Division : Mahi Division, Gandhinagar**

Local River : Bhadar **Sub-Division : Sabarmati Sub Divn., Ahmedabad**

Day	Jun		Jul		Aug		Sep		Oct		Nov	
	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q
1	23.650	0.000	27.210	0.000	27.110	0.000	26.190	0.000	26.920	0.000	26.170	0.000
2	23.645	0.000	27.210	0.000	27.100	0.000	26.170	0.000	26.890	0.000	26.150	0.000
3	23.640	0.000	27.200	0.000	27.090	0.000	26.140	0.000	26.860	0.000	26.130	0.000
4	23.635	0.000	27.200	0.000	27.070	0.000	26.110	0.000	26.830	0.000	26.120	0.000
5	23.630	0.000	27.170	0.000	27.060	0.000	26.080	0.000	26.800	0.000	26.110	0.000
6	23.615	0.000	27.040	0.000	27.050	0.000	26.050	0.000	26.780	0.000	26.090	0.000
7	23.590	0.000	26.940	0.000	27.050	0.000	26.010	0.000	26.760	0.000	26.070	0.000
8	23.575	0.000	26.900	0.000	27.020	0.000	25.970	0.000	26.730	0.000	26.060	0.000
9	23.550	0.000	26.890	0.000	27.010	0.000	25.930	0.000	26.650	0.000	26.050	0.000
10	23.530	0.000	26.850	0.000	27.000	0.000	25.890	0.000	26.610	0.000	26.040	0.000
11	23.515	0.000	26.820	0.000	26.990	0.000	25.850	0.000	26.550	0.000	26.030	0.000
12	23.490	0.000	26.780	0.000	26.930	0.000	25.810	0.000	26.500	0.000	26.020	0.000
13	23.460	0.000	26.750	0.000	26.880	0.000	25.780	0.000	26.470	0.000	26.010	0.000
14	23.440	0.000	26.740	0.000	26.850	0.000	25.750	0.000	26.430	0.000	26.000	0.000
15	23.410	0.000	26.690	0.000	26.800	0.000	25.730	0.000	26.420	0.000	25.990	0.000
16	23.380	0.000	26.640	0.000	26.770	0.000	25.720	0.000	26.410	0.000	25.980	0.000
17	23.365	0.000	26.600	0.000	26.750	0.000	25.700	0.000	26.400	0.000	25.970	0.000
18	23.350	0.000	26.550	0.000	26.710	0.000	25.670	0.000	26.395	0.000	25.960	0.000
19	23.340	0.000	26.510	0.000	26.680	0.000	25.650	0.000	26.390	0.000	25.940	0.000
20	23.325	0.000	26.470	0.000	26.630	0.000	25.790	0.000	26.380	0.000	25.920	0.000
21	23.315	0.000 *	26.440	0.000	26.600	0.000	27.400	0.000	26.370	0.000	25.900	0.000
22	23.300	0.000	26.415	0.000	26.560	0.000	27.280	0.000	26.360	0.000	25.870	0.000
23	23.285	0.000	26.440	0.000	26.530	0.000	27.140	0.000	26.350	0.000	25.840	0.000
24	23.285	0.000	26.440	0.000	26.500	0.000	27.110	0.000	26.330	0.000	25.820	0.000
25	29.950	2030	26.415	0.000	26.470	0.000	27.070	0.000	26.320	0.000	25.800	0.000
26	28.650	1922	26.410	0.000	26.430	0.000	27.040	0.000	26.310	0.000	25.780	0.000
27	27.945	453.0	26.450	0.000	26.390	0.000	27.020	0.000	26.290	0.000	25.760	0.000
28	27.390	0.000	26.980	0.000	26.340	0.000	27.000	0.000	26.270	0.000	25.730	0.000
29	27.360	0.000	27.430	0.000	26.300	0.000	26.980	0.000	26.250	0.000	25.700	0.000
30	27.330	0.000	27.130	0.000	26.260	0.000	26.950	0.000	26.220	0.000	25.650	0.000
31			27.115	0.000	26.230	0.000			26.190	0.000		
Ten-Daily Mean												
I Ten-Daily	23.606	0.000	27.061	0.000	27.056	0.000	26.054	0.000	26.783	0.000	26.099	0.000
II Ten-Daily	23.408	0.000	26.655	0.000	26.799	0.000	25.745	0.000	26.434	0.000	25.982	0.000
III Ten-Daily	26.181	440.5	26.697	0.000	26.419	0.000	27.099	0.000	26.296	0.000	25.785	0.000
Monthly												
Min.	23.285	0.000	26.410	0.000	26.230	0.000	25.650	0.000	26.190	0.000	25.650	0.000
Max.	29.950	2030	27.430	0.000	27.110	0.000	27.400	0.000	26.920	0.000	26.170	0.000
Mean	24.398	146.8	26.801	0	26.747	0	26.299	0	26.498	0	25.955	0

Annual Runoff in MCM = 381 Annual Runoff in mm = 61

Peak Observed Discharge = 2030 cumecs on 25/06/2015 Corres. Water Level :29.95 m

Lowest Observed Discharge = 0.000 cumecs on 01/06/2015 Corres. Water Level :23.65 m

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

Note:Missing values ignored while arriving at Annual Runoff

Stage-Discharge Data for the period 2015 - 2016

Station Name : Bhadar at Ganod (01 02 07 001) **Division : Mahi Division, Gandhinagar**

Local River : Bhadar **Sub-Division : Sabarmati Sub Divn., Ahmedabad**

Day	Dec		Jan		Feb		Mar		Apr		May	
	W.L	Q	WL	Q	WL	Q	WL	Q	WL	Q	WL	Q
1	25.620	0.000	24.670	0.000	23.660	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
2	25.590	0.000	24.630	0.000	23.620	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
3	25.560	0.000	24.600	0.000	23.580	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
4	25.530	0.000	24.560	0.000	23.550	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
5	25.500	0.000	24.530	0.000	23.520	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
6	25.470	0.000	24.490	0.000	23.490	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
7	25.430	0.000	24.450	0.000	23.460	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
8	25.380	0.000	24.420	0.000	23.430	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
9	25.350	0.000	24.390	0.000	23.400	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
10	25.340	0.000	24.360	0.000	23.360	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
11	25.330	0.000	24.320	0.000	23.320	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
12	25.310	0.000	24.290	0.000	23.290	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
13	25.290	0.000	24.260	0.000	23.260	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
14	25.280	0.000	24.230	0.000	23.220	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
15	25.250	0.000	24.200	0.000	23.180	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
16	25.210	0.000	24.160	0.000	23.150	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
17	25.170	0.000	24.130	0.000	23.120	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
18	25.140	0.000	24.100	0.000	23.090	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
19	25.110	0.000	24.070	0.000	23.060	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
20	25.070	0.000	24.040	0.000	23.030	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
21	25.020	0.000	24.010	0.000	23.000	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
22	24.980	0.000	23.980	0.000	22.970	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
23	24.950	0.000	23.960	0.000	22.930	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
24	24.920	0.000	23.950	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
25	24.890	0.000	23.930	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
26	24.860	0.000	23.900	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
27	24.830	0.000	23.860	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
28	24.800	0.000	23.820	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
29	24.780	0.000	23.780	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
30	24.750	0.000	23.730	0.000			R Dry	0.000	R Dry	0.000	R Dry	0.000
31			23.690	0.000			R Dry	0.000			R Dry	0.000
Ten-Daily Mean												
I Ten-Daily	25.477	0.000	24.510	0.000	23.507	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
II Ten-Daily	25.216	0.000	24.180	0.000	23.172	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
III Ten-Daily	24.878	0.000	23.874	0.000	22.967	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
Monthly												
Min.	24.750	0.000	23.690	0.000	22.930	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
Max.	25.620	0.000	24.670	0.000	23.660	0.000	R Dry	0.000	R Dry	0.000	R Dry	0.000
Mean	25.190	0	24.178	0.000	23.291	0	R Dry	0.000	R Dry	0.000	R Dry	0.000

Peak Computed Discharge = 0.000 cumecs on 21/06/2015 Corres. Water Level :23.315 m

Lowest Computed Discharge = 0.000 cumecs on 21/06/2015 Corres. Water Level :23.315 m

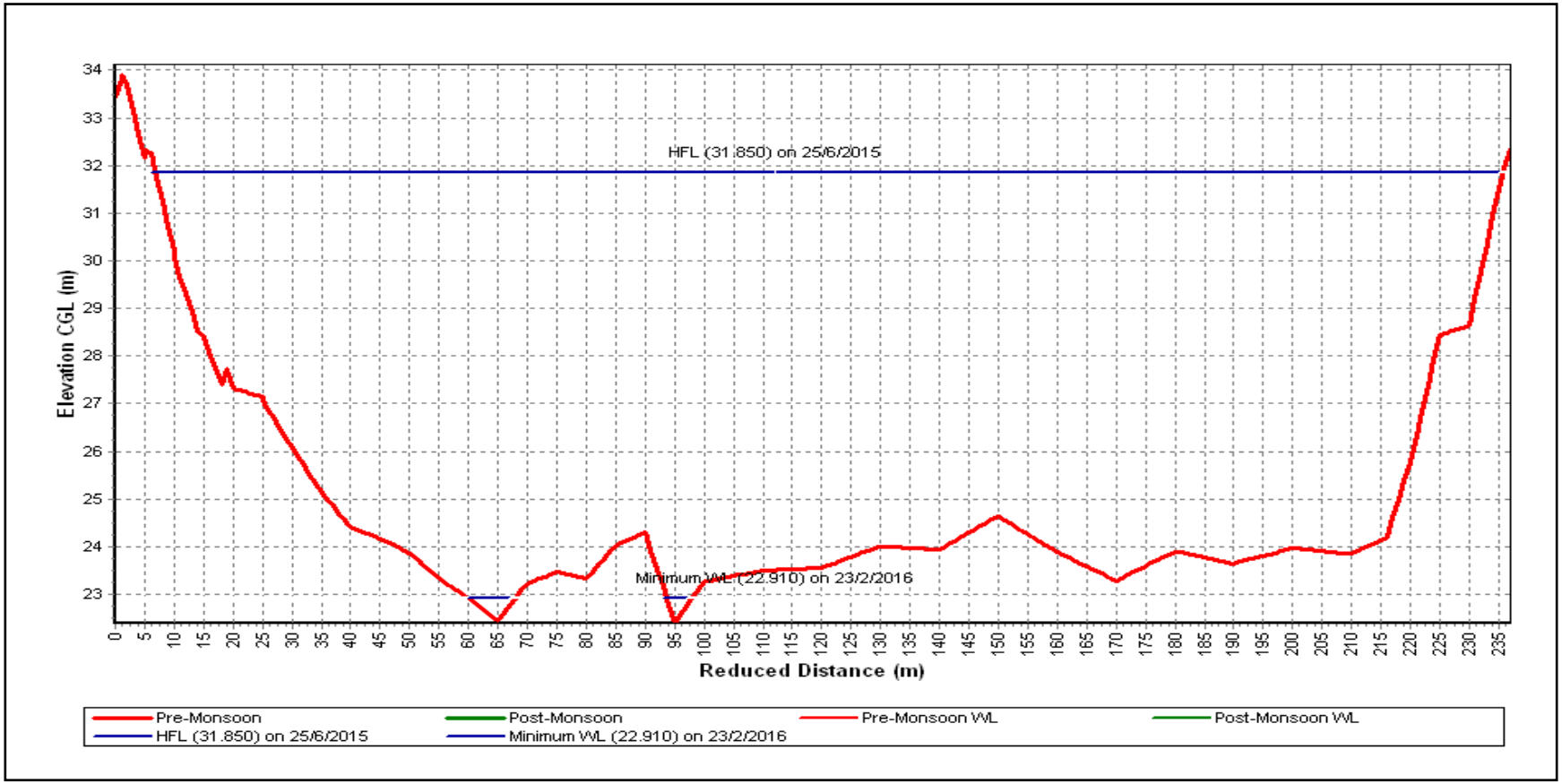
Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

Note:Missing values ignored while arriving at Annual Runoff

Pre-Monsoon & Post-Monsoon X-Section for Water Year : 2015-2016

Station Name : Bhadar at Ganod (01 02 07 001) **Division : Mahi Division, Gandhinagar**

Local River : Bhadar **Sub-Division : Sabarmati Sub Divn., Ahmedabad**



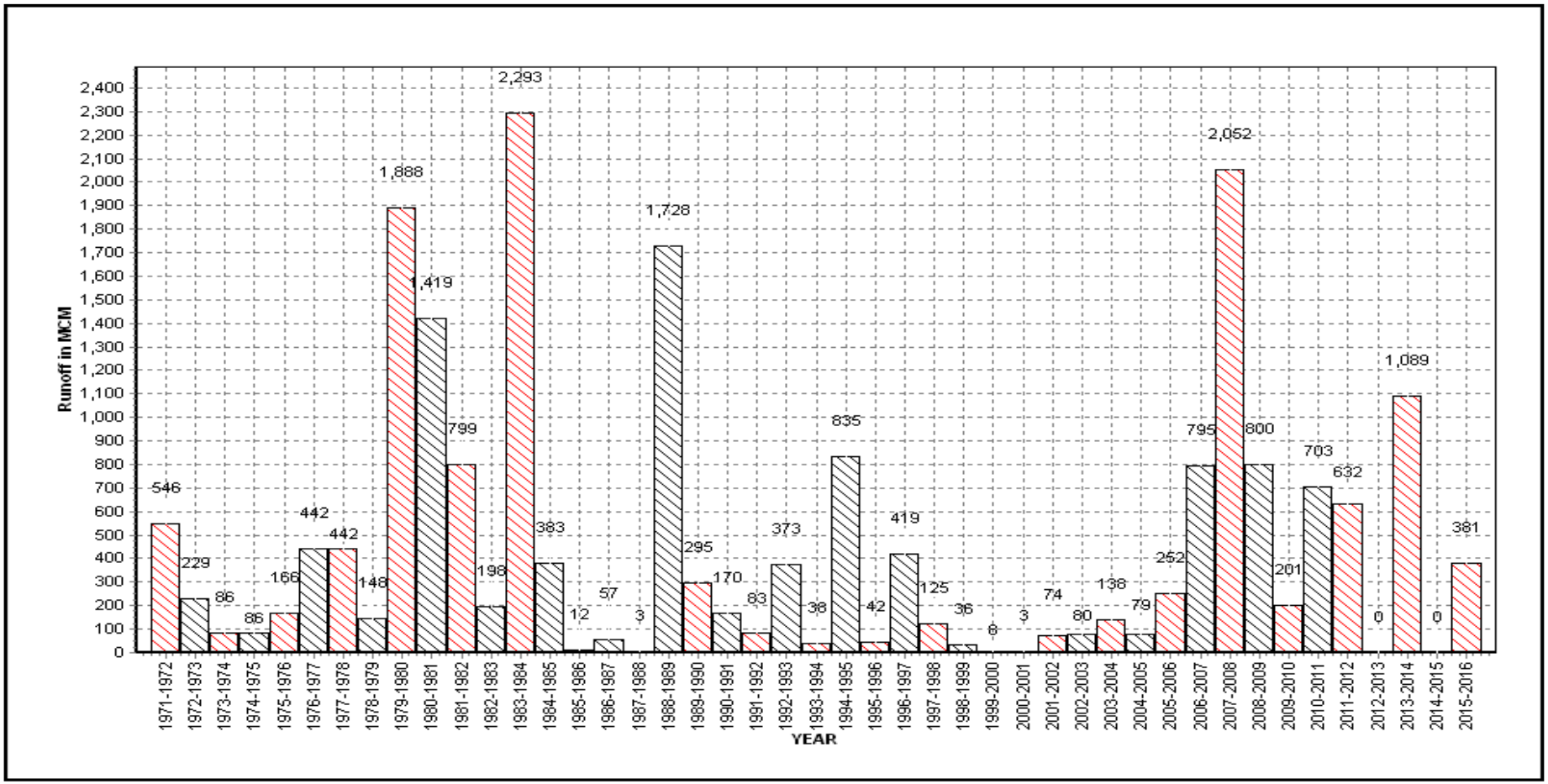
Historic Flood Level-34.100m on 22.06.1983 at 0800 hrs

Note: HFL marked on graph denotes Maximum Water Level observed during the Water Year 2015-15

Annual Runoff Values for the period: 1971 - 2016

Station Name : Bhadar at Ganod (01 02 07 001) **Division : Mahi Division, Gandhinagar**

Local River : Bhadar **Sub-Division : Sabarmati Sub Divn., Ahmedabad**

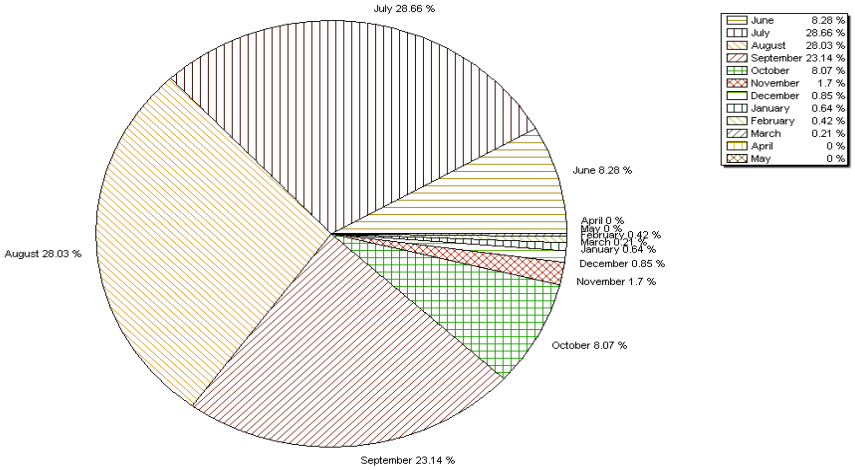


Note: Missing values have not been considered while arriving at Annual Runoff

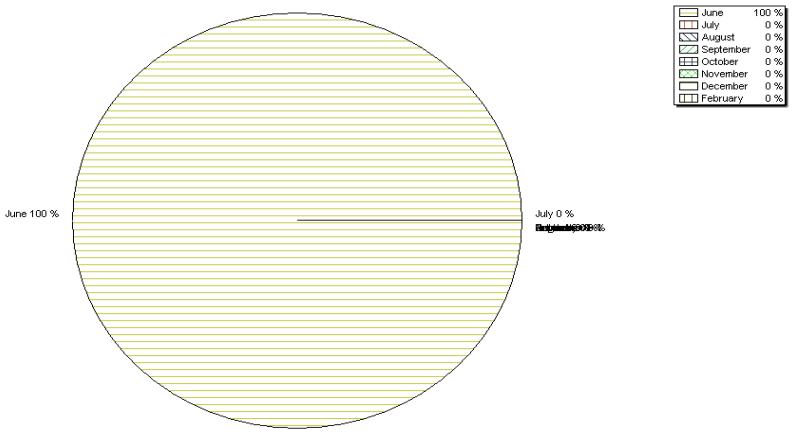
Station Name : Bhadar at Ganod (01 02 07 001) **Division : Mahi Division, Gandhinagar**

Local River : Bhadar **Sub-Division : Sabarmati Sub Divn., Ahmedabad**

Monthly Average Runoff based on period : 1971-2015

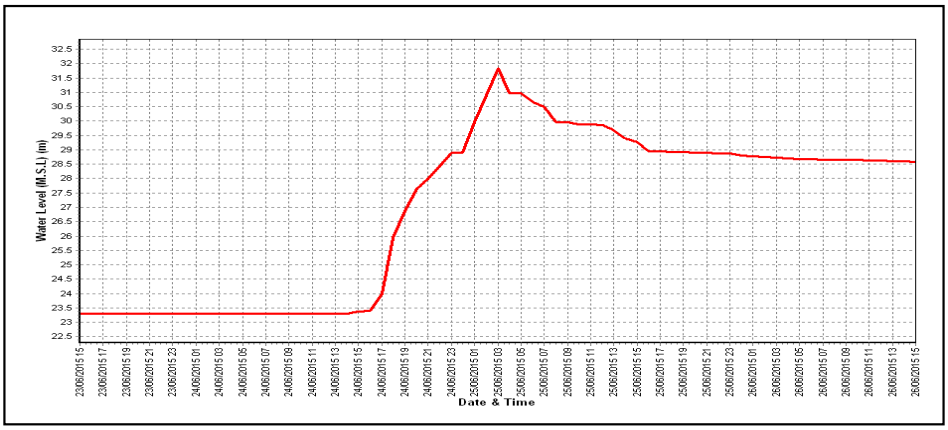


Monthly Runoff for the Year : 2015-2016

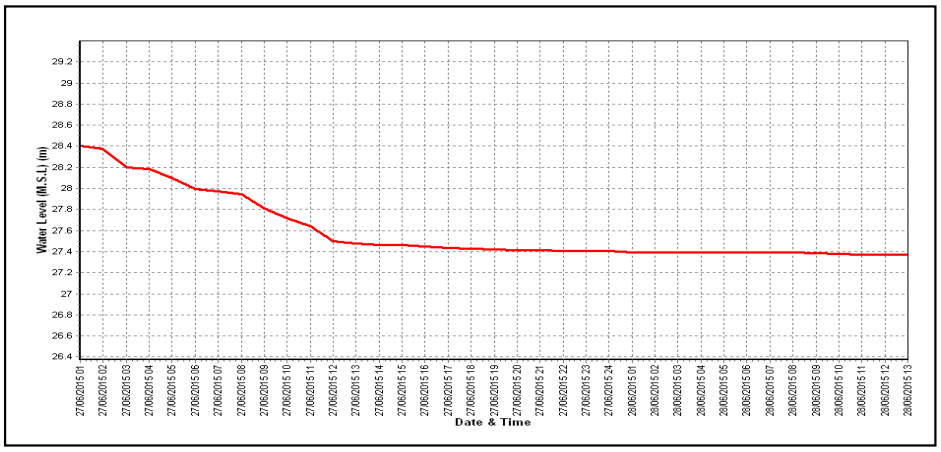


Station Name : Bhadar at Ganod (01 02 07 001) **Division : Mahi Division, Gandhinagar**
Local River : Bhadar **Sub-Division : Sabarmati Sub Divn., Ahmedabad**

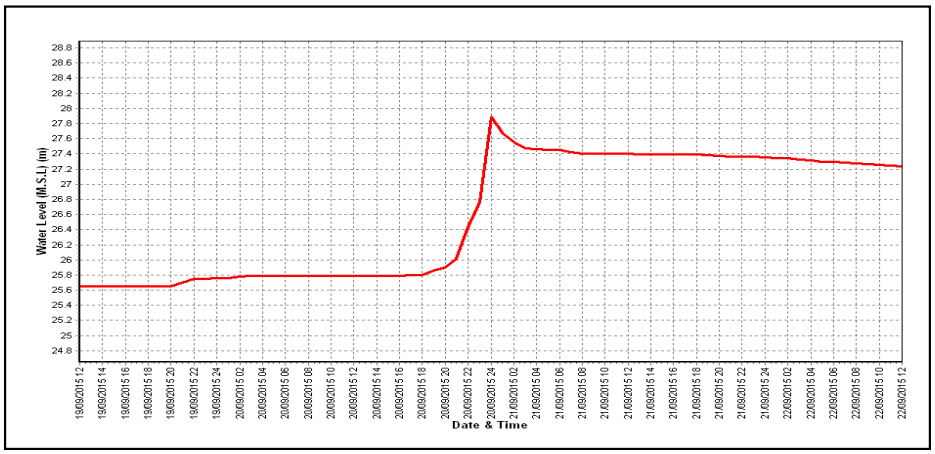
Water Level vs. Time - Graph of Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 2nd Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 3rd Highest Flood Peak during the Year : 2015-2016



Time Span: 72 Hrs

HISTORY SHEET

			Water Year	**:**	**2015-16**
Site	**:**	**Machhu at Gungan**	**Code**	**:**	**01 02 03 001**
State	:	Gujarat	District		Rajkot
Basin	:	WFR of Kach.-Saur. & Luni	Independent River	:	Machhu
Tributary	:	Machhu	Sub Tributary	:	
Sub-Sub Tributary	:		Local River	:	Machhu
Division	:	Mahi Division, Gandhinagar	Sub-Division	:	Sabarmati Sub Divn., Ahmedabad
Drainage Area	:	2137 Sq. Km.	Bank	:	Right
Latitude	:	22°57'42" N	Longitude	:	70°45'52" E
Zero of Gauge (m)	:	8 (m.s.l)	13/09/70	-	
		Opening Date	Closing Date		
Gauge	:	13/09/70			
Discharge	:	09/12/70			
Sediment	:	--			
Water Quality	:	--			

Annual Maximum / Minimum discharge with corresponding Water Level (m.s.l)

	Maximum			Minimum		
Year	**Q (cumecs)**	**WL (m)**	**Date**	**Q (cumecs)**	**WL (m)**	**Date**
1971-1972	956.3	11.590	17/07/71	0.000	River Dry	31/12/71
1972-1973	47.02	9.585	08/07/72	0.000	River Dry	25/01/73
1973-1974	River Dry					
1974-1975	River Dry					
1975-1976	279.4	10.645	15/07/75	0.000	8.425	17/12/75
1976-1977	1805	14.075	30/08/76	0.000	River Dry	03/06/76
1977-1978	726.0	13.120	27/07/77	0.000	9.335	19/05/78
1978-1979	95.70	10.670	31/08/78	0.000	9.485	13/06/78
1979-1980	79.00	10.375	28/06/79	0.000	River Dry	25/08/79
1980-1981	1645	15.700	28/06/80	0.000	River Dry	04/05/81
1981-1982	628.1	12.180	11/08/81	0.000	9.570	05/04/82
1982-1983	750.8	12.410	24/07/82	0.000	9.660	20/12/82
1983-1984	1498	13.850	08/08/83	0.000	River Dry	17/12/83
1984-1985	475.3	11.645	14/09/84	0.000	River Dry	17/12/84
1985-1986	160.7	10.965	17/07/85	0.000	River Dry	21/11/85
1986-1987	407.7	11.760	09/08/86	0.000	River Dry	07/01/87
1987-1988	80.98	10.530	16/07/87	0.000	River Dry	07/02/88
1988-1989	2681	15.973	28/07/88	0.000	River Dry	08/11/88

1989-1990	1781	13.850	25/07/89	0.000	River Dry	25/11/89
1990-1991	195.4	10.765	25/08/90	0.000	River Dry	01/08/90
1991-1992	9.854	10.070	20/07/91	0.000	River Dry	26/01/92
1992-1993	131.6	10.950	31/07/92	0.000	8.925	30/01/93
1993-1994	5.395	10.250	10/07/93	0.000	River Dry	25/01/94
1994-1995	1657	13.880	15/07/94	0.000	9.520	06/04/95
1995-1996	96.96	10.790	26/07/95	0.000	9.130	26/01/96
1996-1997	179.0	11.180	21/06/96	0.000	River Dry	25/01/97
1997-1998	990.0	16.000	24/06/97	0.000	9.590	10/11/97
1998-1999	50.09	11.125	17/10/98	0.000	9.160	17/12/98
1999-2000	3.300	9.980	13/10/99	0.000	8.710	26/01/00
2000-2001	50.00	11.005	15/07/00	0.000	8.260	25/01/01
2001-2002	20.16	10.290	11/07/01	0.000	River Dry	27/01/02
2002-2003	70.80	10.625	28/06/02	0.000	River Dry	22/05/03
2003-2004	70.16	11.135	24/07/03	0.000	8.575	23/12/03
2004-2005	76.00	11.765	11/08/04	0.000	8.545	25/01/05
2005-2006	394.0	12.910	20/09/05	0.000	River Dry	01/06/05
2006-2007	531.2	12.810	31/07/06	0.000	River Dry	01/06/06
2007-2008	1524	12.875	09/08/07	0.000	9.350	01/06/08
2008-2009	1689	14.975	18/09/08	0.000	9.800	02/09/08
2009-2010	13.48	10.520	31/08/09	0.000	9.275	01/12/09
2010-2011	1699	14.720	30/08/10	0.000	9.190	01/10/10
2011-2012	58.8	11.750	13/08/11	0.000	9.560	30/05/12
2012-2013	0.00	10.030	08/09/12	0.000	9.305	31/05/13
2013-2014	289.6	12.175	28/09/13	0.000	River Dry	01/03/14
2014-2015	4.712	10.31	03/09/14	0.000	9.76	01/06/14
2015-2016	3.556	10.22	01/08/15	0.000	9.92	22/08/15

Stage-Discharge Data for the period 2015 - 2016

Station Name : Machhu at Gungan (01 02 03 001) **Division : Mahi Division, Gandhinagar**

Local River : Machhu **Sub-Division : Sabarmati Sub Divn., Ahmedabad**

Day	Jun		Jul		Aug		Sep		Oct		Nov	
	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q
1	8.955	0.000	8.910	0.000	10.220	3.556	9.830	0.000	9.800	0.000	9.630	0.000
2	8.955	0.000	8.910	0.000	10.115	2.550	9.820	0.000	9.800	0.000	9.620	0.000
3	8.950	0.000	8.910	0.000	10.050	2.468	9.800	0.000	9.800	0.000	9.610	0.000
4	8.950	0.000	8.910	0.000	10.010	1.964	9.780	0.000	9.790	0.000	9.600	0.000
5	8.950	0.000	8.905	0.000	10.010	0.320 *	9.760	0.000	9.790	0.000	9.580	0.000
6	8.945	0.000	8.905	0.000	10.000	0.290 *	9.750	0.000	9.790	0.000	9.560	0.000
7	8.945	0.000	8.905	0.000	10.000	0.290 *	9.740	0.000	9.780	0.000	9.540	0.000
8	8.945	0.000	8.905	0.000	10.000	0.290 *	9.730	0.000	9.770	0.000	9.530	0.000
9	8.945	0.000	8.900	0.000	10.000	0.290 *	9.720	0.000	9.770	0.000	9.510	0.000
10	8.945	0.000	8.900	0.000	10.000	0.290 *	9.710	0.000	9.760	0.000	9.500	0.000
11	8.945	0.000	8.900	0.000	10.000	0.290 *	9.700	0.000	9.760	0.000	9.480	0.000
12	8.940	0.000	8.900	0.000	10.000	0.290 *	9.700	0.000	9.750	0.000	9.460	0.000
13	8.940	0.000	8.900	0.000	9.990	0.260 *	9.690	0.000	9.750	0.000	9.440	0.000
14	8.940	0.000	8.900	0.000	9.990	0.260 *	9.690	0.000	9.740	0.000	9.410	0.000
15	8.935	0.000	8.900	0.000	9.980	0.260 *	9.690	0.000	9.740	0.000	9.390	0.000
16	8.935	0.000	8.900	0.000	9.970	0.190 *	9.680	0.000	9.720	0.000	9.390	0.000
17	8.935	0.000	8.895	0.000	9.970	0.190 *	9.680	0.000	9.720	0.000	9.390	0.000
18	8.930	0.000	8.895	0.000	9.960	0.170 *	9.680	0.000	9.720	0.000	9.390	0.000
19	8.930	0.000	8.895	0.000	9.960	0.170 *	9.670	0.000	9.710	0.000	9.380	0.000
20	8.925	0.000	8.895	0.000	9.950	0.150 *	9.700	0.000	9.710	0.000	9.380	0.000
21	8.925	0.000	8.895	0.000	9.940	0.130 *	9.740	0.000	9.700	0.000	9.380	0.000
22	8.925	0.000	8.895	0.000	9.920	0.000	9.800	0.000	9.700	0.000	9.730	0.000
23	8.920	0.000	8.895	0.000	9.890	0.000	9.800	0.000	9.690	0.000	9.850	0.000
24	8.920	0.000	8.895	0.000	9.880	0.000	9.800	0.000	9.690	0.000	9.850	0.000
25	8.920	0.000	8.900	0.000	9.880	0.000	9.800	0.000	9.680	0.000	9.850	0.000
26	8.920	0.000	9.220	0.000	9.870	0.000	9.800	0.000	9.670	0.000	9.850	0.000
27	8.915	0.000	9.270	0.000	9.870	0.000	9.800	0.000	9.670	0.000	9.850	0.000
28	8.915	0.000	11.350	129.6 *	9.870	0.000	9.800	0.000	9.660	0.000	9.850	0.000
29	8.915	0.000	11.900	228.9 *	9.860	0.000	9.800	0.000	9.650	0.000	9.850	0.000
30	8.910	0.000	11.180	101.0 *	9.850	0.000	9.800	0.000	9.650	0.000	9.840	0.000
31			10.530	12.63 *	9.840	0.000			9.640	0.000		
Ten-Daily Mean												
I Ten-Daily	8.948	0.000	8.906	0.000	10.040	1.231	9.764	0.000	9.785	0.000	9.568	0.000
II Ten-Daily	8.936	0.000	8.898	0.000	9.977	0.223	9.688	0.000	9.732	0.000	9.411	0.000
III Ten-Daily	8.918	0.000	9.812	42.91	9.879	0.012	9.794	0.000	9.673	0.000	9.790	0.000
Monthly												
Min.	8.910	0.000	8.895	0.000	9.840	0.000	9.670	0.000	9.640	0.000	9.380	0.000
Max.	8.955	0.000	11.900	228.9	10.220	3.556	9.830	0.000	9.800	0.000	9.850	0.000
Mean	8.934	0	9.225	15.23	9.963	0.473	9.749	0	9.728	0	9.590	0

Annual Runoff in MCM = 42 Annual Runoff in mm = 20

Peak Observed Discharge = 3.556 cumecs on 01/08/2015 Corres. Water Level :10.22 m

Lowest Observed Discharge = 0.000 cumecs on 01/06/2015 Corres. Water Level :8.955 m

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

Note:Missing values ignored while arriving at Annual Runoff

Stage-Discharge Data for the period 2015 - 2016

Station Name : Machhu at Gungan (01 02 03 001) **Division : Mahi Division, Gandhinagar**

Local River : Machhu **Sub-Division : Sabarmati Sub Divn., Ahmedabad**

Day	Dec		Jan		Feb		Mar		Apr		May	
	W.L	Q	WL	Q	WL	Q	WL	Q	WL	Q	WL	Q
1	9.840	0.000	9.790	0.000	9.670	0.000	9.590	0.000	9.490	0.000	9.400	0.000
2	9.840	0.000	9.790	0.000	9.670	0.000	9.580	0.000	9.490	0.000	9.400	0.000
3	9.840	0.000	9.790	0.000	9.670	0.000	9.580	0.000	9.480	0.000	9.400	0.000
4	9.860	0.000	9.780	0.000	9.660	0.000	9.570	0.000	9.480	0.000	9.390	0.000
5	9.880	0.000	9.780	0.000	9.660	0.000	9.570	0.000	9.470	0.000	9.390	0.000
6	9.880	0.000	9.770	0.000	9.660	0.000	9.560	0.000	9.470	0.000	9.390	0.000
7	9.880	0.000	9.760	0.000	9.660	0.000	9.560	0.000	9.460	0.000	9.380	0.000
8	9.880	0.000	9.760	0.000	9.650	0.000	9.560	0.000	9.460	0.000	9.380	0.000
9	9.880	0.000	9.750	0.000	9.650	0.000	9.550	0.000	9.450	0.000	9.380	0.000
10	9.870	0.000	9.750	0.000	9.640	0.000	9.550	0.000	9.450	0.000	9.380	0.000
11	9.870	0.000	9.740	0.000	9.640	0.000	9.550	0.000	9.450	0.000	9.370	0.000
12	9.860	0.000	9.740	0.000	9.640	0.000	9.540	0.000	9.450	0.000	9.370	0.000
13	9.860	0.000	9.730	0.000	9.630	0.000	9.540	0.000	9.440	0.000	9.370	0.000
14	9.850	0.000	9.730	0.000	9.630	0.000	9.540	0.000	9.440	0.000	9.370	0.000
15	9.840	0.000	9.730	0.000	9.630	0.000	9.540	0.000	9.440	0.000	9.370	0.000
16	9.840	0.000 *	9.730	0.000	9.630	0.000	9.540	0.000	9.430	0.000	9.370	0.000
17	9.840	0.000	9.720	0.000	9.620	0.000	9.530	0.000	9.430	0.000	9.360	0.000
18	9.830	0.000	9.720	0.000	9.620	0.000	9.530	0.000	9.430	0.000	9.360	0.000
19	9.830	0.000	9.720	0.000	9.620	0.000	9.530	0.000	9.420	0.000	9.360	0.000
20	9.830	0.000	9.720	0.000	9.620	0.000	9.530	0.000	9.420	0.000	9.360	0.000
21	9.820	0.000	9.710	0.000	9.610	0.000	9.520	0.000	9.420	0.000	9.360	0.000
22	9.820	0.000	9.710	0.000	9.610	0.000	9.520	0.000	9.420	0.000	9.360	0.000
23	9.810	0.000	9.700	0.000	9.610	0.000	9.520	0.000	9.420	0.000	9.360	0.000
24	9.810	0.000	9.700	0.000	9.600	0.000	9.520	0.000	9.420	0.000	9.350	0.000
25	9.810	0.000	9.700	0.000	9.600	0.000	9.510	0.000	9.420	0.000	9.350	0.000
26	9.810	0.000	9.700	0.000	9.600	0.000	9.510	0.000	9.410	0.000	9.350	0.000
27	9.810	0.000	9.690	0.000	9.590	0.000	9.510	0.000	9.410	0.000	9.350	0.000
28	9.800	0.000	9.690	0.000	9.590	0.000	9.500	0.000	9.410	0.000	9.340	0.000
29	9.800	0.000	9.680	0.000	9.590	0.000	9.500	0.000	9.400	0.000	9.340	0.000
30	9.800	0.000	9.680	0.000			9.500	0.000	9.400	0.000	9.340	0.000
31	9.790	0.000	9.680	0.000			9.500	0.000			9.330	0.000
Ten-Daily Mean												
I Ten-Daily	9.865	0.000	9.772	0.000	9.659	0.000	9.567	0.000	9.470	0.000	9.389	0.000
II Ten-Daily	9.845	0.000	9.728	0.000	9.628	0.000	9.537	0.000	9.435	0.000	9.366	0.000
III Ten-Daily	9.807	0.000	9.695	0.000	9.600	0.000	9.510	0.000	9.413	0.000	9.348	0.000
Monthly												
Min.	9.790	0.000	9.680	0.000	9.590	0.000	9.500	0.000	9.400	0.000	9.330	0.000
Max.	9.880	0.000	9.790	0.000	9.670	0.000	9.590	0.000	9.490	0.000	9.400	0.000
Mean	9.838	0	9.730	0	9.630	0	9.537	0	9.439	0	9.367	0

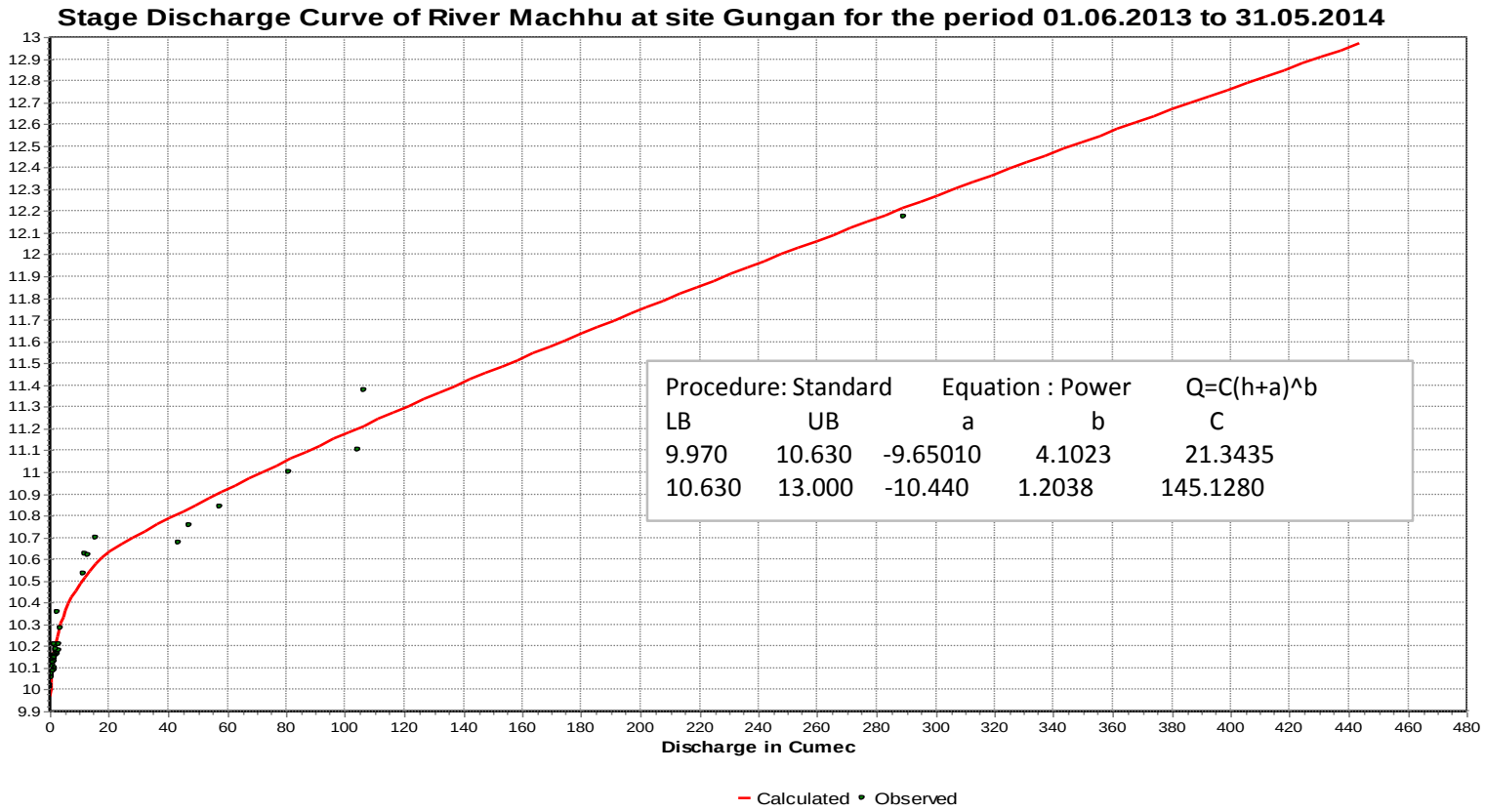
Annual Runoff in MC **Peak Computed Discharge = 228.9 cumecs on 29/07/2015** **Corres. Water Level :11.9 m**

Peak Observed Disch **Lowest Computed Discharge = 0.000 cumecs on 16/12/2015** **Corres. Water Level :9.84 m**

Lowest Observed Di

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

Note:Missing values ignored while arriving at Annual Runoff

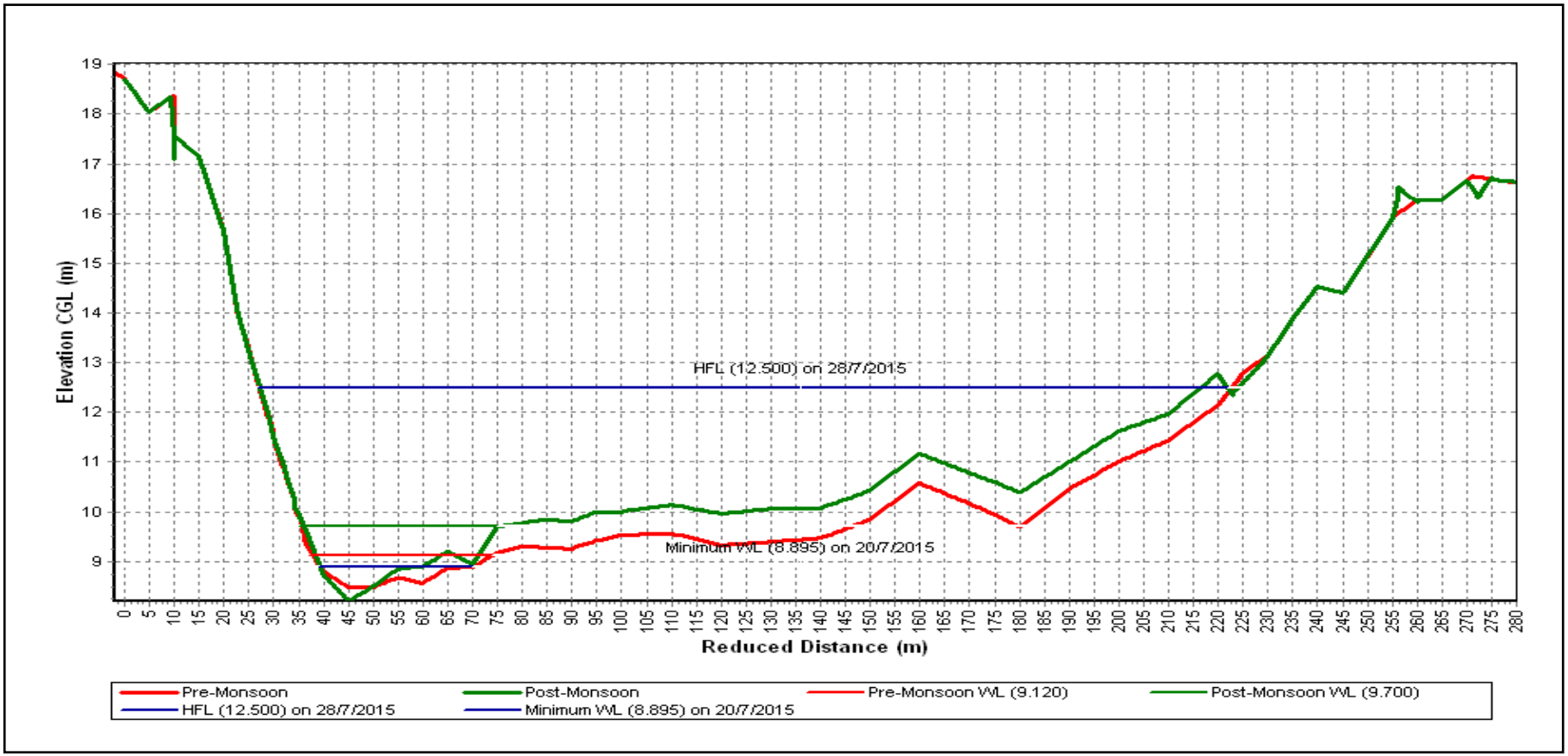


SD Curve of year 2013-14 used for estimation for the current year . Data of the current year were not sufficient to plot SD curve

Pre-Monsoon & Post-Monsoon X-Section for Water Year : 2015-2016

Station Name : Machhu at Gungan (01 02 03 001) **Division : Mahi Division, Gandhinagar**

Local River : Machhu **Sub-Division : Sabarmati Sub Divn., Ahmedabad**



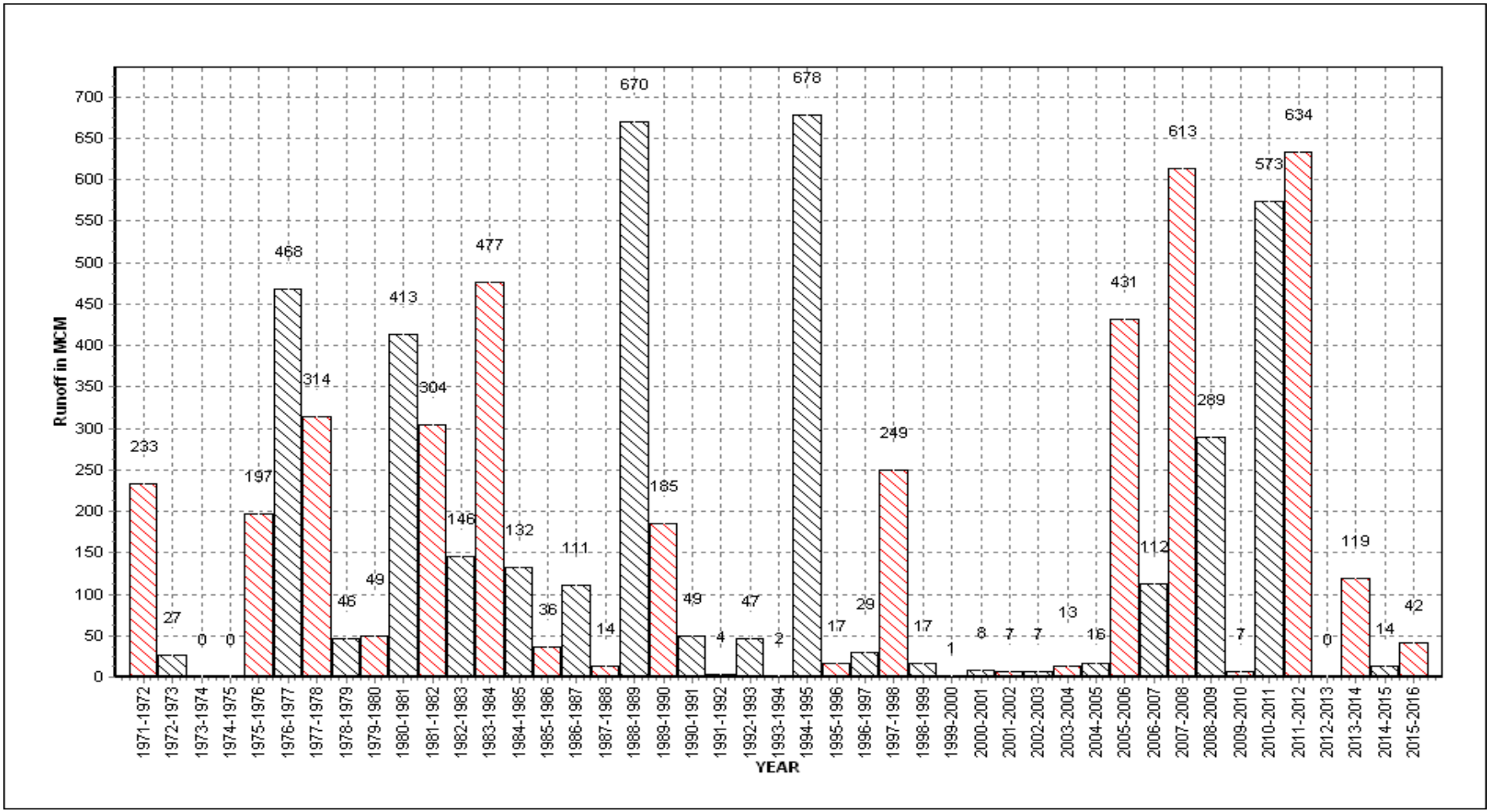
Historic Flood Level-24.595m on 11.08.1979 at 1400 hrs

Note: HFL marked on graph denotes Maximum Water Level observed during the Water Year 2015-16

Annual Runoff Values for the period: 1971 - 2016

Station Name : Machhu at Gungan (01 02 03 001) **Division : Mahi Division, Gandhinagar**

Local River : Machhu **Sub-Division : Sabarmati Sub Divn., Ahmedabad**

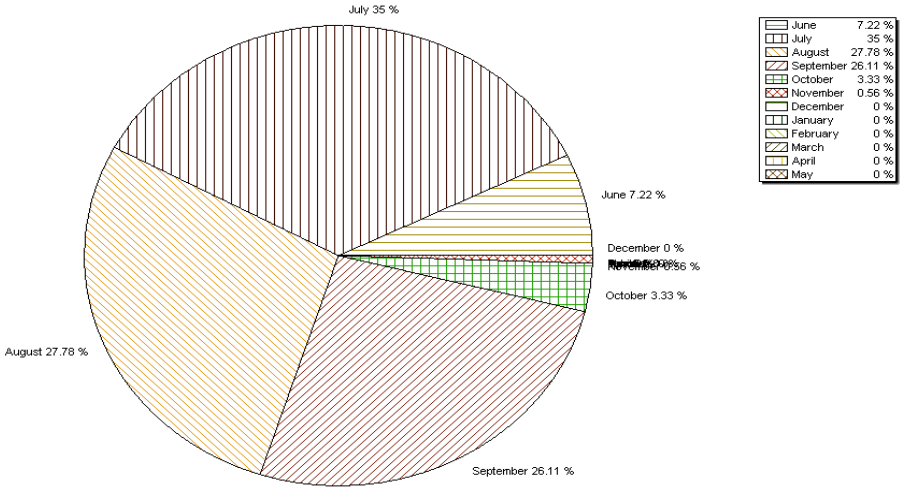


Note: Missing values have not been considered while arriving at Annual Runoff

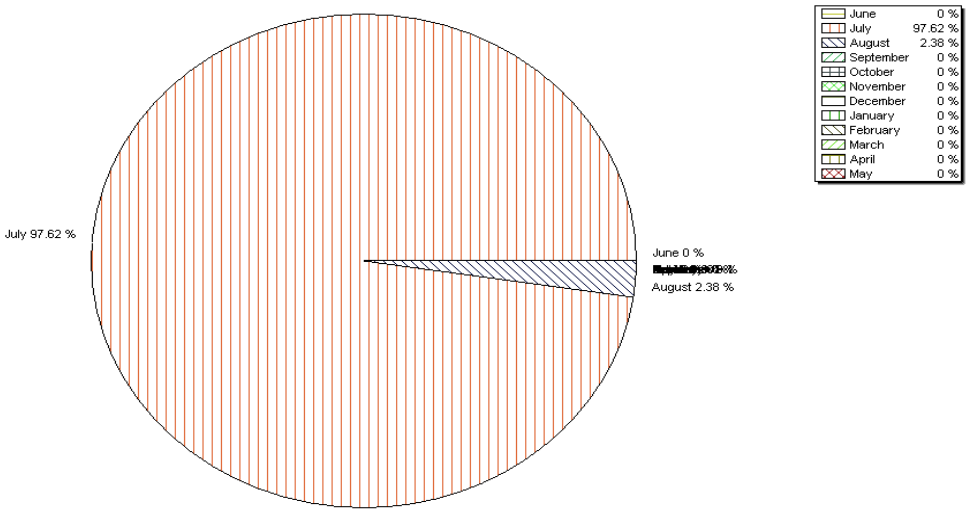
Station Name : Machhu at Gungan (01 02 03 001) **Division : Mahi Division, Gandhinagar**

Local River : Machhu **Sub-Division : Sabarmati Sub Divn., Ahmedabad**

Monthly Average Runoff based on period : 1971-2015

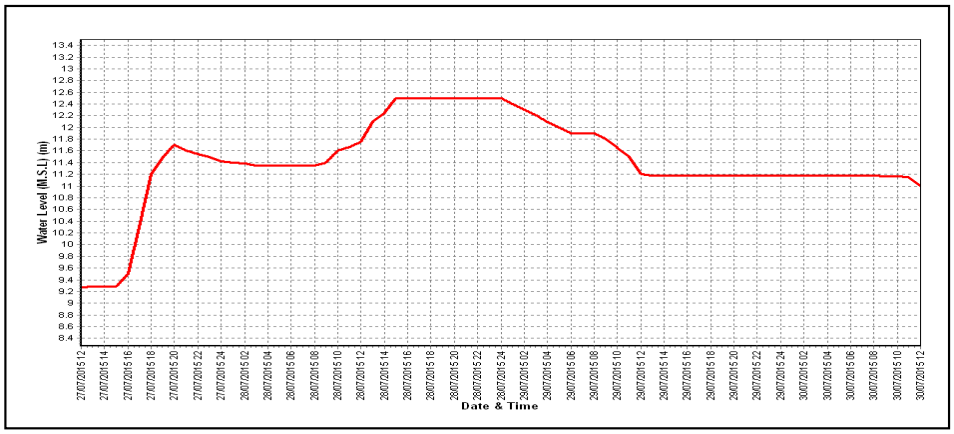


Monthly Runoff for the Year : 2015-2016

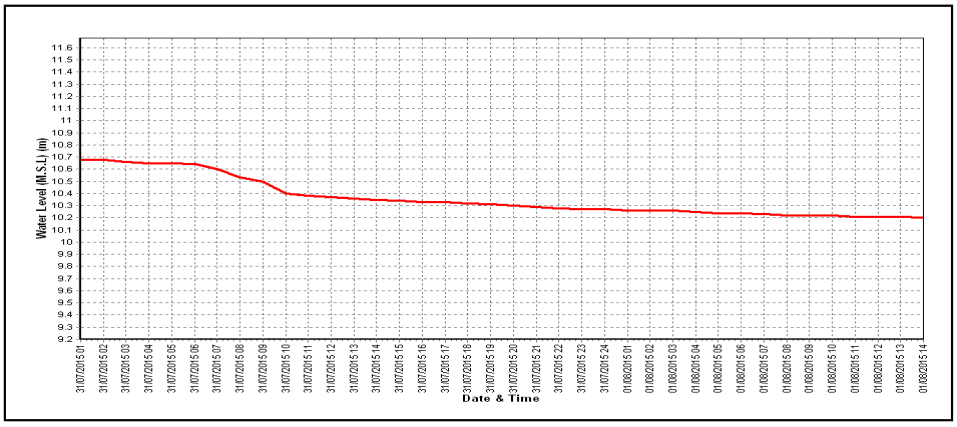


Station Name : Machhu at Gungan (01 02 03 001) **Division : Mahi Division, Gandhinagar**
Local River : Machhu **Sub-Division : Sabarmati Sub Divn., Ahmedabad**

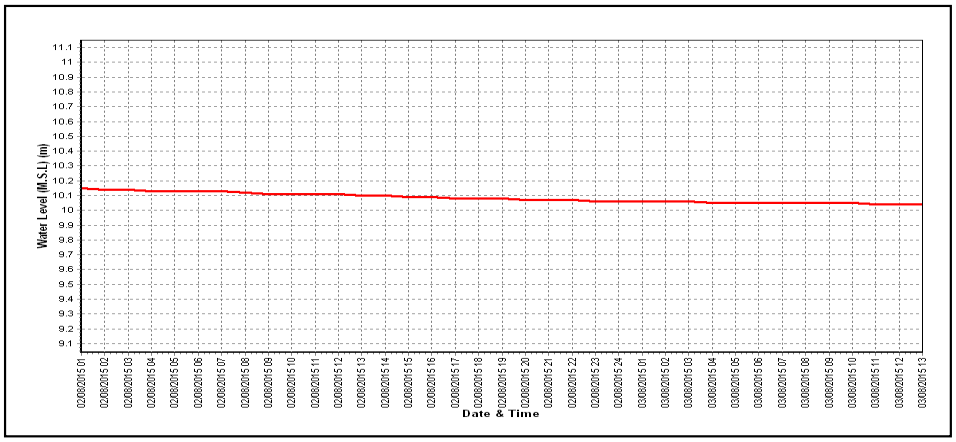
Water Level vs. Time - Graph of Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 2nd Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 3rd Highest Flood Peak during the Year : 2015-2016



Time Span: 72 Hrs

HISTORY SHEET

			Water Year	**:**	**2015-16**
Site	:	**Rupen at Sapawada**	**Code**	**:**	**01 02 04 001**
State	:	Gujarat	District		Mahesana
Basin	:	WFR of Kach.-Saur. & Luni	Independent River	:	Rupen
Tributary	:	-	Sub Tributary	:	
Sub-Sub Tributary	:		Local River	:	Rupen
Division	:	Mahi Division, Gandhinagar	Sub-Division	:	B.L.Sub Divn, Palanpur
Drainage Area	:	2125 Sq. Km.	Bank	:	Right
Latitude	:	23°32'54"	Longitude	:	72°00'52"
Zero of Gauge (m)	:	36.65 (m.s.l)	01/08/89	-	04/04/97
		36 (m.s.l)	05/04/97		
		Opening Date	Closing Date		
Gauge	:	20/08/89			
Discharge	:	31/08/89			
Sediment	:				
Water Quality	:				

Annual Maximum / Minimum discharge with corresponding Water Level (m.s.l)

	Maximum			Minimum			
Year	Q (cumecs)	WL (m)	Date	Q (cumecs)		WL (m)	Date
1990-1991	490.6	40.000	25/08/90	0.000		R Dry	25/01/91
1991-1992	46.45	37.650	01/08/91	0.000		R Dry	26/01/92
1992-1993	221.2	38.315	09/09/92	0.000		R Dry	30/12/92
1993-1994	753.1	40.715	10/07/93	0.000		R Dry	26/01/94
1994-1995	964.3	40.900	03/08/94	0.000		R Dry	26/01/95
1995-1996	66.52	38.100	22/07/95	0.000		R Dry	27/10/95
1996-1997	R Dry						
1997-1998	325	43.000	27/06/97	0.000		R Dry	04/02/98
1998-1999	66.5	38.700	19/09/98	0.000		R Dry	17/12/98
1999-2000	7.725	37.600	23/06/99	0.000		R Dry	09/11/99
2000-2001	14.17	37.700	16/07/00	0.000		R Dry	25/01/01
2001-2002	19.58	37.800	17/06/01	0.000		R Dry	25/01/02
2002-2003	R Dry						
2003-2004	178	40.050	29/07/03	0.000		R Dry	26/01/04
2004-2005	129	39.800	09/08/04	0.000		R Dry	09/05/05
2005-2006	444.5	41.475	03/08/05	0.000		R Dry	01/06/05
2006-2007	474	40.250	16/08/06	0.000		R Dry	01/06/06
2007-2008	595.1	40.750	09/08/07	0.000		36.5	01/06/07
2008-2009	418.2	40.000	13/08/08	0.000		36.3	18/08/08
2009-2010	5.436	37.000	19/03/10	0.000		36.06	01/06/09
2010-2011	494.2	40.000	04/08/10	0.000		R Dry	01/06/10
2011-2012	58.80	37.76	14/09/11	0.000		R Dry	01/06/11
2012-2013	0.708	36.58	15/09/12	0.000		R Dry	01/06/12
2013-2014	77.83	37.9	14/07/13	0.000		36.1	01/06/13
2014-2015	8.953	37.3	03/08/14	0.000		R Dry	01/06/14
2015-2016	9.579	37.9	02/08/15	0.000		36.1	01/06/15

Stage-Discharge Data for the period 2015 - 2016

Station Name : Rupen at Sapawada (01 02 04 001) **Division : Mahi Division, Gandhinagar**

Local River : Rupen **Sub-Division : B.L.Sub Divn, Palanpur**

Day	Jun		Jul		Aug		Sep		Oct		Nov	
	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q
1	36.100	0.000	36.100	0.000	37.100	9.206	36.450	0.000	36.550	0.000	36.500	0.000
2	36.100	0.000	36.100	0.000	37.900	9.579	36.450	0.000	36.520	0.000	36.500	0.000
3	36.100	0.000	36.100	0.000	37.000	6.297	36.400	0.000	36.500	0.000	36.450	0.000
4	36.100	0.000	36.100	0.000	36.800	4.949	36.400	0.000	36.500	0.000	36.400	0.000
5	36.100	0.000	36.100	0.000	36.800	5.975	36.400	0.000	36.500	0.000	36.400	0.000
6	36.100	0.000	36.100	0.000	36.800	6.508	36.400	0.000	36.500	0.000	36.400	0.000
7	36.100	0.000	36.100	0.000	36.810	6.357	36.400	0.000	36.500	0.000	36.400	0.000
8	36.100	0.000	36.100	0.000	36.810	5.174	36.400	0.000	36.500	0.000	36.400	0.000
9	36.100	0.000	36.100	0.000	36.810	5.185	36.400	0.000	36.500	0.000	36.300	0.000
10	36.100	0.000	36.100	0.000	36.800	4.823	36.400	0.000	36.500	0.000	36.300	0.000
11	36.100	0.000	36.100	0.000	36.800	3.999	36.400	0.000	36.500	0.000	36.300	0.000
12	36.100	0.000	36.100	0.000	36.800	3.912	36.400	0.000	36.500	0.000	36.300	0.000
13	36.100	0.000	36.100	0.000	36.800	4.258	36.400	0.000	36.500	0.000	36.300	0.000
14	36.100	0.000	36.100	0.000	36.800	4.202	36.400	0.000	36.500	0.000	36.300	0.000
15	36.100	0.000	36.100	0.000	36.800	4.428	36.400	0.000	36.500	0.000	36.300	0.000
16	36.100	0.000	36.100	0.000	36.800	3.469	36.400	0.000	36.500	0.000	36.300	0.000
17	36.100	0.000	36.100	0.000	36.800	4.172	36.400	0.000	36.500	0.000	36.300	0.000
18	36.100	0.000	36.100	0.000	36.800	4.258	36.400	0.000	36.500	0.000	36.300	0.000
19	36.100	0.000	36.100	0.000	36.750	3.497	36.400	0.000	36.500	0.000	36.300	0.000
20	36.100	0.000	36.100	0.000	36.750	3.564	36.500	0.000	36.500	0.000	36.300	0.000
21	36.100	0.000	36.100	0.000 *	36.750	3.662	36.550	0.000	36.500	0.000	36.300	0.000
22	36.100	0.000	36.100	0.000	36.750	3.825	36.550	0.000	36.500	0.000	36.300	0.000
23	36.100	0.000	36.100	0.000	36.750	3.975	36.550	0.000	36.500	0.000	36.300	0.000
24	36.100	0.000	36.100	0.000	36.750	3.824	36.550	0.000	36.500	0.000	36.300	0.000
25	36.100	0.000	36.100	0.000	36.750	4.054	36.550	0.000	36.500	0.000	36.300	0.000
26	36.100	0.000	36.150	0.000	36.750	4.003	36.550	0.000	36.500	0.000	36.300	0.000
27	36.100	0.000	36.300	0.000	36.750	3.803	36.550	0.000 #	36.500	0.000	36.300	0.000
28	36.100	0.000	36.400	0.000	36.650	3.329	36.550	0.000	36.500	0.000	36.300	0.000
29	36.100	0.000	38.000	89.65 *	36.500	0.000	36.550	0.000	36.500	0.000	36.300	0.000
30	36.100	0.000	42.000	1455 *	36.450	0.000	36.550	0.000	36.500	0.000	36.300	0.000
31			38.000	89.65 *	36.450	0.000			36.500	0.000		
Ten-Daily Mean												
I Ten-Daily	36.100	0.000	36.100	0.000	36.963	6.405	36.410	0.000	36.507	0.000	36.405	0.000
II Ten-Daily	36.100	0.000	36.100	0.000	36.790	3.976	36.410	0.000	36.500	0.000	36.300	0.000
III Ten-Daily	36.100	0.000	37.032	148.6	36.664	2.770	36.550	0.000	36.500	0.000	36.300	0.000
Monthly												
Min.	36.100	0.000	36.100	0.000	36.450	0.000	36.400	0.000	36.500	0.000	36.300	0.000
Max.	36.100	0.000	42.000	1455	37.900	9.579	36.550	0.000	36.550	0.000	36.500	0.000
Mean	36.100	0.000	36.431	52.72	36.801	4.332	36.457	0.000	36.502	0.000	36.335	0.000

Annual Runoff in MCM = 153 Annual Runoff in mm = 72

Peak Observed Discharge = 9.579 cumecs on 02/08/2015 Corres. Water Level :37.9 m

Lowest Observed Discharge = 0.000 cumecs on 01/06/2015 Corres. Water Level :36.1 m

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff

Stage-Discharge Data for the period 2015 - 2016

Station Name : Rupen at Sapawada (01 02 04 001) **Division : Mahi Division, Gandhinagar**

Local River : Rupen **Sub-Division : B.L.Sub Divn, Palanpur**

Day	Dec		Jan		Feb		Mar		Apr		May	
	W.L	Q	WL	Q	WL	Q	WL	Q	WL	Q	WL	Q
1	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000
2	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.200	0.000
3	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	R.dry	0.000
4	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	R.dry	0.000
5	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	R.dry	0.000
6	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	R.dry	0.000
7	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	R.dry	0.000
8	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	R.dry	0.000
9	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	R.dry	0.000
10	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	R.dry	0.000
11	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	R.dry	0.000
12	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	R.dry	0.000
13	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	R.dry	0.000
14	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	R.dry	0.000
15	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	R.dry	0.000
16	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	R.dry	0.000
17	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	R.dry	0.000
18	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	R.dry	0.000
19	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	R.dry	0.000
20	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	R.dry	0.000
21	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	R.dry	0.000
22	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	R.dry	0.000
23	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	R.dry	0.000
24	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	R.dry	0.000
25	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	R.dry	0.000
26	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	R.dry	0.000
27	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	R.dry	0.000
28	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	R.dry	0.000
29	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	R.dry	0.000
30	36.300	0.000	36.300	0.000			36.300	0.000	36.300	0.000	R.dry	0.000
31	36.300	0.000	36.300	0.000			36.300	0.000			R.dry	0.000
Ten-Daily Mean												
I Ten-Daily	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.250	0.000
II Ten-Daily	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	R.dry	0.000
III Ten-Daily	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	R.dry	0.000
Monthly												
Min.	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.200	0.000
Max.	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000
Mean	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.300	0.000	36.250	0.000

Annual Runoff in MC **Peak Computed Discharge = 1455 cumecs on 30/07/2015** **Corres. Water Level :42 m**

Peak Observed Disc **Lowest Computed Discharge = 0.000 cumecs on 21/07/2015** **Corres. Water Level :36.1 m**

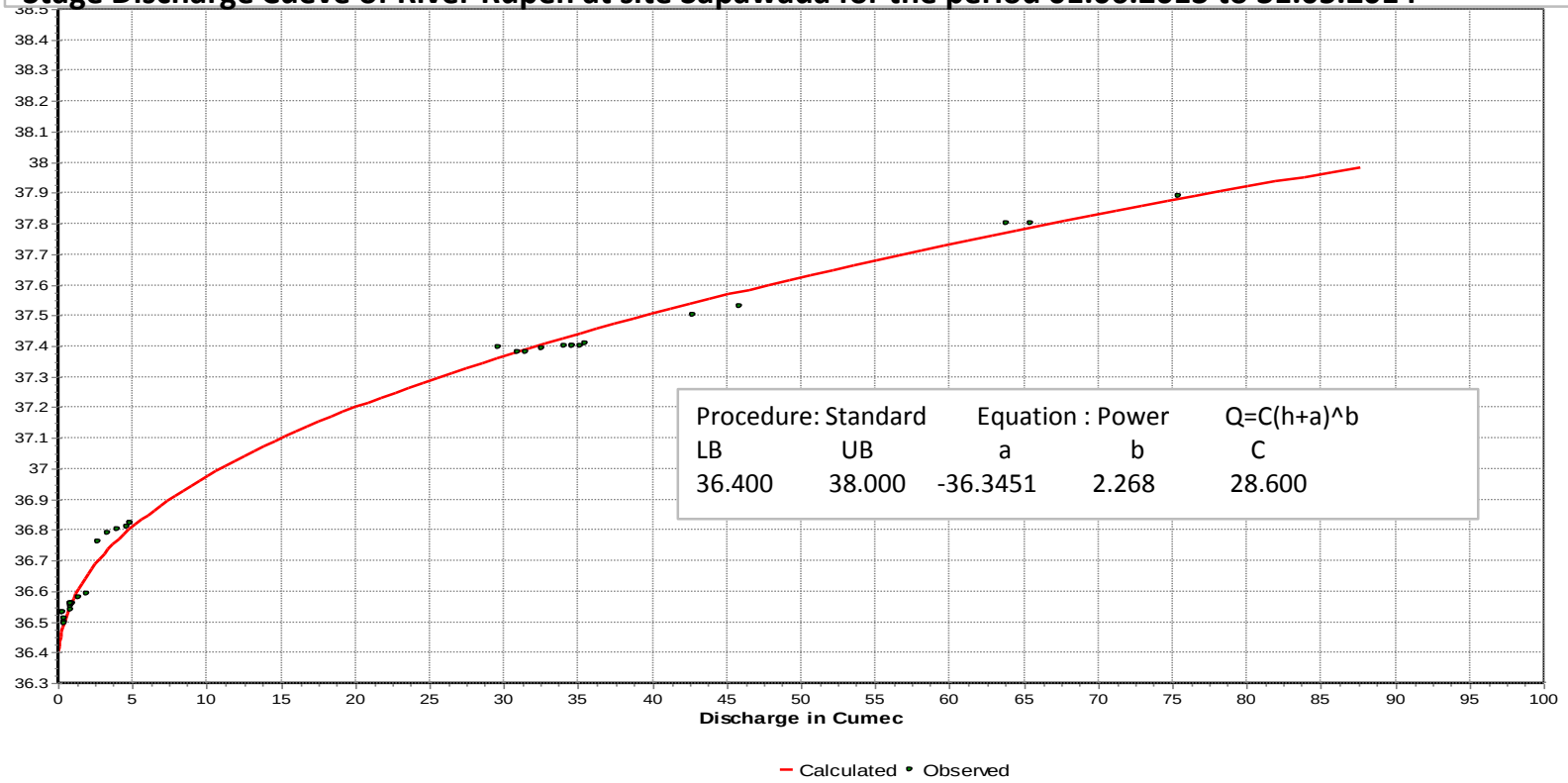
Lowest Observed Di

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff

Stage Discharge Cueve of River Rupen at site Sapawada for the period 01.06.2013 to 31.05.2014

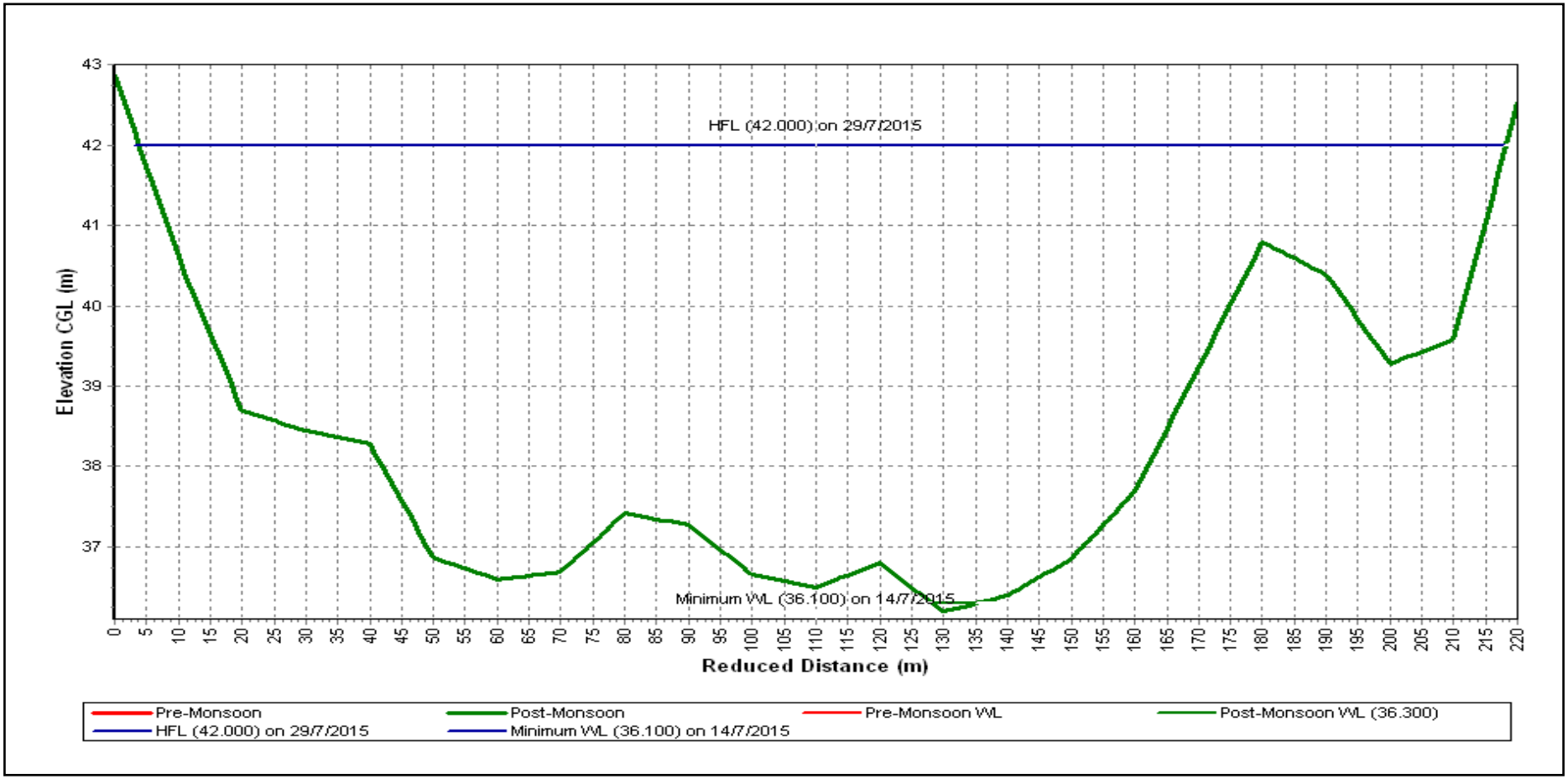


Only lower stage data for current year 2015-16. Curve 13-14 used for estimation

Pre-Monsoon & Post-Monsoon X-Section for Water Year : 2015-2016

Station Name : Rupen at Sapawada (01 02 04 001) **Division : Mahi Division, Gandhinagar**

Local River : Rupen **Sub-Division : B.L.Sub Divn, Palanpur**



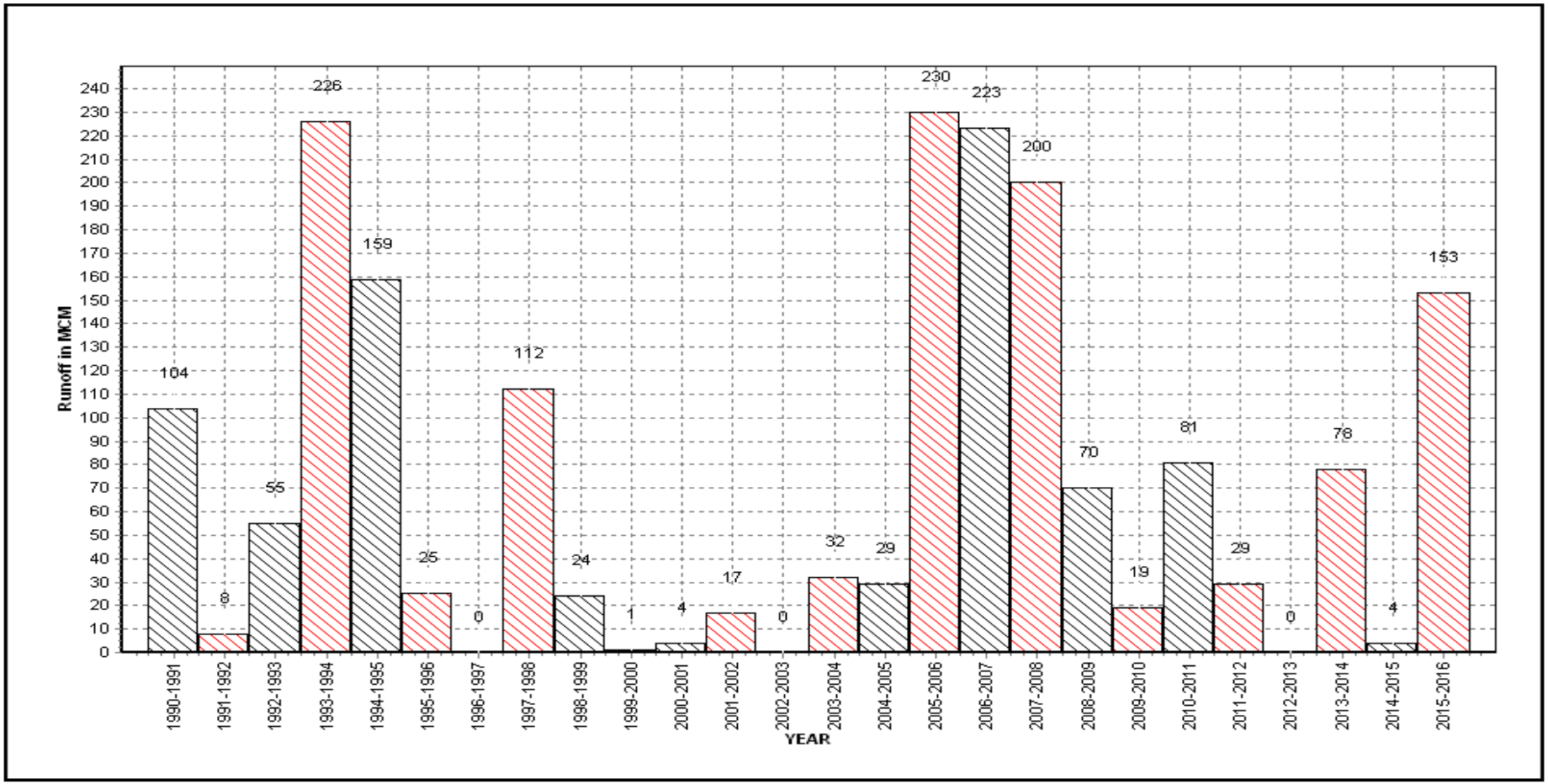
Historical Flood Level-43.0m on 27.08.1997 at 0800hrs

Note: HFL marked on graph denotes Maximum Water Level observed during the Water Year 2015-15

Annual Runoff Values for the period: 1990 - 2016

Station Name : Rupen at Sapawada (01 02 04 001) **Division : Mahi Division, Gandhinagar**

Local River : Rupen **Sub-Division : B.L.Sub Divn, Palanpur**

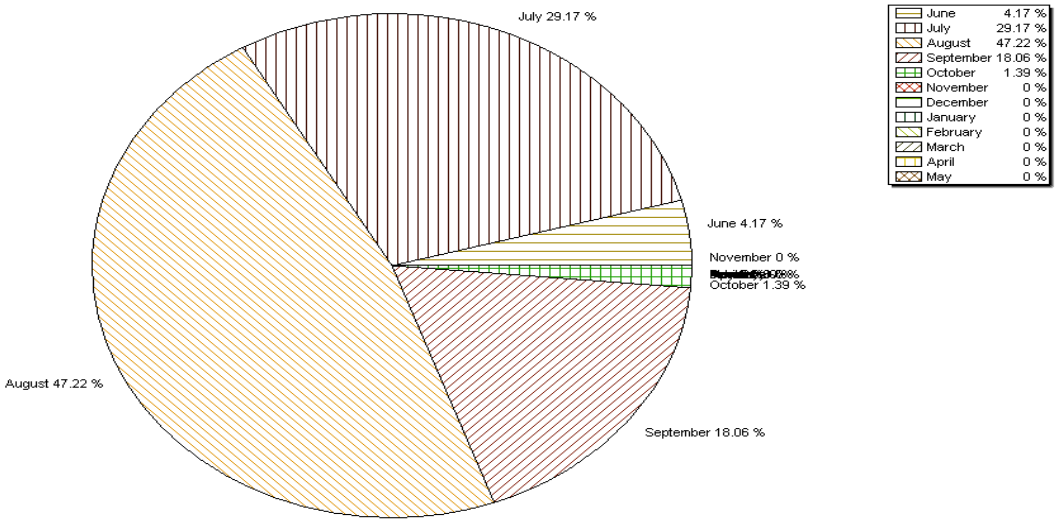


Note: Missing values have not been considered while arriving at Annual Runoff

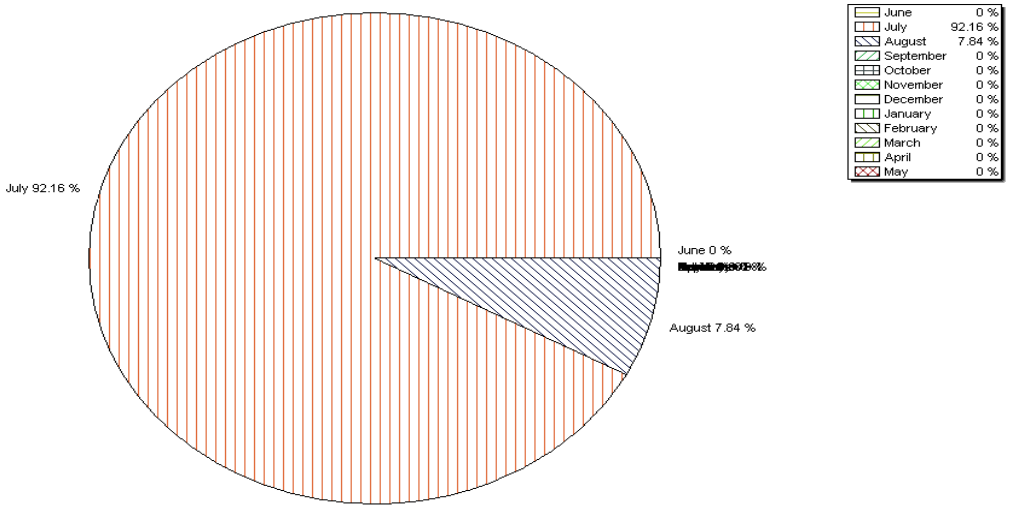
Station Name : Rupen at Sapawada (01 02 04 001) **Division : Mahi Division, Gandhinagar**

Local River : Rupen **Sub-Division : B.L.Sub Divn, Palanpur**

Monthly Average Runoff based on period : 1990-2015



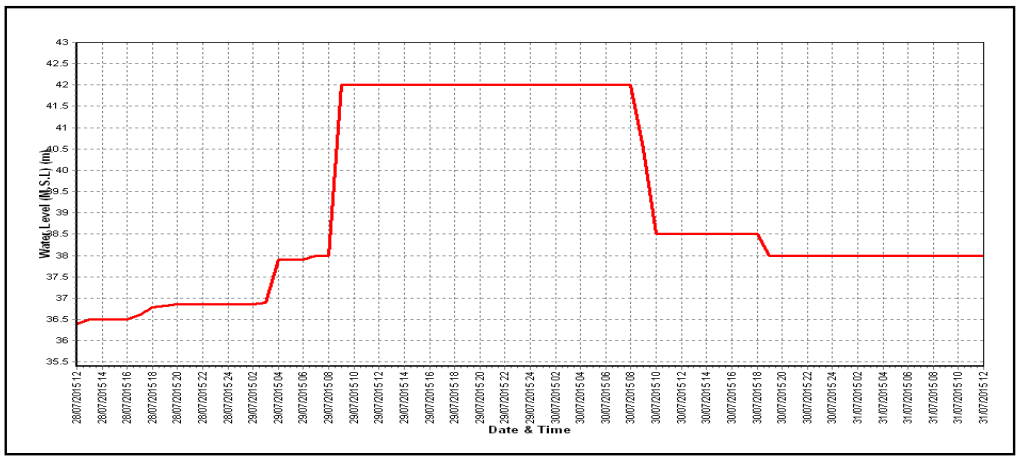
Monthly Runoff for the Year : 2015-2016



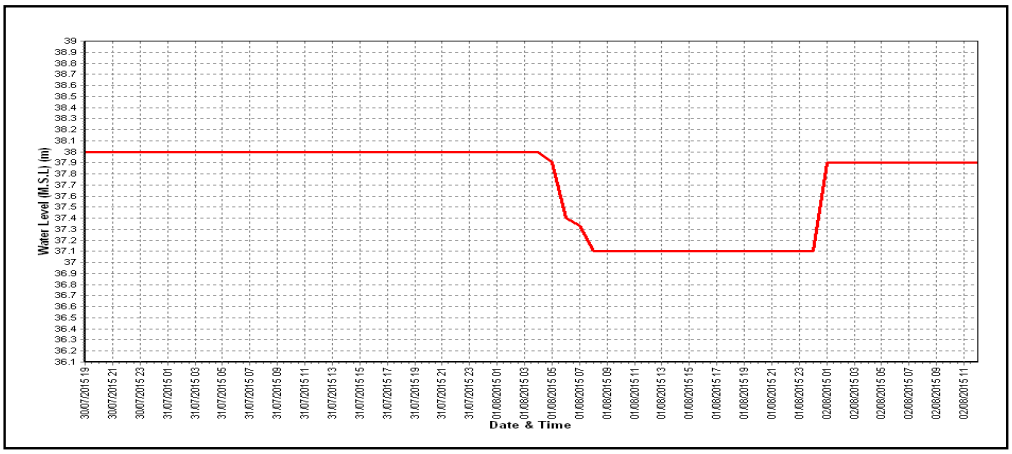
Station Name : Rupen at Sapawada (01 02 04 001) **Division : Mahi Division, Gandhinagar**

Local River : Rupen **Sub-Division : B.L.Sub Divn, Palanpur**

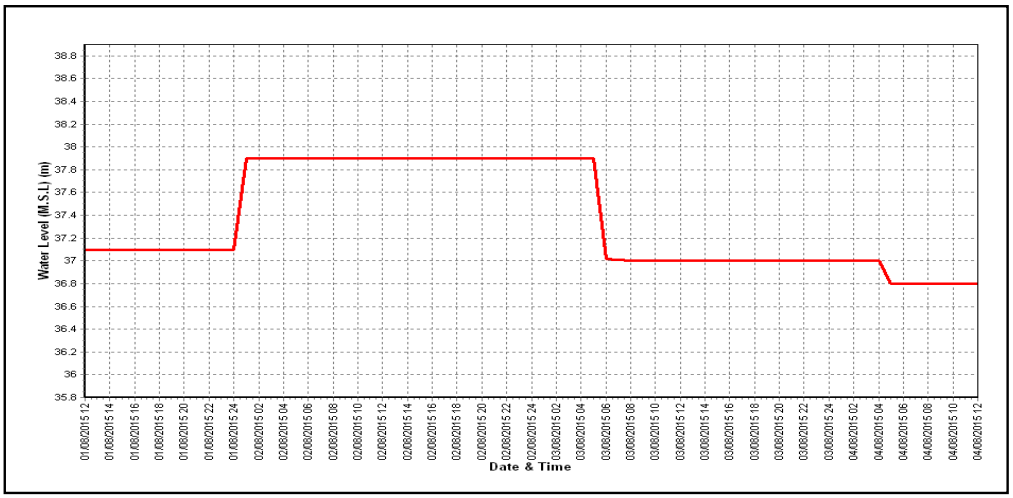
Water Level vs. Time - Graph of Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 2nd Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 3rd Highest Flood Peak during the Year : 2015-2016



Time Span: 72 Hrs

HISTORY SHEET

			Water Year	:	**2015-16**
Site	:	**Machhundri at Una**	**Code**	:	**01 02 14 001**
State	:	Gujarat	District		Somnath (Gir)
Basin	:	WFR of Kach.-Saur. & Luni	Independent River	:	Machhundri
Tributary	:	-	Sub Tributary	:	-
Sub-Sub Tributary	:	-	Local River	:	Machhundri
Division	:	E.E., Ahmedabad	Sub-Division	:	Ahmedabad
Drainage Area	:	395.01 Sq. Km.	Bank	:	Left
Latitude	:	20°49'42"	Longitude	:	71°02'51"
Zero of Gauge (m)	:	15.5 (m.s.l)	27/07/14		
		Opening Date	Closing Date		
Gauge	:	26/07/14			
Discharge	:	26/07/14			
Sediment	:				
Water Quality	:				

Annual Maximum / Minimum discharge with corresponding Water Level (m.s.l)

	Maximum			Minimum		
Year	**Q (cumecs)**	**WL (m)**	**Date**	**Q (cumecs)**	**WL (m)**	**Date**
2014-2015	34.83	16.925	04/09/14	0.000	River Dry	01/06/14
2015-2016	7.959	16.705	21/09/15	0.000	River Dry	01/06/15

Stage-Discharge Data for the period 2015 - 2016

Station Name : Machhundri at Una (01 02 14 001) **Division : E.E., Ahmedabad**

Local River : Machhundri **Sub-Division : Ahmedabad**

Day	Jun		Jul		Aug		Sep		Oct		Nov	
	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q
1	R.dry	0.000	16.340	0.244	16.320	0.146 *	16.300	0.100 *	16.400	0.647	16.305	0.000
2	R.dry	0.000	16.340	0.220	16.325	0.170 *	16.285	0.000	16.390	0.690 *	16.305	0.000
3	R.dry	0.000	16.340	0.186	16.325	0.170 *	16.280	0.000	16.375	0.540 #	16.305	0.000
4	R.dry	0.000	16.340	0.168	16.325	0.170 *	16.270	0.000	16.375	0.540 *	16.300	0.000
5	R.dry	0.000	16.330	0.200 *	16.325	0.170 *	16.270	0.000	16.370	0.490 #	16.300	0.000
6	R.dry	0.000	16.325	0.177	16.325	0.170 *	16.270	0.000	16.370	0.490 #	16.300	0.000
7	R.dry	0.000	16.325	0.190	16.325	0.170 *	16.270	0.000	16.365	0.490 #	16.300	0.000
8	R.dry	0.000	16.325	0.171	16.325	0.170 *	16.270	0.000	16.355	0.370 #	16.300	0.000
9	R.dry	0.000	16.325	0.165	16.325	0.170 *	16.265	0.000	16.345	0.378	16.300	0.000
10	R.dry	0.000	16.325	0.181	16.320	0.146 *	16.265	0.000	16.340	0.370	16.300	0.000
11	R.dry	0.000	16.325	0.191	16.320	0.146 *	16.265	0.000	16.345	0.300 *	16.295	0.000
12	R.dry	0.000	16.325	0.170 *	16.320	0.146 *	16.260	0.000	16.340	0.354	16.295	0.000
13	R.dry	0.000	16.325	0.173	16.320	0.000 *	16.300	0.030 #	16.340	0.333	16.295	0.000
14	R.dry	0.000	16.325	0.174	16.320	0.146 *	16.350	0.248	16.335	0.322	16.295	0.000
15	R.dry	0.000	16.325	0.170 #	16.320	0.146 *	16.390	0.450	16.330	0.286	16.295	0.000
16	R.dry	0.000	16.325	0.170 #	16.320	0.146 *	16.345	0.233	16.353	0.423	16.295	0.000
17	R.dry	0.000	16.325	0.170 #	16.320	0.146 *	16.345	0.247	16.345	0.380	16.295	0.000
18	R.dry	0.000	16.320	0.146 *	16.320	0.146 *	16.340	0.233	16.340	0.260 *	16.295	0.000
19	R.dry	0.000	16.320	0.146 *	16.320	0.146 *	16.365	0.437	16.335	0.294	16.295	0.000
20	R.dry	0.000	16.320	0.146 *	16.320	0.146 *	16.760	10.03 *	16.335	0.297	16.295	0.000
21	R.dry	0.000	16.320	0.146 *	16.320	0.146 *	16.708	7.959	16.335	0.265	16.290	0.000
22	R.dry	0.000	16.320	0.146 *	16.320	0.146 *	16.530	3.771	16.335	0.230 *	16.290	0.000
23	R.dry	0.000	16.320	0.146 *	16.320	0.146 *	16.500	1.850	16.330	0.277	16.290	0.000
24	19.800	498.7 *	16.320	0.146 *	16.320	0.146 *	16.475	1.457	16.330	0.200 *	16.290	0.000
25	16.505	2.266	16.320	0.146 *	16.320	0.146 *	16.440	1.582	16.330	0.200 *	16.290	0.000
26	16.400	0.633	16.320	0.146 *	16.320	0.146 *	16.440	1.325	16.330	0.285	16.290	0.000
27	16.360	0.418	16.330	0.200 *	16.320	0.146 *	16.440	1.320 *	16.330	0.243	16.290	0.000
28	16.360	0.410 *	16.325	0.175 *	16.320	0.146 *	16.435	0.995	16.320	0.223	16.290	0.000
29	16.340	0.273	16.325	0.175 *	16.315	0.120 *	16.430	1.138	16.315	0.182	16.290	0.000
30	16.330	0.251	16.325	0.175 *	16.315	0.120 *	16.420	0.911	16.310	0.196	16.285	0.000
31			16.320	0.146 *	16.310	0.100 *			16.305	0.185		
Ten-Daily Mean												
I Ten-Daily	R.dry	0.000	16.331	0.190	16.324	0.165	16.275	0.010	16.368	0.501	16.302	0.000
II Ten-Daily	R.dry	0.000	16.324	0.166	16.320	0.131	16.372	1.191	16.340	0.325	16.295	0.000
III Ten-Daily	16.871	71.86	16.322	0.159	16.318	0.137	16.482	2.231	16.325	0.226	16.290	0.000
Monthly												
Min.	16.330	0.251	16.320	0.146	16.310	0.000	16.260	0.000	16.305	0.182	16.285	0.000
Max.	19.800	498.7	16.340	0.244	16.325	0.170	16.760	10.03	16.400	0.690	16.305	0.000
Mean	16.871	71.86	16.326	0.171	16.321	0.144	16.376	1.144	16.344	0.346	16.295	0

Annual Runoff in MCM = 48 Annual Runoff in mm = 122

Peak Observed Discharge = 7.959 cumecs on 21/09/2015 Corres. Water Level :16.7075 m

Lowest Observed Discharge = 0.000 cumecs on 02/09/2015 Corres. Water Level :16.285 m

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff

Stage-Discharge Data for the period 2015 - 2016

Station Name : Machhundri at Una (01 02 14 001) **Division : E.E., Ahmedabad**

Local River : Machhundri **Sub-Division : Ahmedabad**

Day	Dec		Jan		Feb		Mar		Apr		May	
	W.L	Q	WL	Q	WL	Q	WL	Q	WL	Q	WL	Q
1	16.285	0.000	16.120	0.000	16.080	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
2	16.280	0.000	16.120	0.000	16.080	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
3	16.275	0.000	16.120	0.000	16.080	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
4	16.275	0.000	16.120	0.000	16.080	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
5	16.270	0.000	16.120	0.000	16.080	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
6	16.270	0.000	16.120	0.000	16.080	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
7	16.270	0.000	16.120	0.000	16.080	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
8	16.265	0.000	16.120	0.000	16.080	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
9	16.260	0.000	16.120	0.000	16.080	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
10	16.255	0.000	16.120	0.000	16.080	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
11	16.250	0.000	16.120	0.000	16.080	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
12	16.250	0.000	16.120	0.000	16.080	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
13	16.250	0.000	16.120	0.000	16.080	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
14	16.245	0.000	16.115	0.000	16.080	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
15	16.240	0.000	16.110	0.000	16.080	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
16	16.240	0.000	16.115	0.000	16.075	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
17	16.240	0.000	16.100	0.000	16.075	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
18	16.235	0.000	16.090	0.000	16.075	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
19	16.235	0.000	16.085	0.000	16.075	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
20	16.235	0.000	16.085	0.000	16.075	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
21	16.230	0.000	16.085	0.000	16.075	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
22	16.230	0.000	16.080	0.000	16.075	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
23	16.230	0.000	16.080	0.000	16.075	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
24	16.230	0.000	16.080	0.000	16.065	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
25	16.220	0.000	16.080	0.000	16.055	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
26	16.200	0.000	16.080	0.000	16.035	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
27	16.185	0.000	16.080	0.000	R Dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
28	16.145	0.000	16.080	0.000	R Dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
29	16.120	0.000	16.080	0.000	R Dry	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
30	16.120	0.000	16.080	0.000			R.dry	0.000	R.dry	0.000	R.dry	0.000
31	16.120	0.000	16.080	0.000			R.dry	0.000			R.dry	0.000
Ten-Daily Mean												
I Ten-Daily	16.271	0.000	16.120	0.000	16.080	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
II Ten-Daily	16.242	0.000	16.106	0.000	16.077	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
III Ten-Daily	16.185	0.000	16.080	0.000	16.063	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
Monthly												
Min.	16.120	0.000	16.080	0.000	16.035	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
Max.	16.285	0.000	16.120	0.000	16.080	0.000	R.dry	0.000	R.dry	0.000	R.dry	0.000
Mean	16.231	0	16.101	0	16.075	0	R.dry	0.000	R.dry	0.000	R.dry	0.000

Annual Runoff in M(Peak Computed Discharge = 498.7 cumecs on 24/06/2015 Corres. Water Level :19.8 m

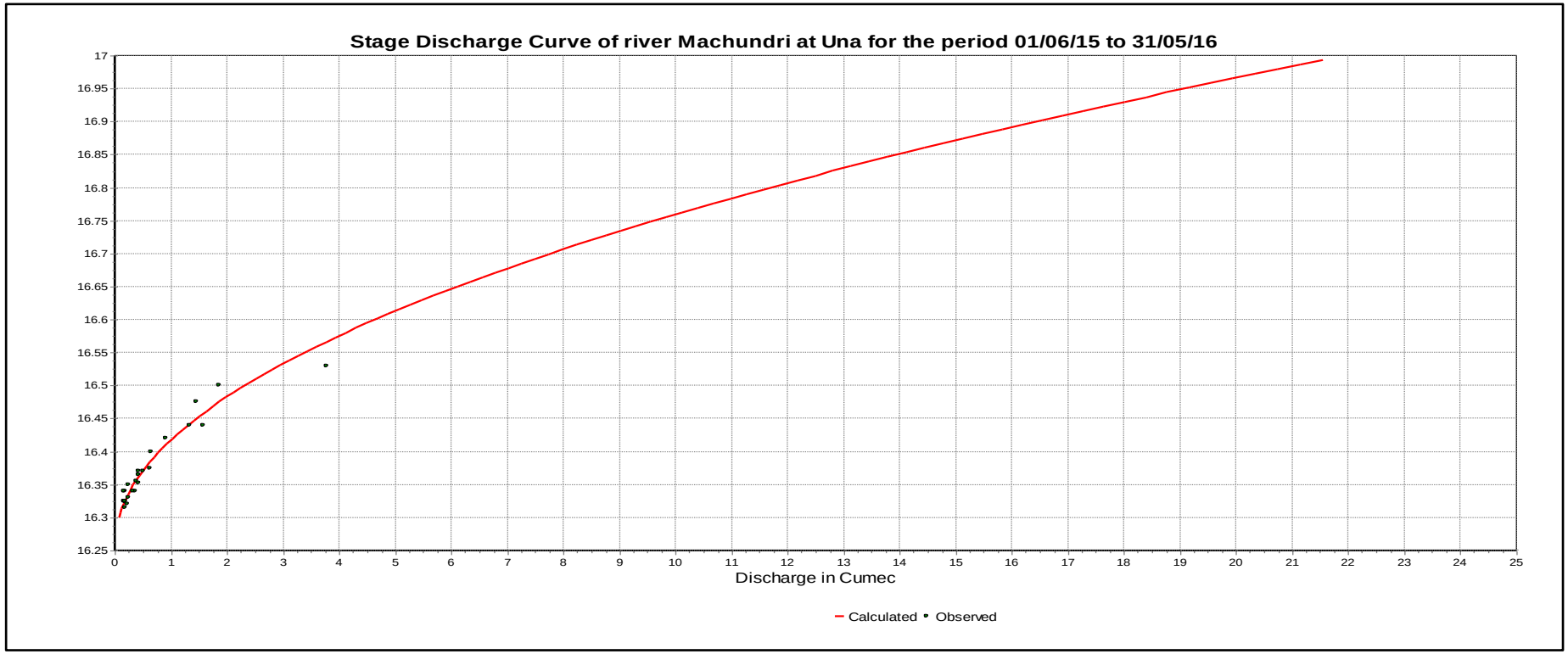
Peak Observed Discl Lowest Computed Discharge = 0.000 cumecs on 13/08/2015 Corres. Water Level :16.32 m

Lowest Observed Di

Q: Observed/Computed Discharge in cumecs WL:Corresponding Mean Water Level(m.s.l) in m *:Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note:Missing values ignored while arriving at Annual Runoff



Procedure - Standard

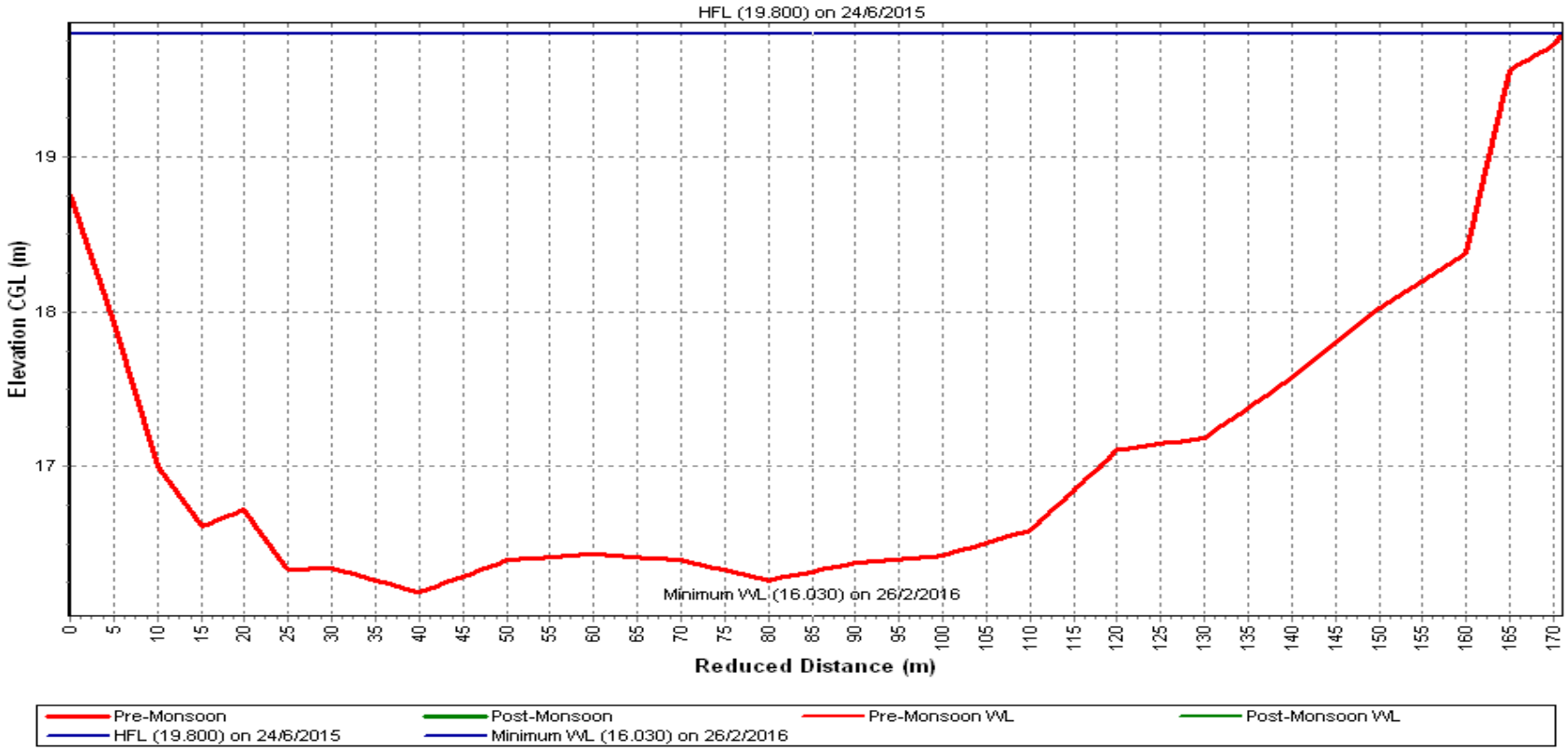
Equation Type - Parabolic $Q=a+b*h+c*h^2$

LB	UB	a	b	c
16.3	17	10503.63	-1292.17	39.74088

Pre-Monsoon & Post-Monsoon X-Section for Water Year : 2015-2016

Station Name : Machhundri at Una (01 02 14 001) **Division : E.E., Ahmedabad**

Local River : Machhundri **Sub-Division : Ahmedabad**



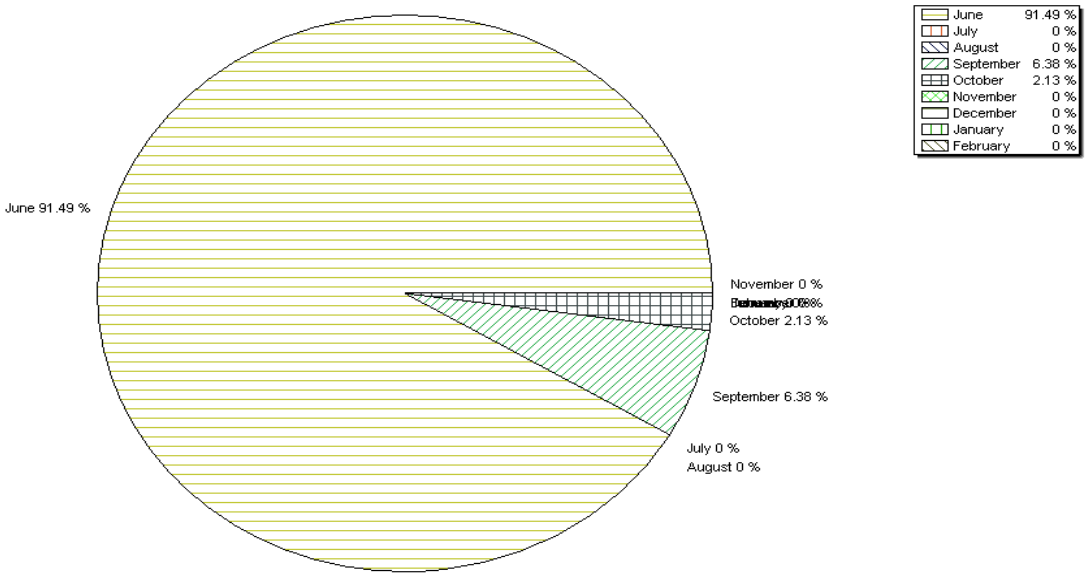
Historical Flood level - sufficient data not available

Note: HFL marked on graph denotes Max Water Level observed during the Water Year 2015-16

Monthly Runoff for the Year : 2015-2016

Station Name : Machhundri at Una (01 02 14 001) **Division : E.E., Ahmedabad**

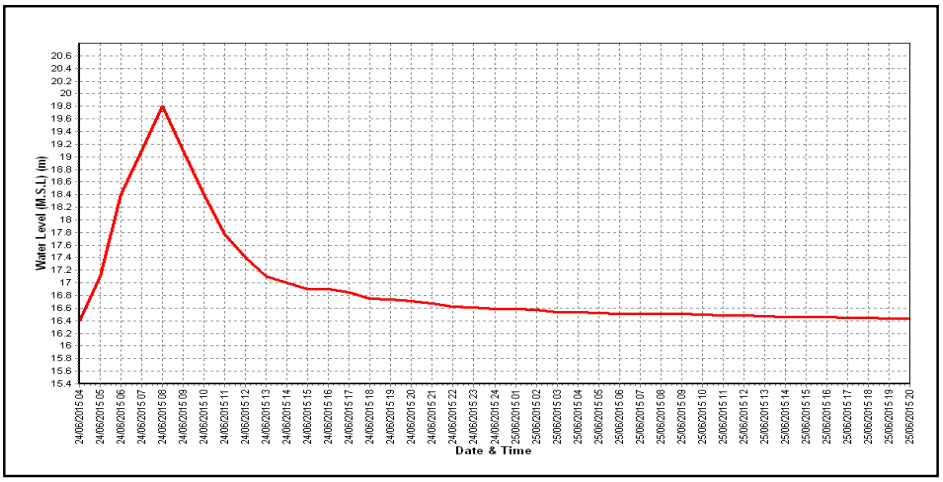
Local River : Machhundri **Sub-Division : Ahmedabad**



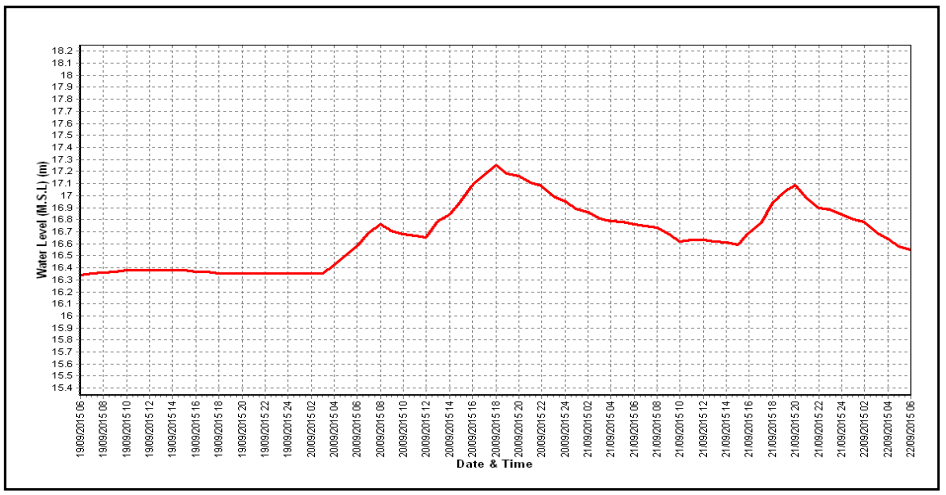
Station Name : Machhundri at Una (01 02 14 001) **Division : E.E., Ahmedabad**

Local River : Machhundri **Sub-Division : Ahmedabad**

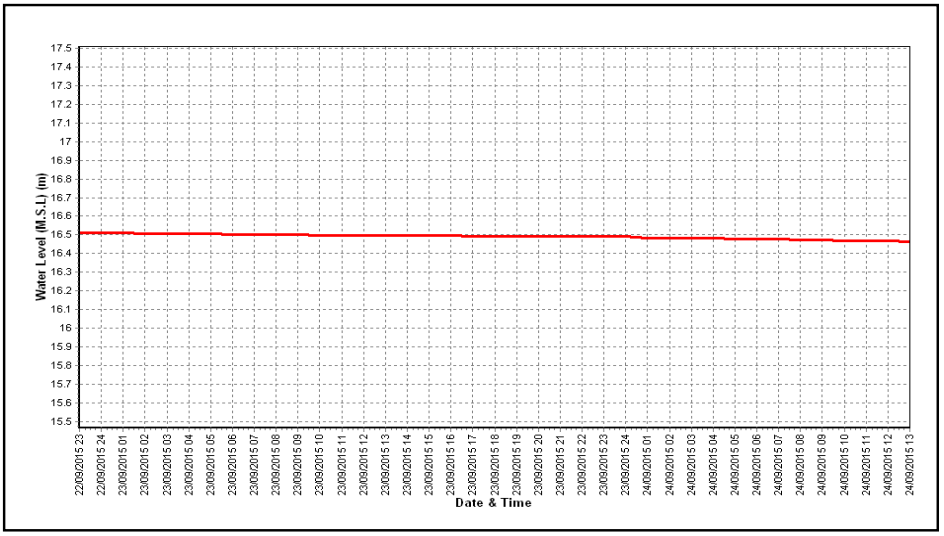
Water Level vs. Time - Graph of Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 2nd Highest Flood Peak during the Year : 2015-2016



Water Level vs. Time - Graph of 3rd Highest Flood Peak during the Year : 2015-2016



Time Span: 72 Hrs

5. Trend Analysis

5.1 Trend Analysis- Mahi Basin

5.1.1 Introduction

Trends are important indicators of the temporal variability of runoff as computed from observed discharge at site. By analyzing the time sequence of the runoff, we assess the magnitude and significance of the temporal variability. The present surface runoff trend study involves analysis of the temporal variability of data sets on the observed discharges in Mahi basin using available data of existing river gauging stations.

5.1.2 Methodology

In the analysis of the trends of runoff on Mahi River and its major tributary Jakham, Som and Anas, annual runoff is computed and analyzed. The analysis is carried out for six (6) river gauging stations with sufficiently long and continuous data sets that are fairly representatively distributed across Mahi river Basin.

Overall six stations have been considered in this study. The length of the data sets of river gauging station varies from 25 to 38 years. Subsequently, time series are analysed on various statistical parameters, fitting of mathematical equations, observing moving means for various period so as to find out if there are any trends in the annual runoff data.

5.1.3 Time series analysis

Time series is defined as a sequence of values arrayed in order of their occurrence which can be characterized by statistical properties. Time series analysis may be used to test the variability, homogeneity and trend of a stream flow series or simply to give an upright list the characteristics of the series as graphically displayed. Significant movements of time series are the secular, periodic, cyclic and irregular trends. A time series may display a tendency to increase or decrease, over a specified period. Such a series provides an interesting illustration because if the trend is usually predominant, virtually no other movements are discernible.

Various methods exist for analysis of time series such as moving averages, residual series, residual mass curves and balance. Trends may also be revealed by determining if observed stream flow follows some mathematical equation as a function of time.

In this chapter, first statistical parameters have been computed for time series data of annual runoff at different sites in Mahi basin. It is also ascertained if any mathematical equation can be fitted to the time series to assess predictability. Finally, the data is analysed by the method of moving means for various periods.

5.1.4 Availability of Annual runoff data

There are 6 G&D sites in Mahi Basin. Availability of annual runoff data for these sites is summarized in **Table -1** and superimposed plot of annual runoff data of all sites in Mahi basin is given under **Fig. 5.1.1.**

Table-1: Availability of Annual runoff data

Sl.No.	Site name	River/Tribu.	Data availability	Tot. years
1	Chakaliya	Anas	1991-92 to 2015-16	25
2	Dhariawad	Jakham	1988-89 to 2015-16	28
3	Khanpur	Mahi	1979-80 to 2015-16	37
4	Mataji	Mahi	1982-81 to 2015-16	34
5	Paderdibadi	Mahi	1978-79 to 2015-16	38
6	Rangeli	Som	1979-80 to 2015-16	37

The data is placed at **Annexure-1** and shown in line diagram in **Plate – 2.1.2.**

5.1.5 Analysis

5.1.5.1 Statistical Analysis

Various statistical parameters of the time series of available data are given below in **Table-2**.

Table-2: Statistical parameters of Annual Runoff series at various sites

GD station	Data length	Mean	Median	SD	Coeff. Of
	(yrs)	(MCM)	(MCM)	(MCM)	variation
Mahi Basin					
Chakaliya	25	1503	1006	1466	0.975
Dhariawad	28	253	120	301	1.191
Khanpur	37	4513	2779	4855	1.076
Mataji	34	1369	1171	1008	0.737
Paderdibadi	38	2060	1480	2071	1.005
Rangeli	37	709	569	656	0.926

5.1.5.2 Fit characteristics

In order to find out if any mathematical equation represents the time series as a function of time, fitting of various types of equations viz. linear, logarithmic, exponential and polynomial have been attempted. Results of such fits are given in the **Table- 3** and shown in **Fig 5.1.2 through 5.1.7**.

Table-3: Fit Characteristics

Sl.No.	Site	Function Type	Fitted Equation	R^2
	MAHI BASIN			
1	Chakaliya	Linear	y = -49.168x + 99985	0.061
		Logarithmic	y = -98412ln(x) + 749673	0.0609
		Polynomial	$y = -3.3366x^2 + 13317x - 1E+07$	0.0726
		Exponential	$y = 2E+15e^{-0.014x}$	0.0088
2	Dhariawad	Linear	y = 12.559x - 24893	0.1189
		Logarithmic	y = 25112ln(x) - 190647	0.1186
		Polynomial	$y = 0.9457x^2 - 3773x + 4E+06$	0.1539
3	Khanpur	Linear	y = 33.759x - 62891	0.0052
		Logarithmic	y = 67643ln(x) - 509523	0.0053
		Polynomial	$y = -4.9011x^2 + 19614x - 2E+07$	0.0147
		Exponential	$y = 1438.6e^{0.0003x}$	1.00E-05
4	Mataji	Linear	y = 21.997x - 42590	0.0472
		Logarithmic	y = 43910ln(x) - 332351	0.047
		Polynomial	$y = 1.3044x^2 - 5191.7x + 5E+06$	0.0599
		Exponential	$y = 1E-08e^{0.0127x}$	0.0182
5	Paderdibadi	Linear	y = -17.20x + 36402	0.008
		Logarithmic	y = -3453ln(x) + 26446	0.008
		Polynomial	$y = 3.931x^2 - 15717x + 2E+07$	0.051
		Exponential	$y = 2E+20e^{-0.02x}$	0.047
6	Rangeli	Linear	y = 3.221x - 5724.	0.002
		Logarithmic	y = 6390ln(x) - 47851	0.0028
		Polynomial	$y = 0.958x^2 - 3826.x + 4E+06$	0.025
		Exponential	$y = 2E+09e^{-0.0076x}$	0.007

5.1.5.3 Moving Mean Analysis

In statistics, a moving mean (average), also called rolling average, rolling mean or running average, is a type of finite impulse response filter used to analyze a set of data points by creating a series of averages of different subsets of the full data set.

The first element of the moving average is obtained by taking the average of the initial fixed subset of the number series. Then the subset is modified by "shifting forward", that is excluding the first number of the series and including the next number following the original subset in the series. This creates a new subset of numbers, which is averaged. This process is repeated over the entire data series. The plot line connecting all the (fixed) averages is the moving average. A moving average is a set of numbers, each of which is the average of the corresponding subset of a larger set of data points.

A moving average may also use unequal weights for each data value in the subset to emphasize particular values in the subset. A moving average is commonly used with time series data to smooth out short-term fluctuations and highlight longer-term trends or cycles.

In the present analysis, moving means have been computed for 3, 5 and 7 year periods for various sites of Mahi River Basin and shown in **Fig 5.1.8 through 5.1.13**.

5.1.6 Interpretation

5.1.6.1 Fitting of various statistical/mathematical models viz linear, logarithmic, exponential and polynomial reveals that values of R^2 range from 0.0088 to 0.0726 for Chakaliya, from 0.1186 to 0.1539 for Dhairawadi, from 1.00E-05 to 0.0147 for Khanpur, from 0.0182 to 0.0599 for Mataji, 0.008 to 0.051 for Paderdibadi and from 0.0028 to 0.025 for Rangeli. The values of R^2 are quite close to 0 indicating absence of any significant trend.

5.6.1.2 Moving average analysis done for all the 6 sites under Mahi basin reveal elements of periodicities present in the data. This feature is observed in plots of all 3, 5 and 7 year moving averages. However, in view of the limited length of data series, it may be premature to conclude that there exists a definite cyclic trend in the average annual runoff.

5.1.7 Conclusion

Statistically speaking, the annual runoff of river Mahi and its tributary Anas, Som and Jakham, in general, appears to be a random variable; however elements of cyclicalness cannot be ruled out on the strength of moving mean analysis. A longer set of time series data may help identify trends in annual runoff, if any.

****

Annexure - 1

ANNUAL RUNOFF OF MAHI BASIN

YEAR	CHAKALIYA	DHARIAWAD	KHANPUR	MATAJI	PADERDI	RANGELI
1978					5093	
1979			3449		1868	310
1980			2631		3205	1256
1981			5394		3408	744
1982			1769	625	2051	365
1983			4921	1426	2863	809
1984			6034	1996	3123	881
1985			755	171	848	633
1986			2068	1234	1743	614
1987			1109	489	685	320
1988		**81**	2760	1924	885	542
1989		**0**	2300	707	972	569
1990		511	11550	2319	3909	1570
1991	1006	259	4631	1340	2229	1051
1992	331	35	869	388	742	633
1993	1425	148	3470	1107	1321	822
1994	5295	353	19684	2573	6428	2302
1995	778	27	791	891	368	178
1996	4274	340	8804	2833	2970	663
1997	3262	56	8118	1389	1355	390
1998	1881	27	3582	1548	1096	148
1999	125	45	554	258	321	184
2000	48	33	428	137	99	51
2001	313	44	479	161	304	118
2002	780	23	768	220	373	93
2003	1703	32	3553	1563	662	123
2004	2406	336	6890	1055	1837	486
2005	1125	124	2779	1019	930	517
2006	4889	1144	21880	4055	10946	3146
2007	1927	120	6737	2160	1600	264
2008	531	150	868	278	314	229
2009	401	106	553	1067	552	370
2010	458	114	1078	623	407	217
2011	616	937	5014	3001	3778	1299
2012	1228	563	7039	2230	2950	952
2013	1413	814	8787	3488	3003	1960
2014	756	59	2204	704	1360	754
2015	597	359	2692	1570	1678	671
MEAN	**1503**	**253**	**4513**	**1369**	**2060**	**709**
MEDIAN	**1006**	**120**	**2779**	**1171**	**1480**	**569**
STANDARD DEVAIATION	**1466**	**302**	**4855**	**1008**	**2071**	**656**
CO-EFFICIENT OF VARIATION	**0.975**	**1.191**	**1.076**	**0.737**	**1.005**	**0.926**

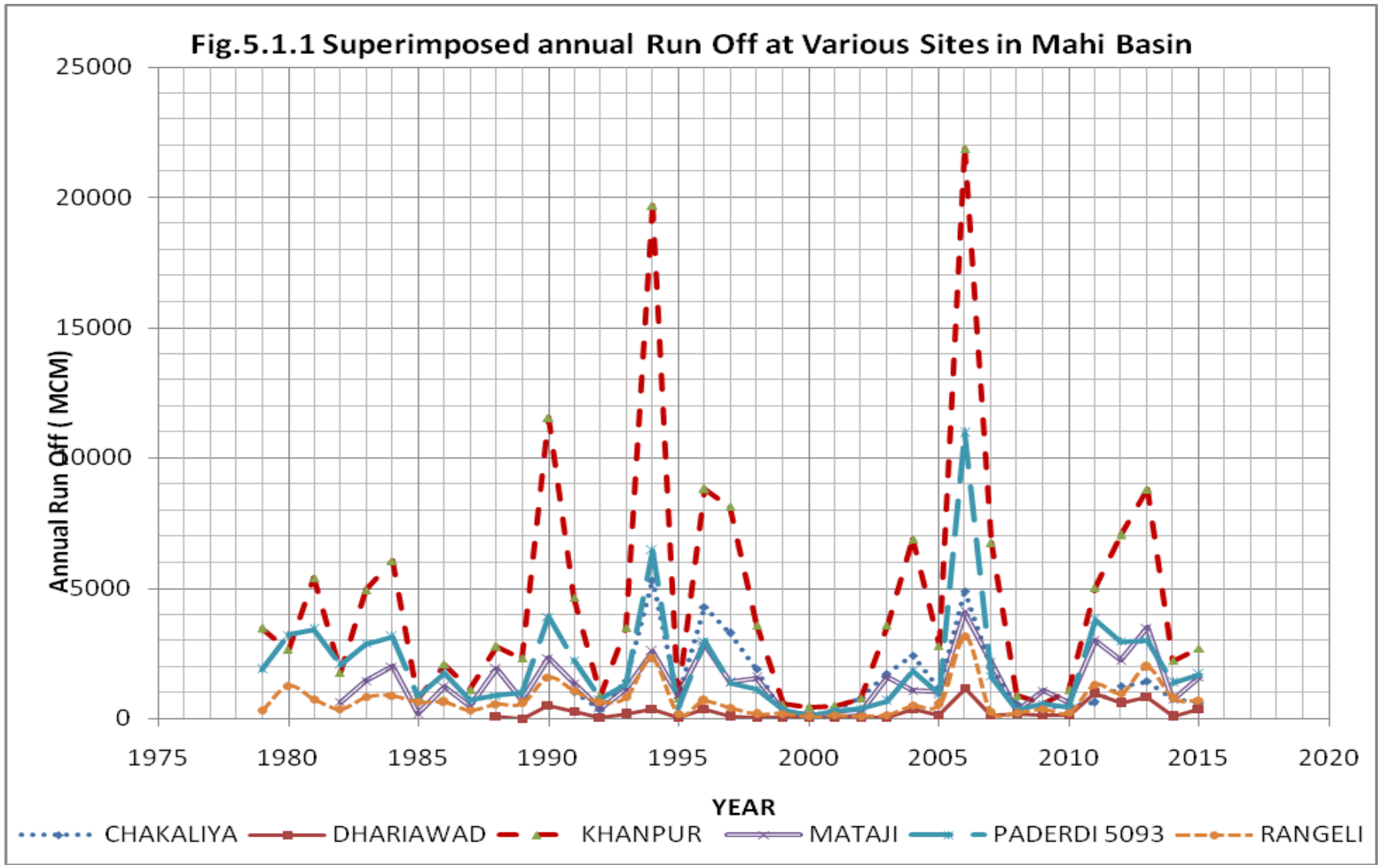


Fig.5.1.1 Superimposed annual Run Off at Various Sites in Mahi Basin
25000
20000
15000
10000
5000
0
Annual Run Off (MCM)
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
YEAR
CHAKALIYA
DHARIAWAD
KHANPUR
MATAJI
PADERDI 5093
RANGELI

Fig.5.1.2 Fit Characteristics - annual run off - Mahi at Khanpur

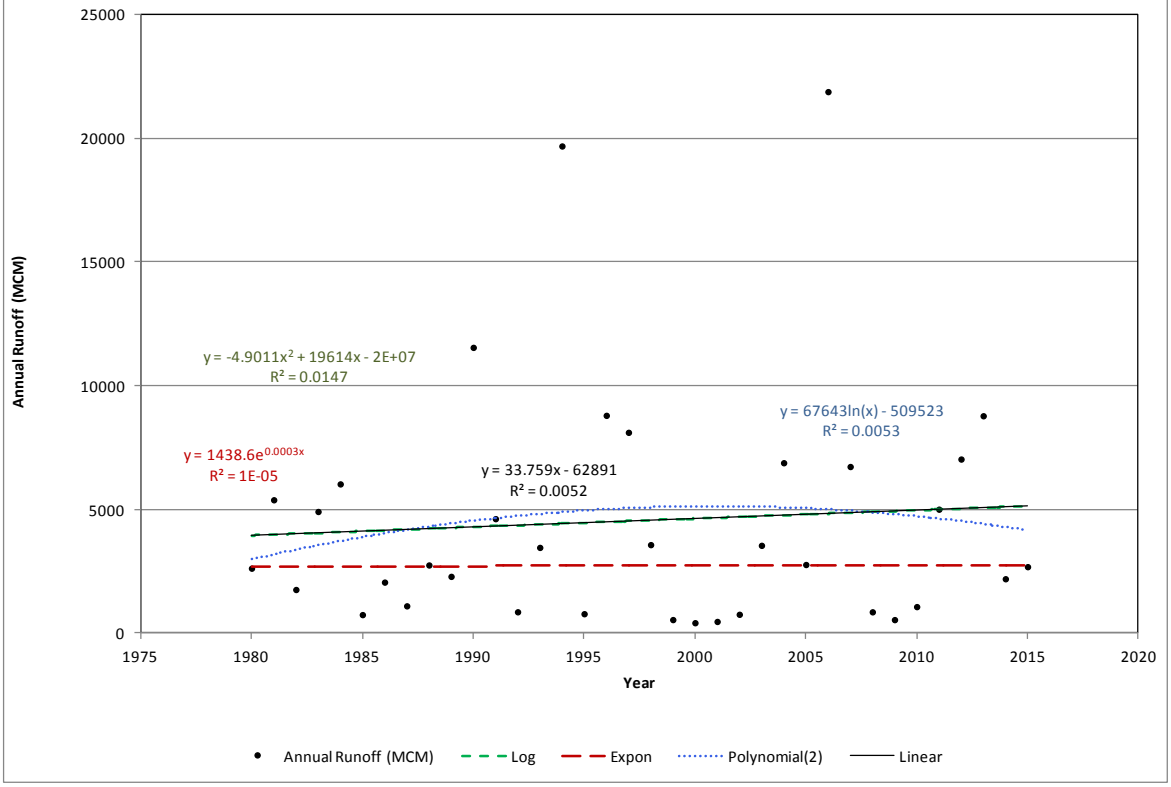
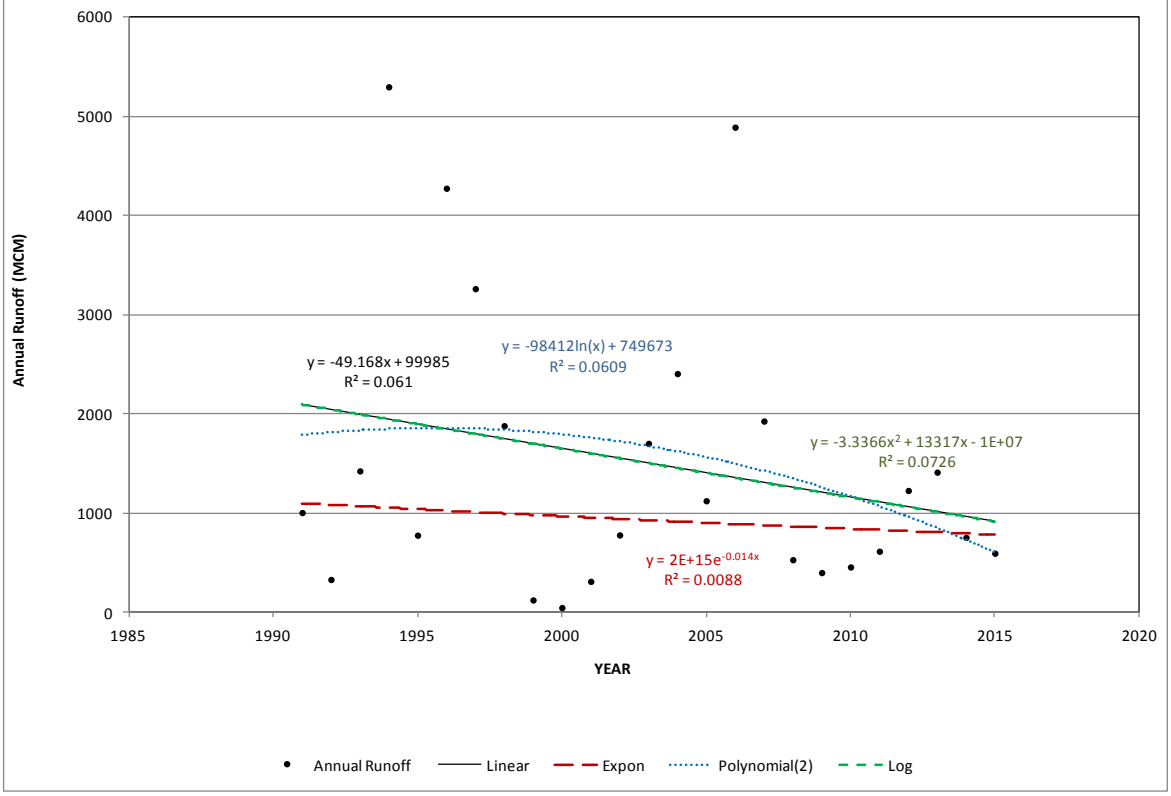


Fig.5.1.3 Fit Characteristics -annual runoff - Mahi at Chakaliya



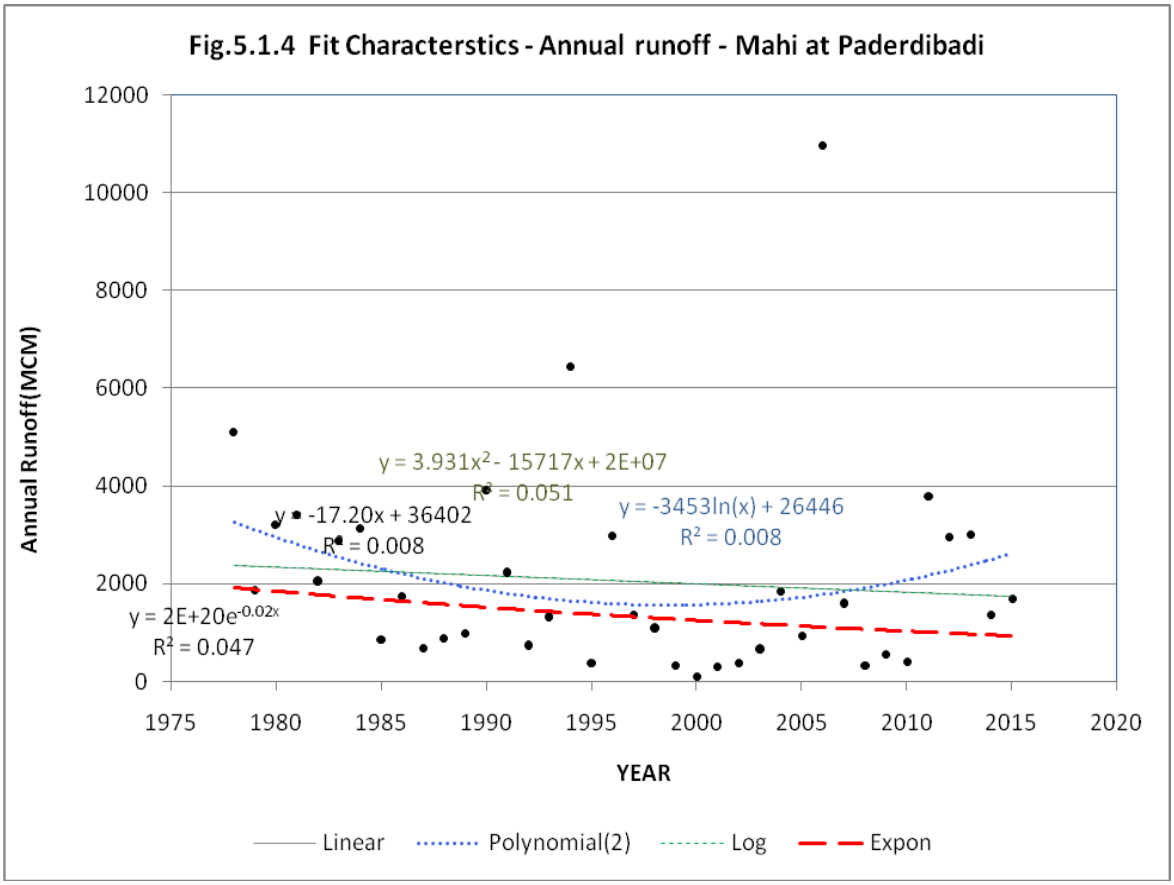


Fig.5.1.4 Fit Characterstics - Annual runoff - Mahi at Paderdibadi
Annual Runoff(MCM)
YEAR
y = 3.931x² - 15717x + 2E+07
R² = 0.051
y = -17.20x + 36402
R² = 0.008
y = -3453ln(x) + 26446
R² = 0.008
y = 2E+20e^-0.02x
R² = 0.047
Linear
Polynomial(2)
Log
Expon

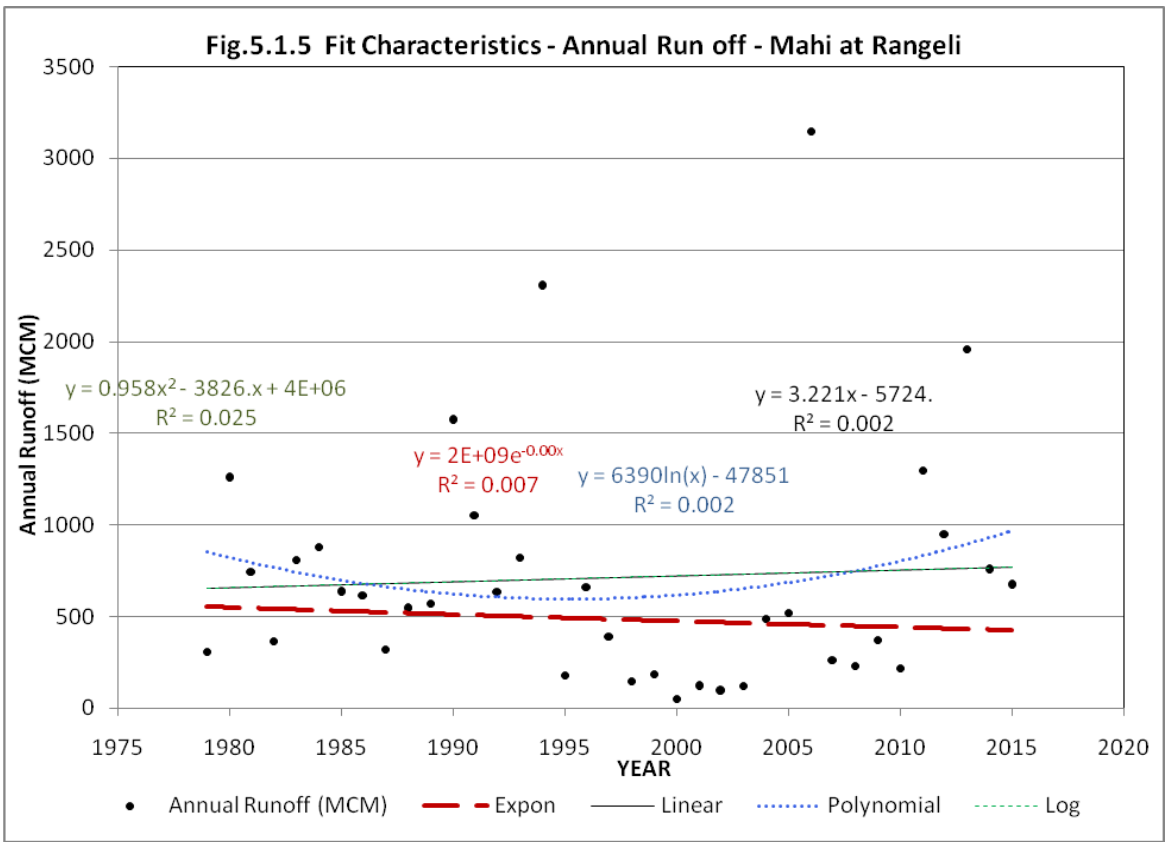


Fig.5.1.5 Fit Characteristics - Annual Run off - Mahi at Rangeli
Annual Runoff (MCM)
YEAR
y = 0.958x² - 3826.x + 4E+06
R² = 0.025
y = 3.221x - 5724.
R² = 0.002
y = 2E+09e^-0.00x
R² = 0.007
y = 6390ln(x) - 47851
R² = 0.002
Annual Runoff (MCM)
Expon
Linear
Polynomial
Log

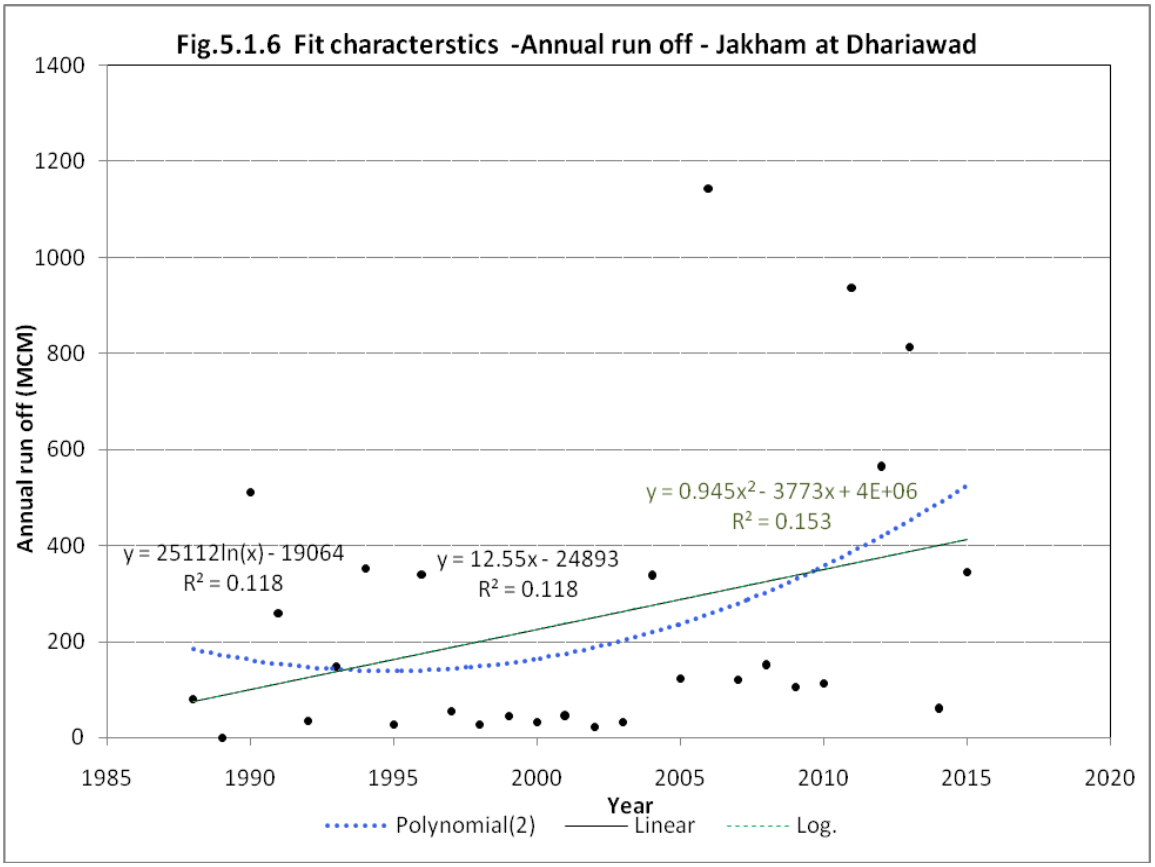


Fig.5.1.6 Fit characterstics -Annual run off - Jakham at Dhariawad
Annual run off (MCM)
Year
y = 25112ln(x) - 19064
R² = 0.118
y = 12.55x - 24893
R² = 0.118
y = 0.945x² - 3773x + 4E+06
R² = 0.153
Polynomial(2)
Linear
Log.

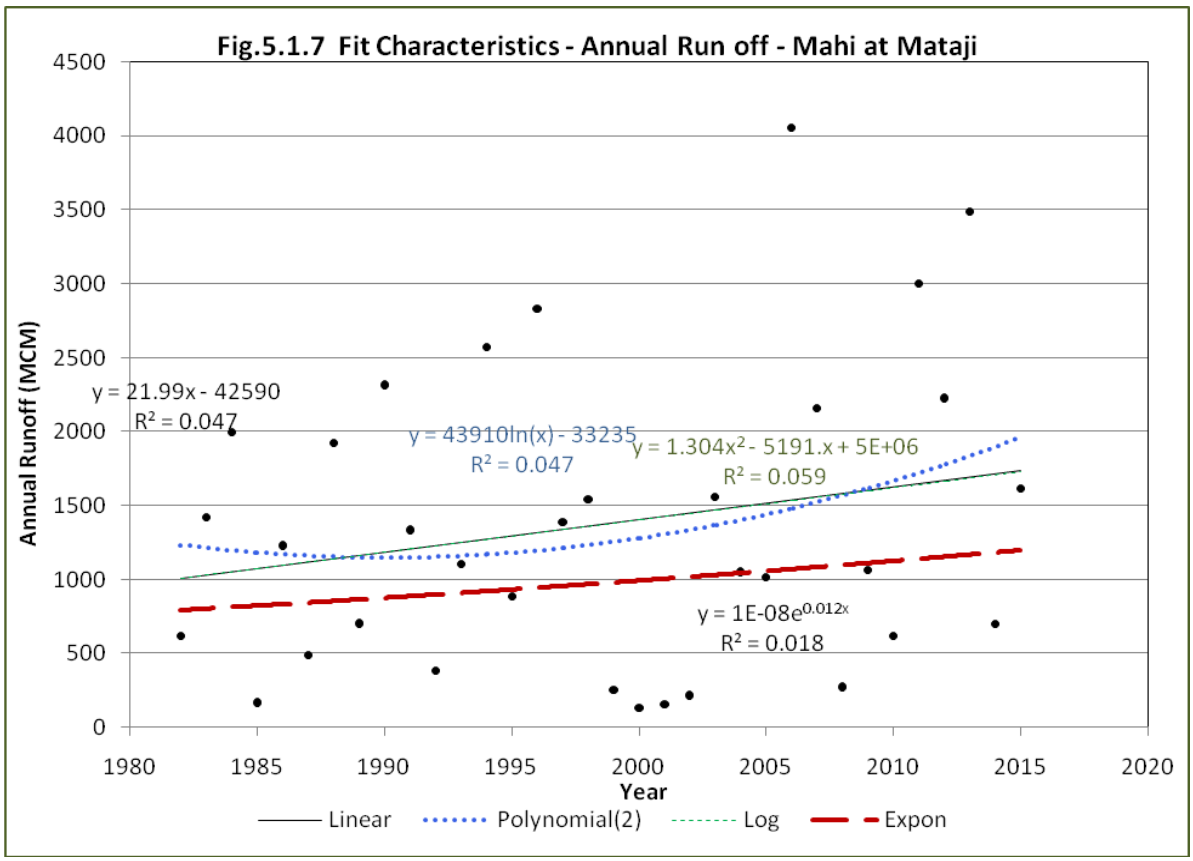


Fig.5.1.7 Fit Characteristics - Annual Run off - Mahi at Mataji
Annual Runoff (MCM)
Year
y = 21.99x - 42590
R² = 0.047
y = 43910ln(x) - 33235
R² = 0.047
y = 1.304x² - 5191.x + 5E+06
R² = 0.059
y = 1E-08e^0.012x
R² = 0.018
Linear
Polynomial(2)
Log
Expon

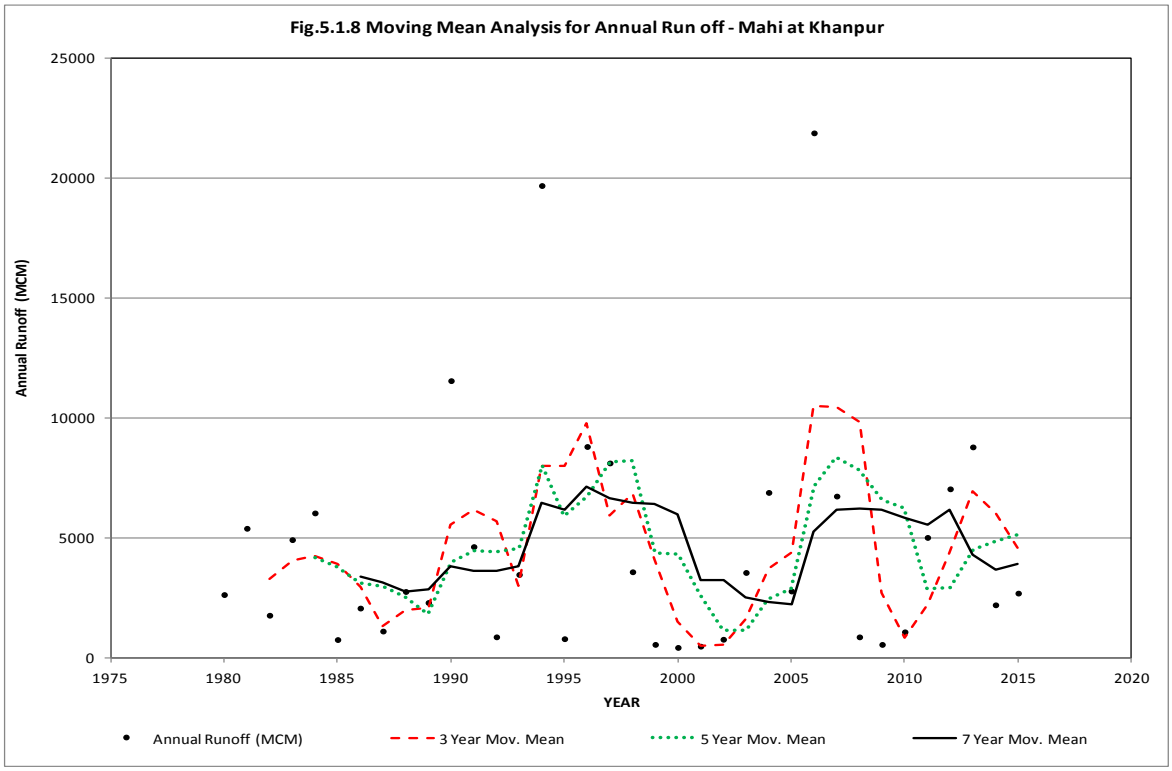


Fig.5.1.8 Moving Mean Analysis for Annual Run off - Mahi at Khanpur
Annual Runoff (MCM)
25000
20000
15000
10000
5000
0
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
YEAR
Annual Runoff (MCM)
3 Year Mov. Mean
5 Year Mov. Mean
7 Year Mov. Mean

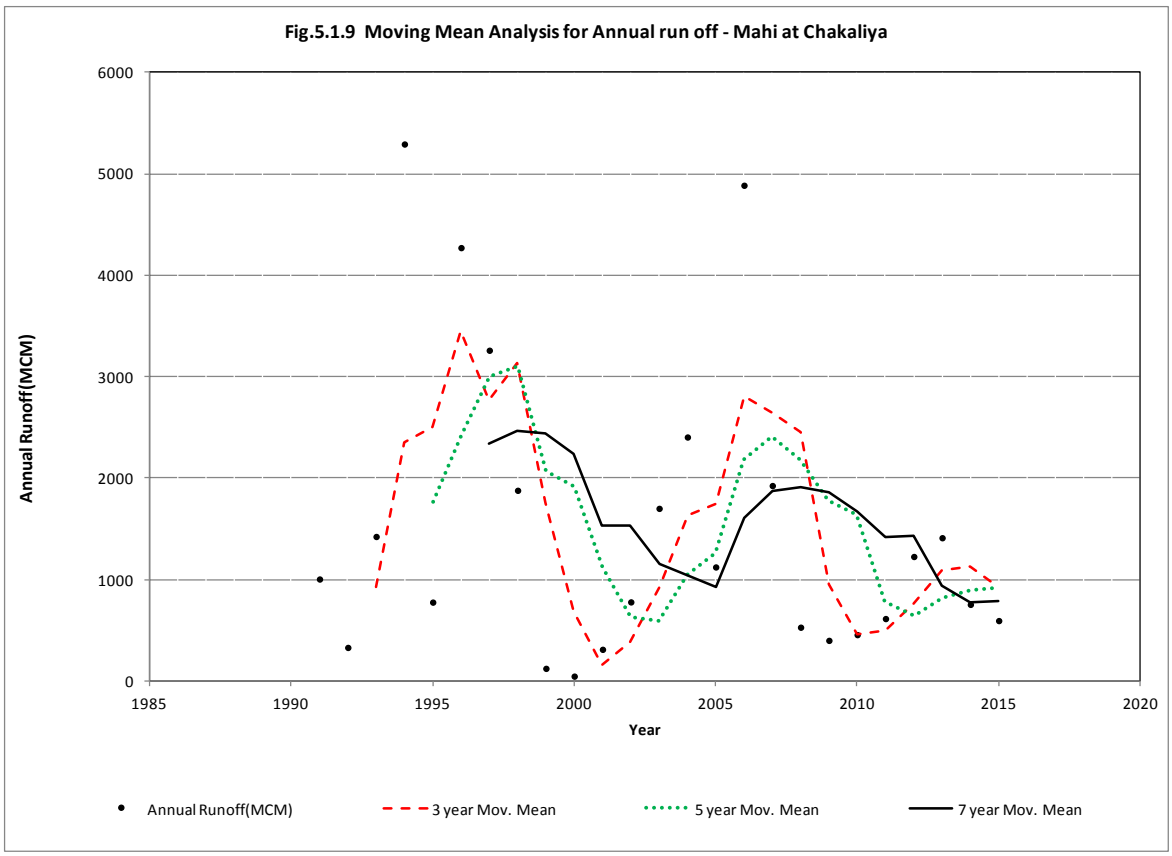


Fig.5.1.9 Moving Mean Analysis for Annual run off - Mahi at Chakaliya
Annual Runoff(MCM)
6000
5000
4000
3000
2000
1000
0
1985
1990
1995
2000
2005
2010
2015
2020
Year
Annual Runoff(MCM)
3 year Mov. Mean
5 year Mov. Mean
7 year Mov. Mean

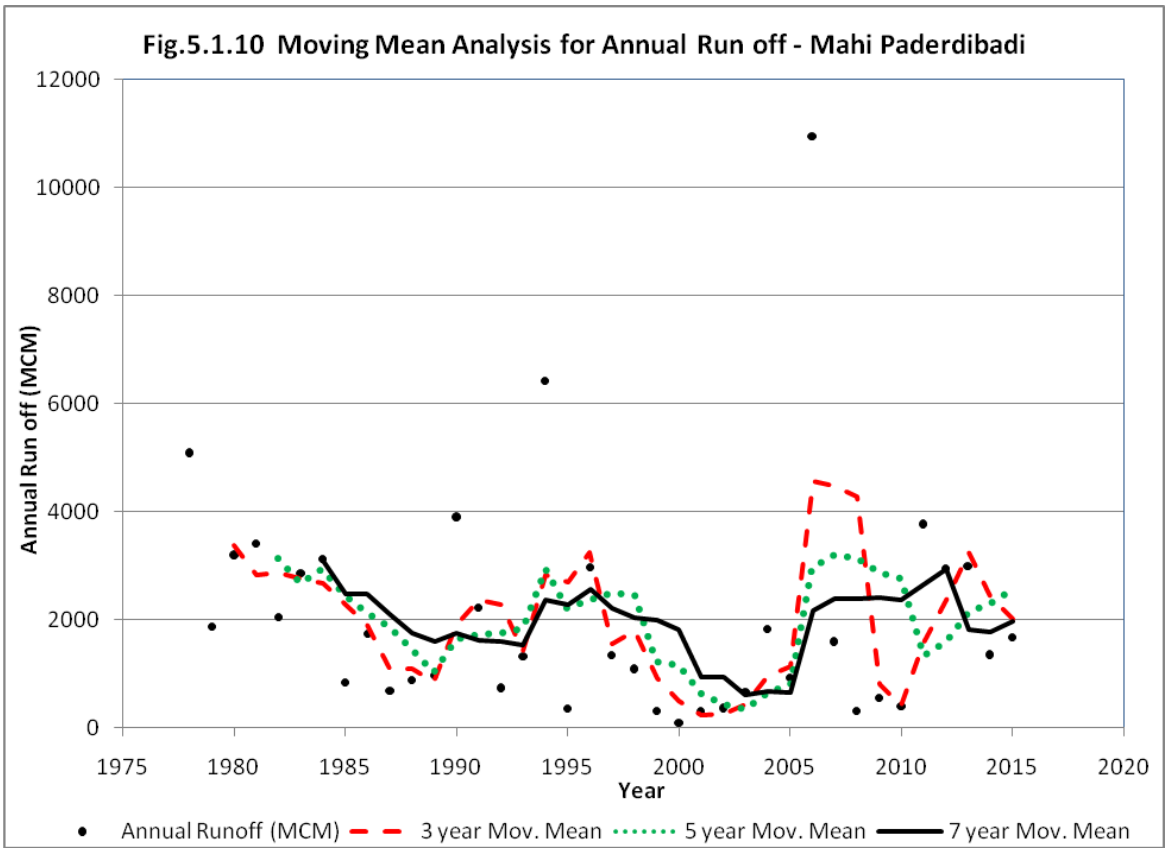


Fig.5.1.10 Moving Mean Analysis for Annual Run off - Mahi Paderdibadi
Annual Run off (MCM)
12000
10000
8000
6000
4000
2000
0
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Year
Annual Runoff (MCM)
3 year Mov. Mean
5 year Mov. Mean
7 year Mov. Mean

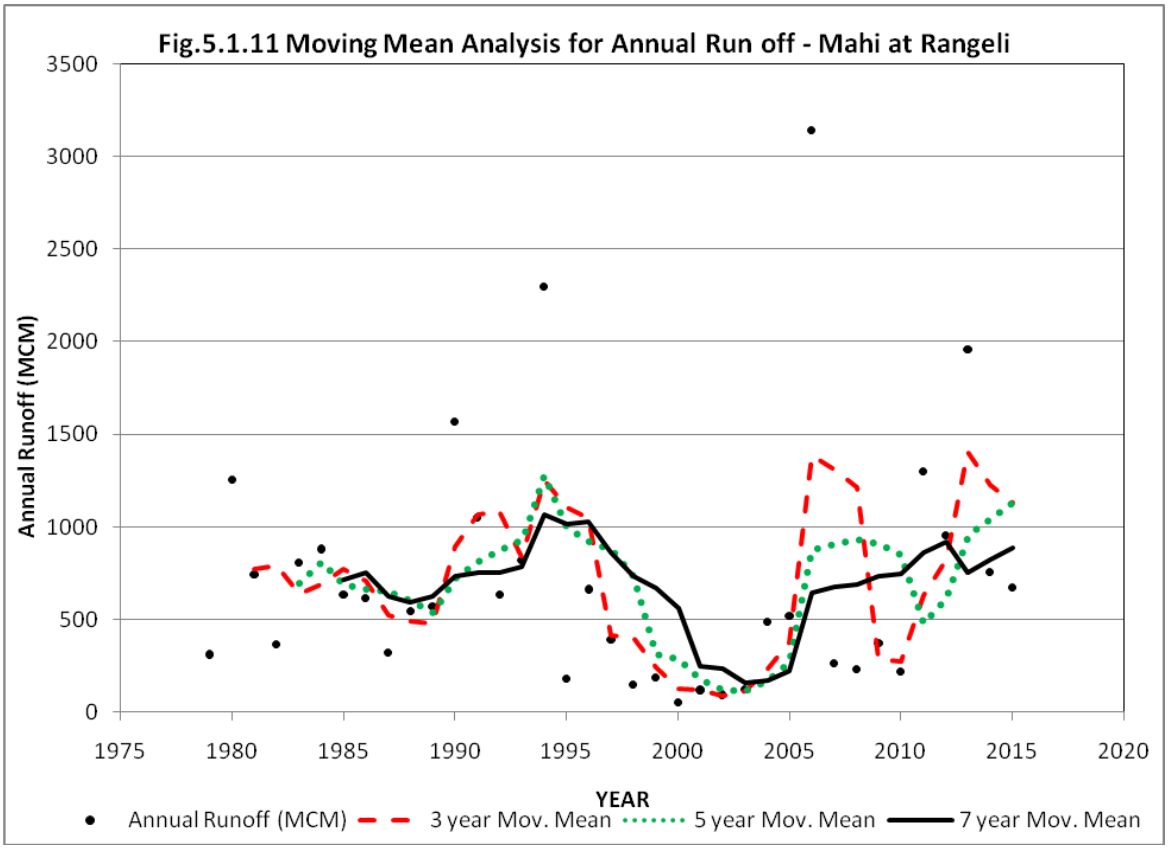


Fig.5.1.11 Moving Mean Analysis for Annual Run off - Mahi at Rangeli
Annual Runoff (MCM)
3500
3000
2500
2000
1500
1000
500
0
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
YEAR
Annual Runoff (MCM)
3 year Mov. Mean
5 year Mov. Mean
7 year Mov. Mean

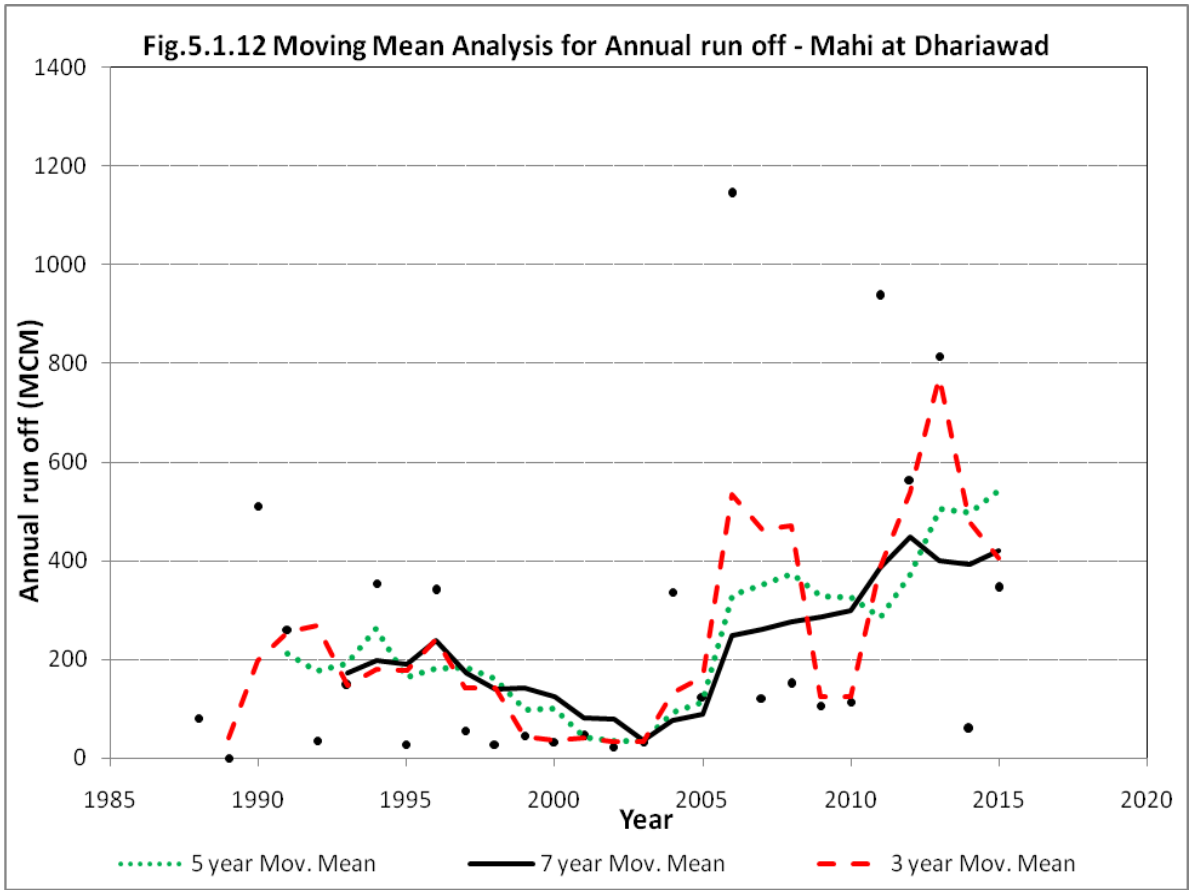


Fig.5.1.12 Moving Mean Analysis for Annual run off - Mahi at Dhariawad
Annual run off (MCM)
1400
1200
1000
800
600
400
200
0
1985
1990
1995
2000
2005
2010
2015
2020
Year
5 year Mov. Mean
7 year Mov. Mean
3 year Mov. Mean

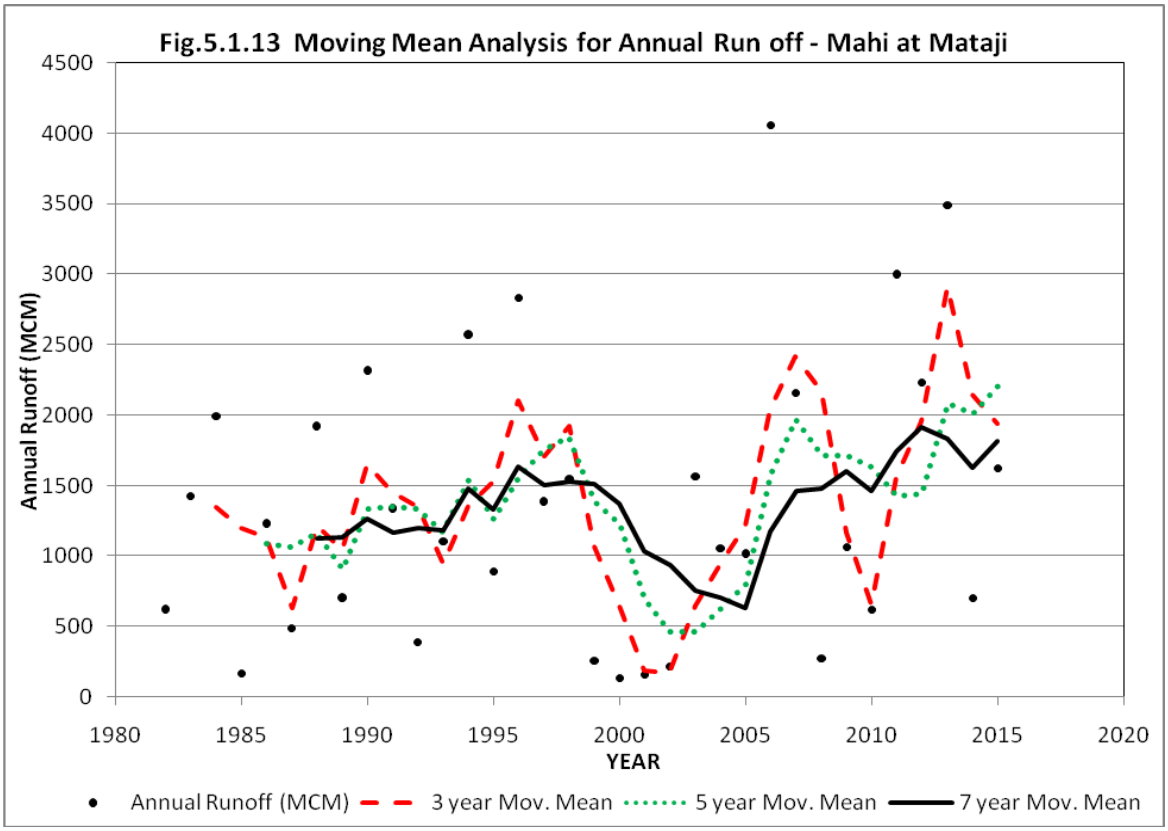


Fig.5.1.13 Moving Mean Analysis for Annual Run off - Mahi at Mataji
Annual Runoff (MCM)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
1980
1985
1990
1995
2000
2005
2010
2015
2020
YEAR
Annual Runoff (MCM)
3 year Mov. Mean
5 year Mov. Mean
7 year Mov. Mean

5.2 Trend Analysis -Sabarmati basin

5.2.1 Introduction

Trends are important indicators of the temporal variability of runoff as computed from observed discharge at site. By analyzing the time sequence of the runoff, we assess the magnitude and significance of the temporal variability. The present surface runoff trend study involves analysis of the temporal variability of data sets on the observed discharges in Sabarmati basin using available data of existing river gauging stations.

5.2.2 Methodology

In the analysis of the trends of runoff on Sabarmati River and its major tributary Wakal, and Watrak, annual runoff is computed and analyzed. The analysis is carried out for six (6) river gauging stations with sufficiently long and continuous data sets that are fairly representatively distributed across Sabarmati River Basin.

Overall six stations have been considered in this study. The length of the data sets of river gauging station varies from 15 to 27 years. Subsequently, time series are analysed on various statistical parameters, fitting of mathematical equations, observing moving means for various period so as to find out if there are any trends in the annual runoff data.

5.2.3 Time series analysis

Time series is defined as a sequence of values arrayed in order of their occurrence which can be characterized by statistical properties. Time series analysis may be used to test the variability, homogeneity and trend of a stream flow series or simply to give an upright list the characteristics of the series as graphically displayed. Significant movements of time series are the secular, periodic, cyclic and irregular trends. A time series may display a tendency to increase or decrease, over a specified period. Such a series provides an interesting illustration because if the trend is usually predominant, virtually no other movements are discernible.

Various methods exist for analysis of time series such as moving averages, residual series, residual mass curves and balance. Trends may also be revealed by determining if observed stream flow follows some mathematical equation as a function of time.

In this chapter, first statistical parameters have been computed for time series data of annual runoff at different sites in Sabarmati Basin. It is also ascertained if any mathematical equation can be fitted to the time series to assess predictability. Finally, the data is analysed by the method of moving means for various periods.

5.2.4 Availability of Annual runoff Data

There are 6 G&D sites in Sabarmati Basin. Availability of annual runoff data for these sites is summarized in **Table -1**

Table-1 Availability of annual runoff data

Sl.No.	Site name	River/Tributaries.	Data availability	Total years
1	Derol bridge	Sabarmati	1992-91 to 2015-16	24
2	Kheroj	Sabarmati	1992-91 to 2015-16	24
3	Voutha	Sabarmati	2001-02 to 2015-16	15
4	Jotasan	Wakal	1995-96 to 2015-16	21
5	Ratanpur	Watrak	1991-92 to 2015-16	25
6	Kheda	Watrak	1989-90 to 2015-16	27

The data is placed at **Annexure-2** and shown in line diagram in **Fig.2.2.2** and superimposed graph of annual runoff is given under Fig.5.2.1.

5.2.5 Analysis

5.2.5.1 Statistical Analysis

Various statistical parameters of the time series of available data are given below in **Table-2**.

Table-2: Statistical parameters of Annual Runoff series at various Sites

GD station	Data length (yrs)	Mean (MCM)	Median (MCM)	SD (MCM)	Coeff. Of variation
Sabarmati Basin					
Derol bridge	24	412	109	697.4	1.69
Kheroj	24	364	220	347.04	0.95
Voutha	15	2623	2146	1877.1	0.72
Jotasan	21	176	104	229.8	1.31
Ratanpur	25	304	146	387.7	1.28
Kheda	27	438	190	620.2	1.42

5.2.5.2 Fit characteristics

In order to find out if any mathematical equation represents the time series as a function of time, fitting of various types of equations viz. linear, logarithmic, exponential and polynomial have been attempted. Results of such fits are given in the **Table- 3** and shown in **Fig.5.2.2** through **5.2.7**.

Table-3: Fit Characteristics

Sl.No.	Site	Function Type	Fitted Equation	R^2
	SABARMATI BASIN			
1	Derol Bridge	Linear	$y = -23.23x + 46953$	0.0555
		Logarithmic	$y = -46589\ln(x) + 354609$	0.0556
		Polynomial	$y = 2.5476x^2 - 10231x + 1E+07$	0.0809
2	Kheroj	Linear	$y = 2.0387x - 3720.6$	0.0017
		Logarithmic	$y = 4020.1\ln(x) - 30200$	0.0017
		Polynomial	$y = 3.3677x^2 - 13492x + 1E+07$	0.1815
		Exponential	$y = 3E-07e^{0.0102x}$	0.0046
3	Voutha	Linear	$y = 8.3877x - 14220$	0.0004
		Logarithmic	$y = 17164\ln(x) - 127905$	0.0004
		Polynomial	$y = -43.536x^2 + 174850x - 2E+08$	0.1589
		Exponential	$y = 2E-66e^{0.0792x}$	0.1161
4	Jotasan	Linear	$y = 9.4512x - 18774$	0.0651
		Logarithmic	$y = 18971\ln(x) - 144067$	0.0653
		Polynomial	$y = -1.4735x^2 + 5918.2x - 6E+06$	0.1112
		Exponential	$y = 2E-68e^{0.08x}$	0.2427
5	Ratanpur	Linear	$y = -0.8632x + 2030.6$	0.0003
		Logarithmic	$y = -1686\ln(x) + 13121$	0.0003
		Polynomial	$y = -2.0676x^2 + 8282.1x - 8E+06$	0.064
		Exponential	$y = 3E-07e^{0.0101x}$	0.003
6	Kheda	Linear	$y = -3.371x + 7188$	0.001
		Logarithmic	$y = -6698\ln(x) + 51358$	0.001
		Polynomial	$y = -1.142x^2 + 4580.x - 5E+06$	0.014

5.2.5.3 Moving Mean Analysis

In statistics, a moving mean (average), also called rolling average, rolling mean or running average, is a type of finite impulse response filter used to analyze a set of data points by creating a series of averages of different subsets of the full data set.

The first element of the moving average is obtained by taking the average of the initial fixed subset of the number series. Then the subset is modified by "shifting forward", that is excluding the first number of the series and including the next number following the original subset in the series. This creates a new subset of numbers, which is averaged. This process is repeated over the entire data series. The plot line connecting all the (fixed) averages is the moving average. A moving average is a set of numbers, each of which is the average of the corresponding subset of a larger set of data points. A moving average

may also use unequal weights for each data value in the subset to emphasize particular values in the subset.

A moving average is commonly used with time series data to smooth out short-term fluctuations and highlight longer-term trends or cycles.

In the present analysis, moving means have been computed for 3, 5 and 7 year periods for various sites of Sabarmati River Basin and shown in **Fig.5.2.8 through 5.2.13**.

5.3.6 Interpretation

5.3.6.1 Fitting of various statistical/mathematical models viz linear, logarithmic, exponential and polynomial reveals that values of R^2 range from .0004 to 0.1589 for Voutha, from 0.001 to 0.014 for Kheda, from 0.0003 to 0.064 for Ratanpur, from 0.0555 to 0.0809 for Derol Bridge, 0.0017 to 0.1815 for Kheroj and from 0.0651 to 0.2427 for Jotasan. The values of R^2 are quite close to 0 indicating absence of any significant trend.

5.3.6.2 Presence of periodicities in annual runoff data of various sites in Sabarmati basin is reflected in the moving mean plots except for site Vautha which has a very small length of time series data. However, the length of time series data at other sites is also too small to conclude definite trends in the annual runoff data.

5.3.7 Conclusion

Statistically speaking, the annual runoff of river Sabarmati and its tributary Wakal, and Watrak, in general, appear to be a random variable; however elements of cyclicalness cannot be ruled out on the strength of moving mean analysis. A longer set of time series data may help identify trends in annual runoff, if any.

****

Annexure – 2

Annual Runoff at various sites over Sabarmati Basin

Year	Derol Bridge	Kheroj	Voutha	Jotasan	Ratanpur	Kheda
1989						151
1990						743
1991					145	190
1992	854	782			55	30
1993	839	421			231	278
1994	2022	1056			748	1294
1995	286	190		62	38	23
1996	165	296		116	115	113
1997	694	233		99	961	1898
1998	164	112		55	271	503
1999	23	29		48	44	38
2000	0	42		16	35	21
2001	15	136	187	46	5	0
2002	2	50	239	20	24	0
2003	13	207	3871	102	505	351
2004	9	44	2490	39	561	326
2005	157	468	4144	370	379	872
2006	2864	1122	6539	1081	1731	2598
2007	693	504	5599	334	542	918
2008	26	128	1291	104	52	89
2009	14	121	914	62	44	63
2010	32	462	1267	185	146	150
2011	326	636	3078	220	329	357
2012	50	237	1894	121	155	230
2013	61	151	3851	169	277	345
2014	38	166	1831	190	85	131
2015	549	1138	2146	251	111	112
MEAN	412	364	2623	176	304	438
MEDIAN	109	220	2146	104	146	190
STANDARD DEVIATION	697.39	347.04	1877.14	229.82	387.67	620.16
CO-EFFICIENT OF VARIATION	1.69	0.95	0.72	1.31	1.28	1.42

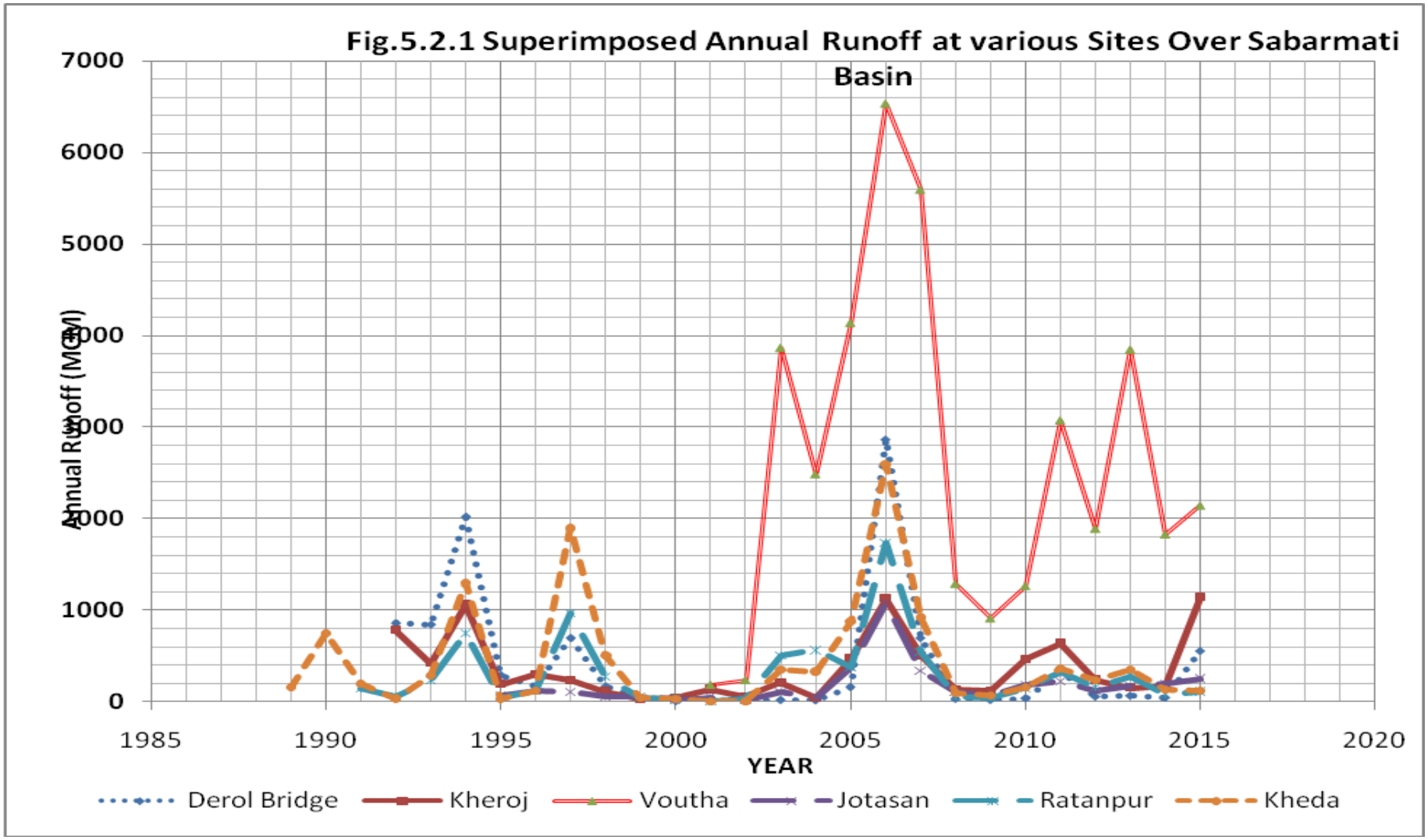


Fig.5.2.1 Superimposed Annual Runoff at various Sites Over Sabarmati Basin
7000
6000
5000
4000
3000
2000
1000
0
Annual Runoff (MCM)
1985
1990
1995
2000
2005
2010
2015
2020
YEAR
Derol Bridge
Kheroj
Voutha
Jotasan
Ratanpur
Kheda

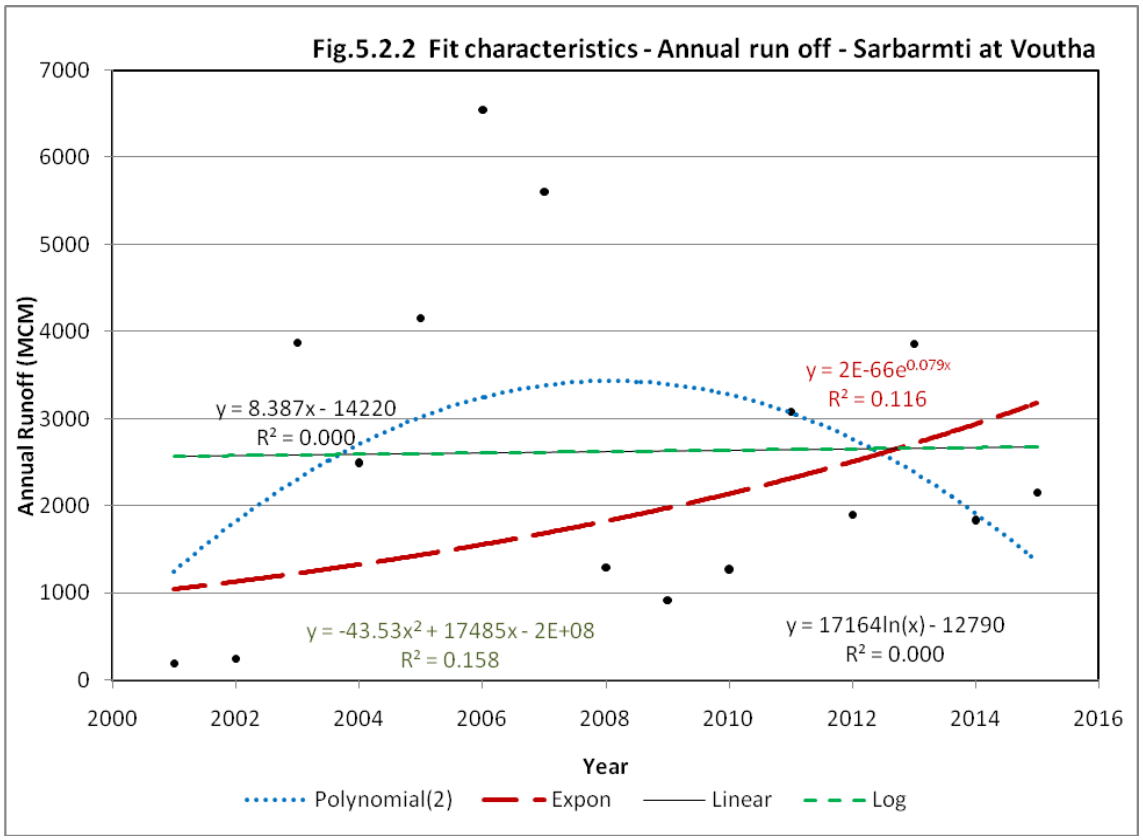


Fig.5.2.2 Fit characteristics - Annual run off - Sarbarmti at Voutha
Annual Runoff (MCM)
Year
y = 8.387x - 14220
R² = 0.000
y = 2E-66e^0.079x
R² = 0.116
y = -43.53x² + 17485x - 2E+08
R² = 0.158
y = 17164ln(x) - 12790
R² = 0.000
Polynomial(2)
Expon
Linear
Log

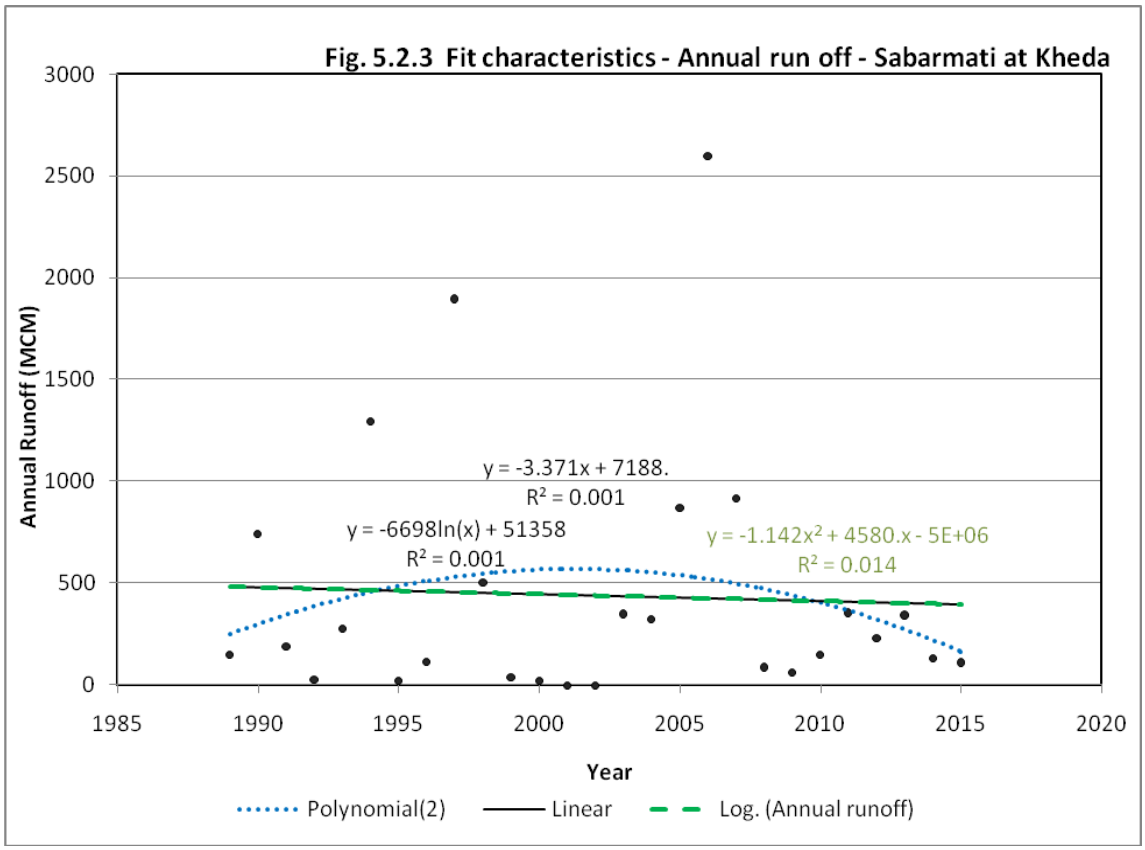


Fig. 5.2.3 Fit characteristics - Annual run off - Sabarmati at Kheda
Annual Runoff (MCM)
Year
y = -3.371x + 7188.
R² = 0.001
y = -6698ln(x) + 51358
R² = 0.001
y = -1.142x² + 4580.x - 5E+06
R² = 0.014
Polynomial(2)
Linear
Log. (Annual runoff)

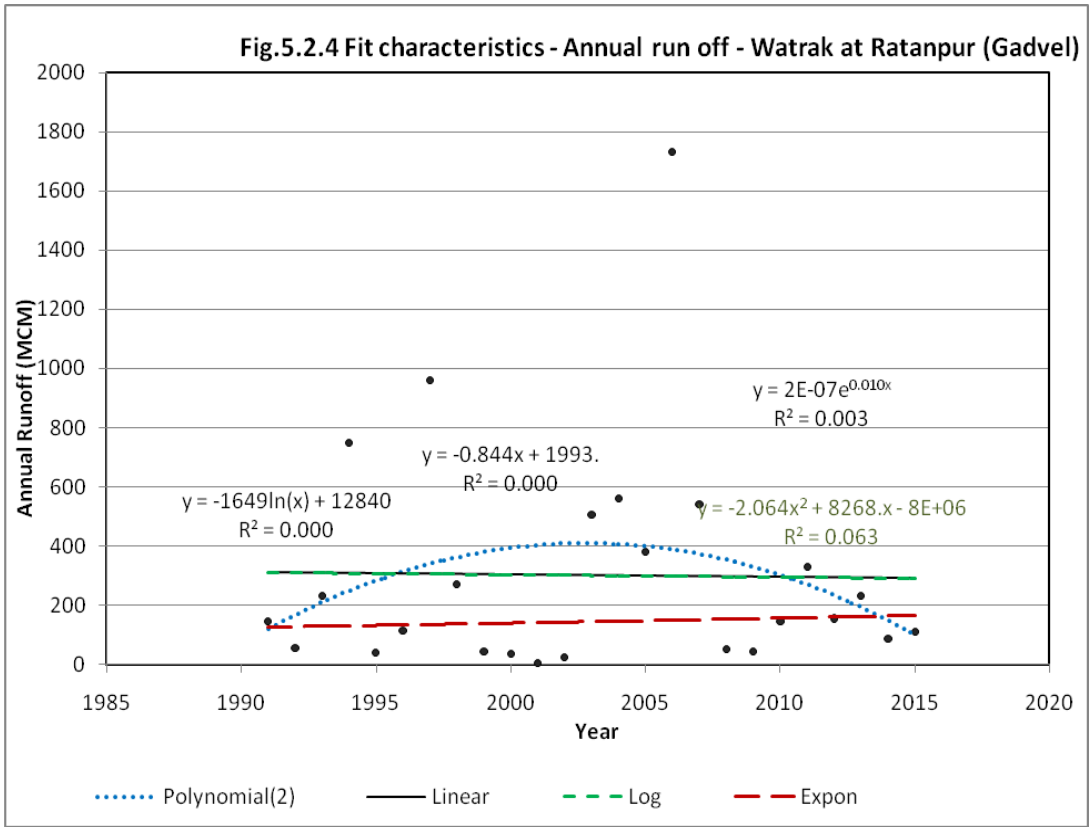


Fig.5.2.4 Fit characteristics - Annual run off - Watrak at Ratanpur (Gadvel)
Annual Runoff (MCM)
Year
y = 2E-07e^0.010x
R² = 0.003
y = -0.844x + 1993.
R² = 0.000
y = -1649ln(x) + 12840
R² = 0.000
y = -2.064x² + 8268.x - 8E+06
R² = 0.063
Polynomial(2)
Linear
Log
Expon

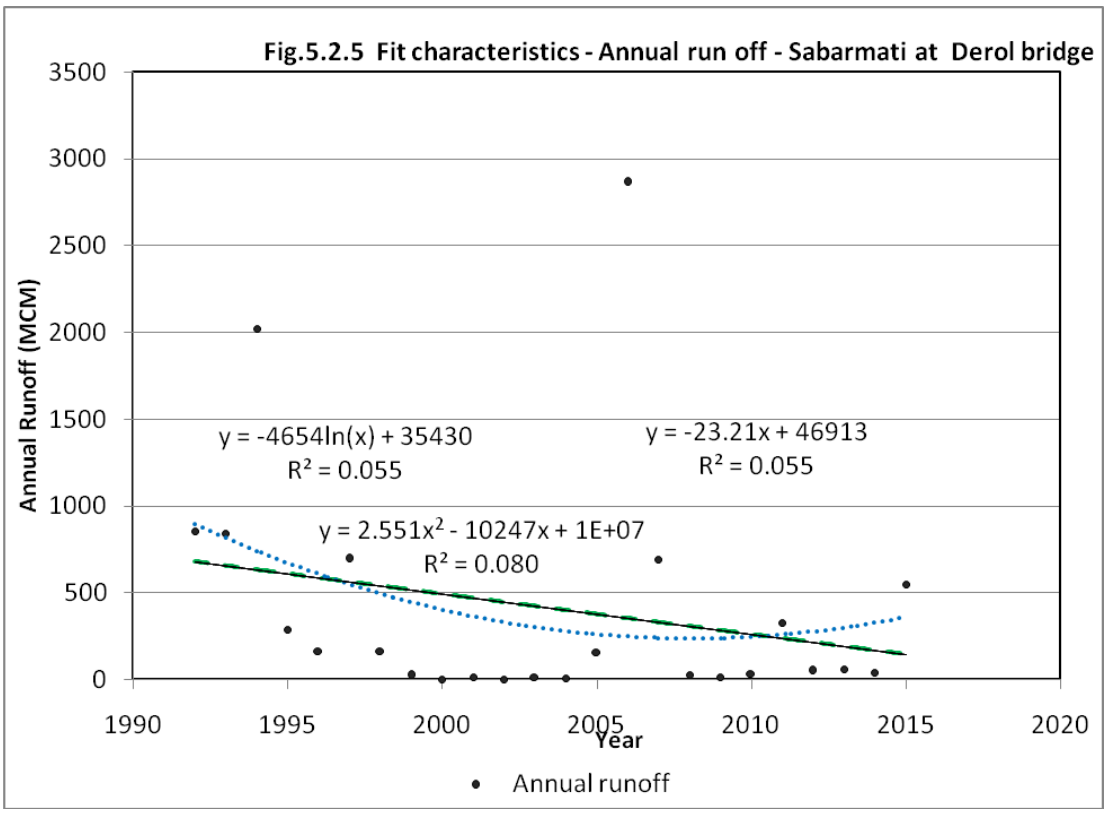


Fig.5.2.5 Fit characteristics - Annual run off - Sabarmati at Derol bridge
Annual Runoff (MCM)
Year
y = -4654ln(x) + 35430
R² = 0.055
y = -23.21x + 46913
R² = 0.055
y = 2.551x² - 10247x + 1E+07
R² = 0.080
Annual runoff

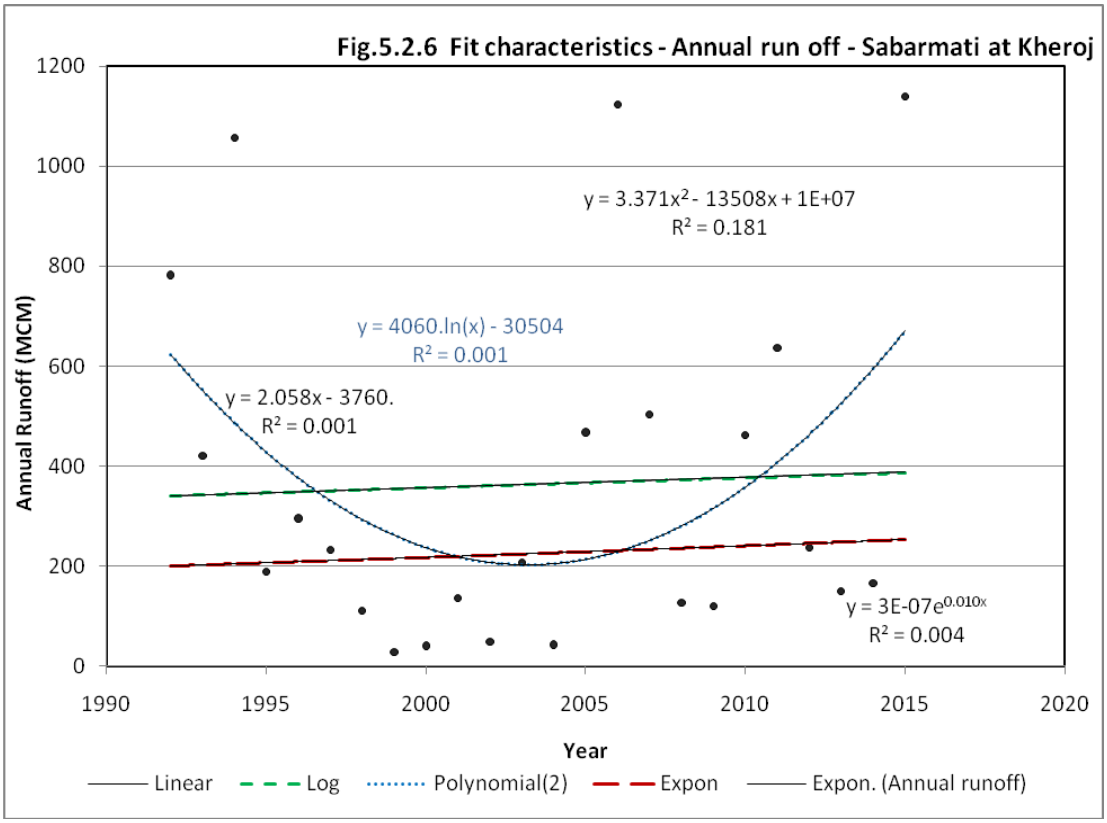


Fig.5.2.6 Fit characteristics - Annual run off - Sabarmati at Kheroj
Annual Runoff (MCM)
Year
y = 3.371x² - 13508x + 1E+07
R² = 0.181
y = 4060.ln(x) - 30504
R² = 0.001
y = 2.058x - 3760.
R² = 0.001
y = 3E-07e^0.010x
R² = 0.004
Linear
Log
Polynomial(2)
Expon
Expon. (Annual runoff)

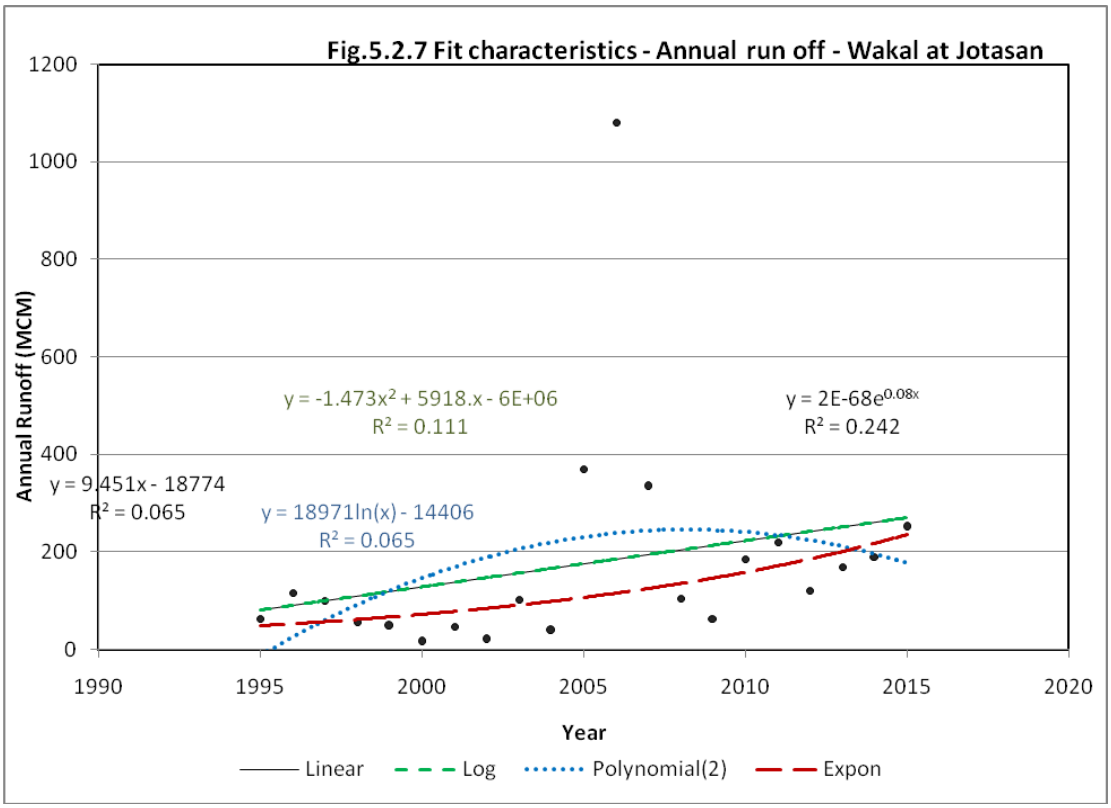


Fig.5.2.7 Fit characteristics - Annual run off - Wakal at Jotasan
Annual Runoff (MCM)
Year
y = -1.473x² + 5918.x - 6E+06
R² = 0.111
y = 2E-68e^0.08x
R² = 0.242
y = 9.451x - 18774
R² = 0.065
y = 18971ln(x) - 14406
R² = 0.065
Linear
Log
Polynomial(2)
Expon

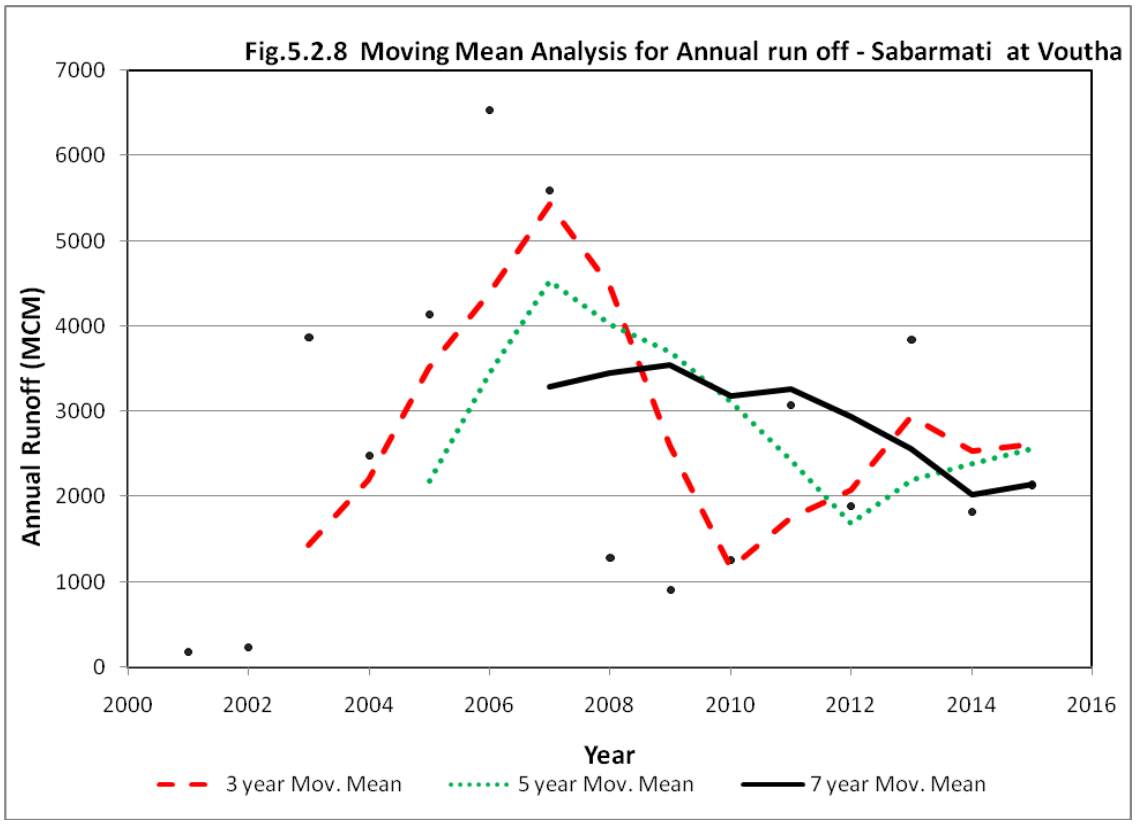


Fig.5.2.8 Moving Mean Analysis for Annual run off - Sabarmati at Voutha
Annual Runoff (MCM)
7000
6000
5000
4000
3000
2000
1000
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
Year
3 year Mov. Mean
5 year Mov. Mean
7 year Mov. Mean

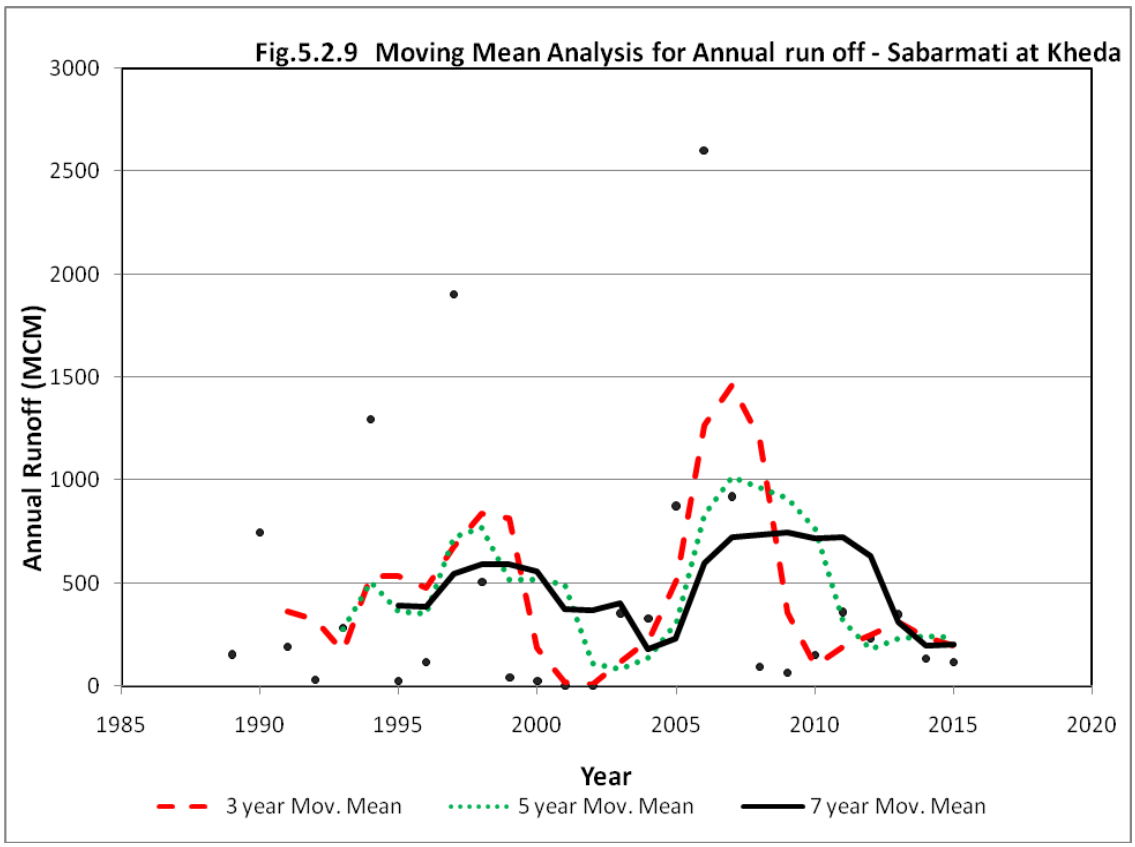


Fig.5.2.9 Moving Mean Analysis for Annual run off - Sabarmati at Kheda
Annual Runoff (MCM)
3000
2500
2000
1500
1000
500
0
1985
1990
1995
2000
2005
2010
2015
2020
Year
3 year Mov. Mean
5 year Mov. Mean
7 year Mov. Mean

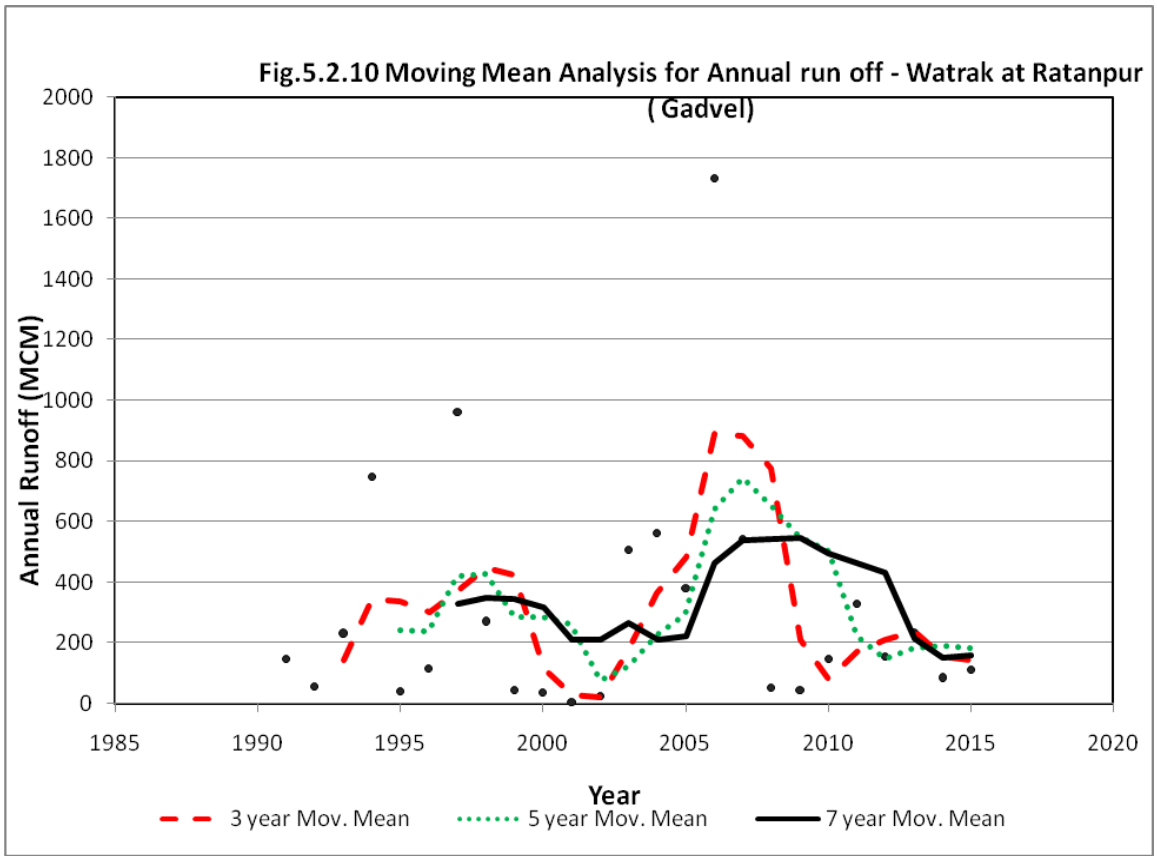


Fig.5.2.10 Moving Mean Analysis for Annual run off - Watrak at Ratanpur (Gadvel)
Annual Runoff (MCM)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
1985
1990
1995
2000
2005
2010
2015
2020
Year
3 year Mov. Mean
5 year Mov. Mean
7 year Mov. Mean

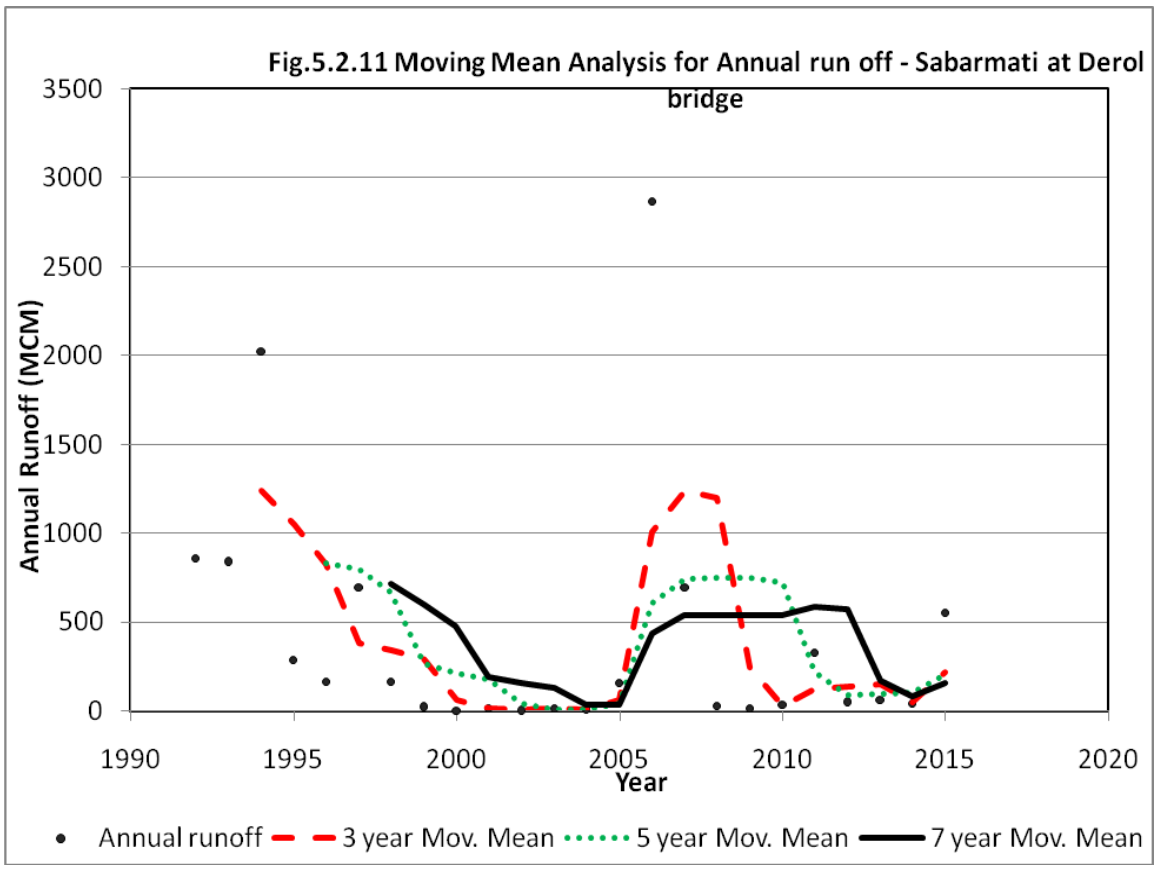


Fig.5.2.11 Moving Mean Analysis for Annual run off - Sabarmati at Derol bridge
Annual Runoff (MCM)
3500
3000
2500
2000
1500
1000
500
0
1990
1995
2000
2005
2010
2015
2020
Year
Annual runoff
3 year Mov. Mean
5 year Mov. Mean
7 year Mov. Mean

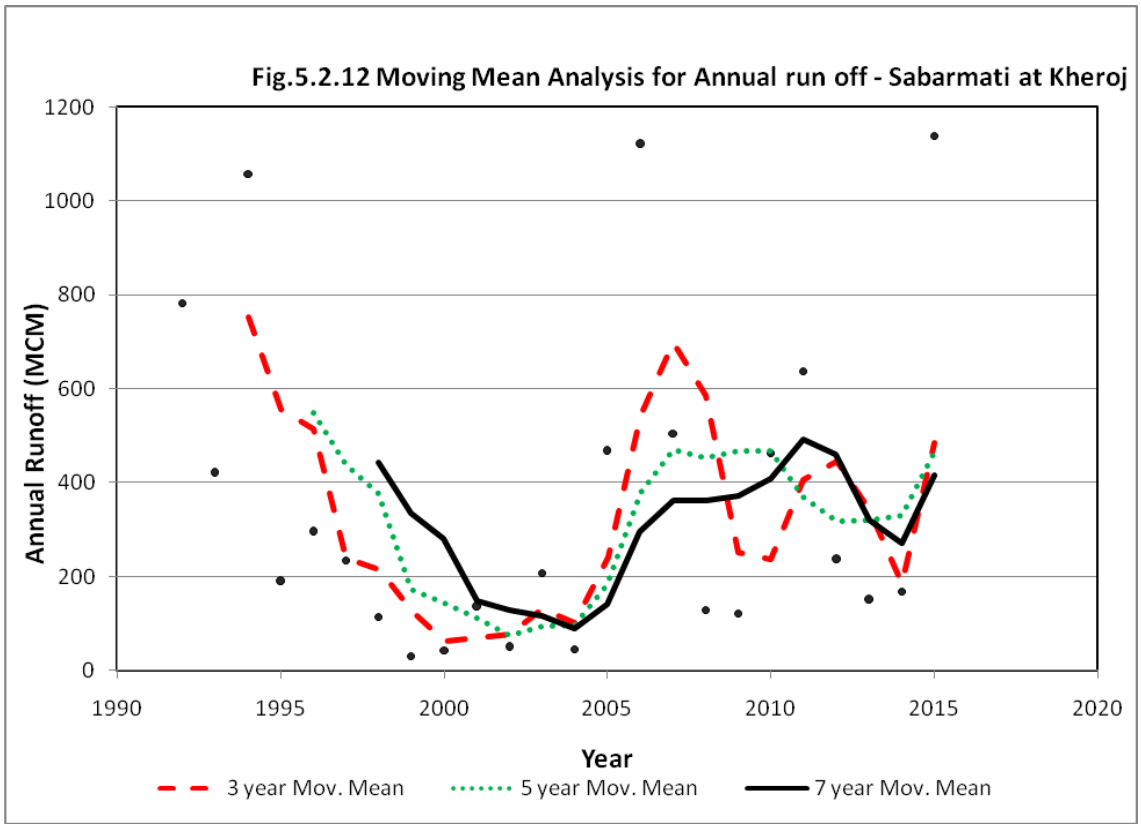


Fig.5.2.12 Moving Mean Analysis for Annual run off - Sabarmati at Kheroj
Annual Runoff (MCM)
1200
1000
800
600
400
200
0
1990
1995
2000
2005
2010
2015
2020
Year
3 year Mov. Mean
5 year Mov. Mean
7 year Mov. Mean

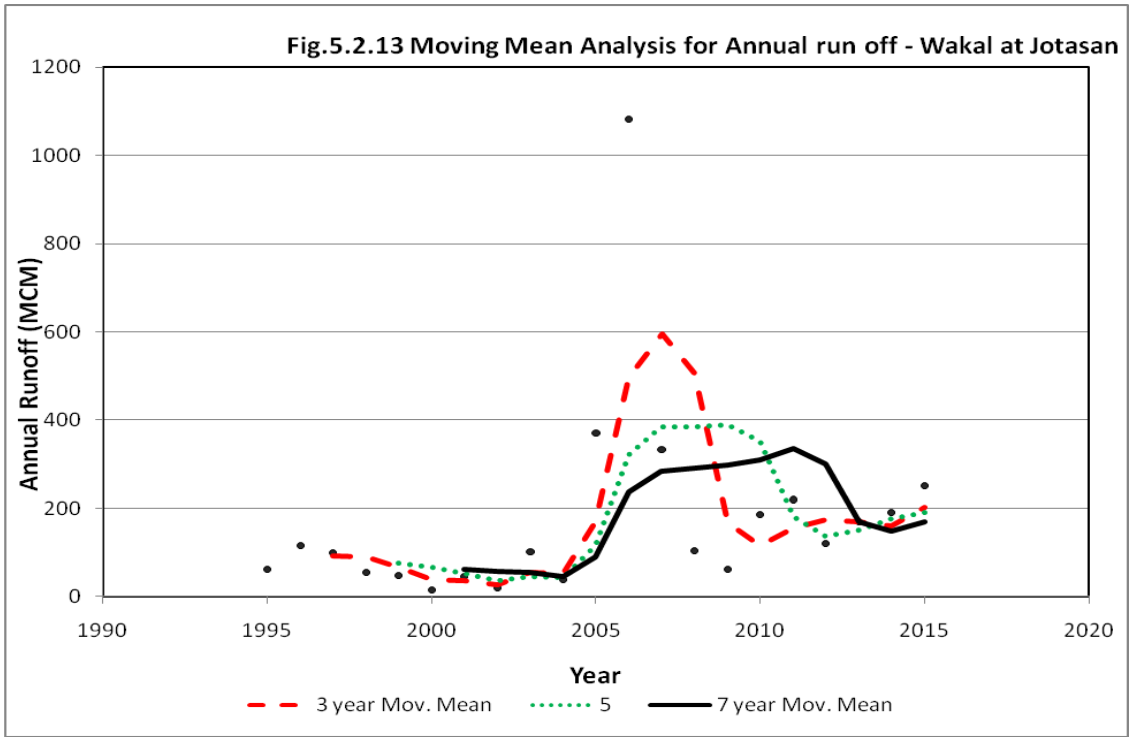


Fig.5.2.13 Moving Mean Analysis for Annual run off - Wakal at Jotasan
Annual Runoff (MCM)
1200
1000
800
600
400
200
0
1990
1995
2000
2005
2010
2015
2020
Year
3 year Mov. Mean
5
7 year Mov. Mean

5.3 Trend Analysis - Luni Basin

5.3.1 Introduction

Trends are important indicators of the temporal variability of runoff as computed from observed discharge at site. By analyzing the time sequence of the runoff, we assess the magnitude and significance of the temporal variability. The present surface runoff trend study involves analysis of the temporal variability of data sets on the observed discharges in Luni basin using available data of existing river gauging stations.

5.3.2 Methodology

In the analysis of the trends of runoff on Luni River, annual runoff is computed and analyzed. The analysis is carried out for two (2) river gauging stations with sufficiently long and continuous data sets that are fairly representatively distributed across Luni river Basin.

Overall two stations have been considered in this study. The length of the data sets of river gauging station varies from 26 to 40 years. Subsequently, time series are analysed on various statistical parameters, fitting of mathematical equations, observing moving means for various period so as to find out if there are any trends in the annual runoff data.

5.3.3 Time series analysis

Time series is defined as a sequence of values arrayed in order of their occurrence which can be characterized by statistical properties. Time series analysis may be used to test the variability, homogeneity and trend of a stream flow series or simply to give an upright list the characteristics of the series as graphically displayed. Significant movements of time series are the secular, periodic, cyclic and irregular trends. A time series may display a tendency to increase or decrease, over a specified period. Such a series provides an interesting illustration because if the trend is usually predominant, virtually no other movements are discernible.

Various methods exist for analysis of time series such as moving averages, residual series, residual mass curves and balance. Trends may also be revealed by determining if observed stream flow follows some mathematical equation as a function of time.

In this chapter, first statistical parameters have been computed for time series data of annual runoff at different sites in Luni basin. It is also ascertained if any mathematical

equation can be fitted to the time series to assess predictability. Finally, the data is analysed by the method of moving means for various periods.

5.3.4 Availability of annual run off Data

There are 2 G&D sites in Luni Basin. Availability of annual runoff data for these sites is summarized in **Table -1** and the superimposed graph of annual run off at both the sites in Luni are given under **Fig.5.3.1.**

Table-1: Availability of Data

Sl.No.	Site name	River/Tributaries.	Data availability	Total years
1	Balotra	Luni	1990-91 to 2015-16	26
2	Gandhav	Luni	1974-75 to 2015-16 No data on 1984-85 & 1985-86	42

The data is placed at Annexure-3 and shown in line diagram in **Plate 2.3.2.**

5.3.5 Analysis

5.3.5.1 Statistical Analysis

Various statistical parameters of the time series of available data are given below in **Table-2**.

Table-2: Statistical parameters of Annual Runoff series at various sites

GD station	Data length (years)	Mean (MCM)	Median (MCM)	SD (MCM)	Coeff. Of variation
Balotra	26	129.32	0	263.58	2.04
Gandhav	42	228.08	6.63	428.02	1.88

5.3.5.2 Fit characteristics

In order to find out if any mathematical equation represents the time series as a function of time, fitting of various types of equations viz. linear, logarithmic, exponential and polynomial have been attempted. Results of such fits are given in the **Table- 3** and shown in **Fig 5.3.2 &5.3.3**.

Table-3: Fit Characteristics

Sl.No.	Site	Function Type	Fitted Equation	R^2
	BANAS BASIN			
1	Balotra	Linear	y = -18.55x + 37294	0.29
		Logarithmic	y = -3720ln(x) + 28296	0.29
		Polynomial	$y = 1.778x^2 - 7140.x + 7E+06$	0.429
2	Gandhav	Linear	y = -12.46x + 25090	0.127
		Logarithmic	y = -2486ln(x) + 18915	0.127
		Polynomial	$y = 0.067x^2 - 280.0x + 29190$	0.128

5.3.5.3 Moving Mean Analysis

In statistics, a moving mean (average), also called rolling average, rolling mean or running average, is a type of finite impulse response filter used to analyze a set of data points by creating a series of averages of different subsets of the full data set.

The first element of the moving average is obtained by taking the average of the initial fixed subset of the number series. Then the subset is modified by "shifting forward", that is excluding the first number of the series and including the next number following the original subset in the series. This creates a new subset of numbers, which is averaged. This process is repeated over the entire data series. The plot line connecting all the (fixed) averages is the moving average. A moving average is a set of numbers, each of which is the average of the corresponding subset of a larger set of data points. A moving average may also use unequal weights for each data value in the subset to emphasize particular values in the subset.

A moving average is commonly used with time series data to smooth out short-term fluctuations and highlight longer-term trends or cycles.

In the present analysis, moving means have been computed for 3, 5 and 7 year periods for various sites of Luni River Basin and shown in **Fig.5.3.4 & 5.3.5.**

5.3.6 Interpretation

5.3.6.1 Fitting of various statistical/mathematical models viz linear, logarithmic, exponential and polynomial reveals that values of R^2 range from 0.127 to 0.128 for Gandhav, and from 0.29 to 0.429 for Balotra, The values of R^2 are much less than 1, though Balotra shows a higher value of $R^{2.}$ Even-though such low values of R^2 do not

establish a definite trend, visually speaking a falling trend in observed annual runoff data is observed at Gandhav.

5.3.6.2 Moving mean analysis for Gandhav may not be much useful for the relatively short time series coupled with several years reporting zero runoff. The moving means for Balotra, corroborate the falling trend as visualized during statistical fitting mentioned above. A very elementary cyclicalness towards the latter part of the series is also observed at Gandhav.

5.3.7 Conclusion

Statistically speaking, the annual runoff of river Luni, in general, appears to be a random variable; however values at Balotra reveal a decreasing trend of observed annual runoff. Elements of similar decreasing trend are also seen at Gandhav. A longer set of time series data may help establish conclusively trends, if any, in annual runoff in this basin.

****

Annexure - 3

Annual Runoff at various sites over various over Luni Basin

Year/Basin	Luni	Luni
Station	Balotra	Gandhav
1974		0
1975		730
1976		1052
1977		610
1978		149
1979		967
1980		23
1981		2
1982		34
1983		1135
1984		0
1985		0
1986		0
1987		0
1988		0
1989		0
1990	713	2010
1991	0	4
1992	1036	847
1993	5	92
1994	308	472
1995	614	489
1996	29	19
1997	264	226
1998	0	11
1999	65	17
2000	0	2
2001	0	203
2002	0	0
2003	0	9
2004	0	0
2005	0	0
2006	98	0
2007	179	227
2008	0	0
2009	0	0
2010	0	0
2011	0	0
2012	0	0
2013	0	0
2014	0	0
2015	51	249
MEAN	129.32	228.08
MEDIAN	0.00	6.63
STANDARD DEVAIATION	263.58	428.02
CO-EFFICIENT OF VARIATION	2.04	1.88

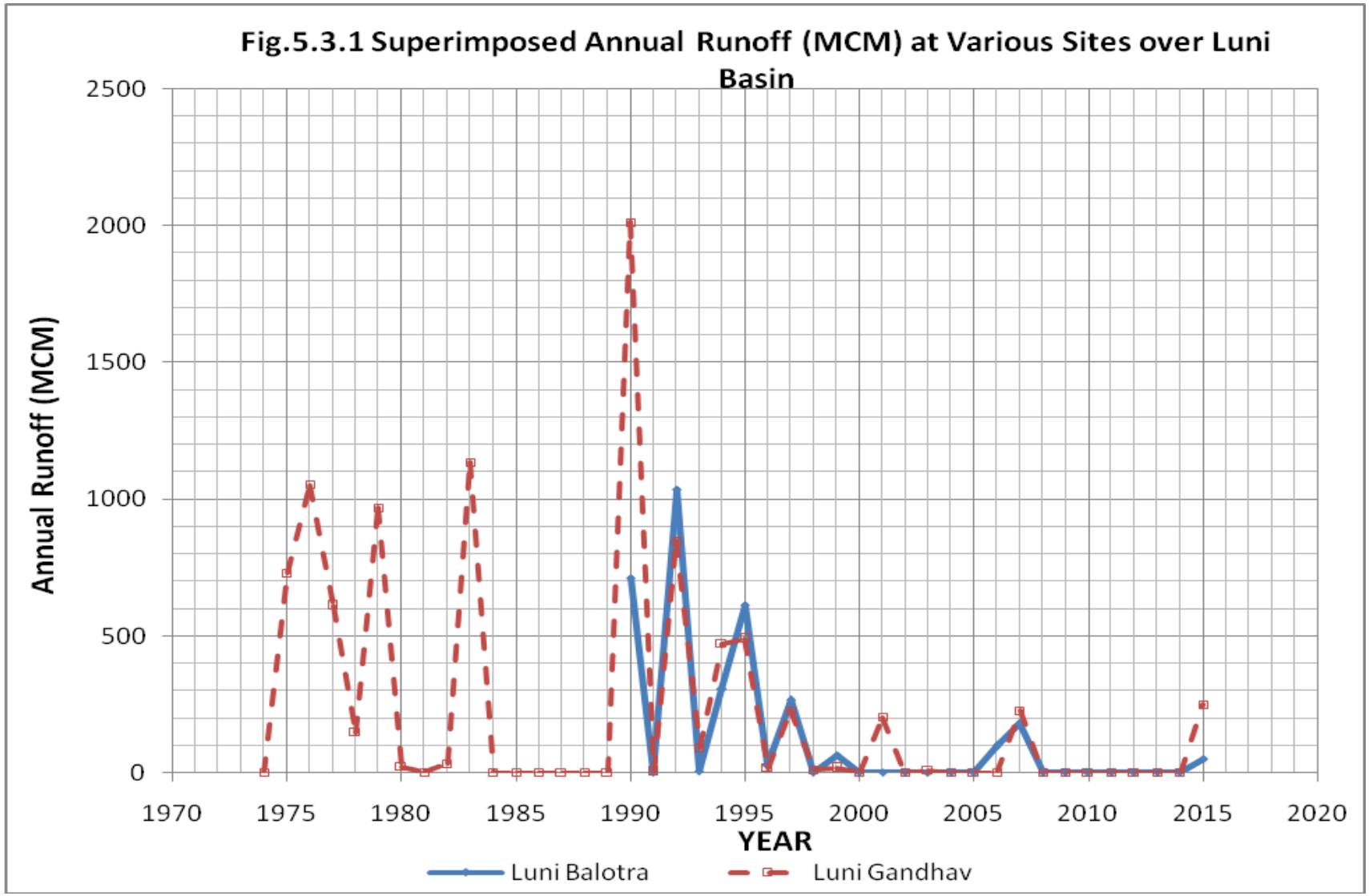


Fig.5.3.1 Superimposed Annual Runoff (MCM) at Various Sites over Luni Basin
Annual Runoff (MCM)
2500
2000
1500
1000
500
0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
YEAR
Luni Balotra
Luni Gandhav

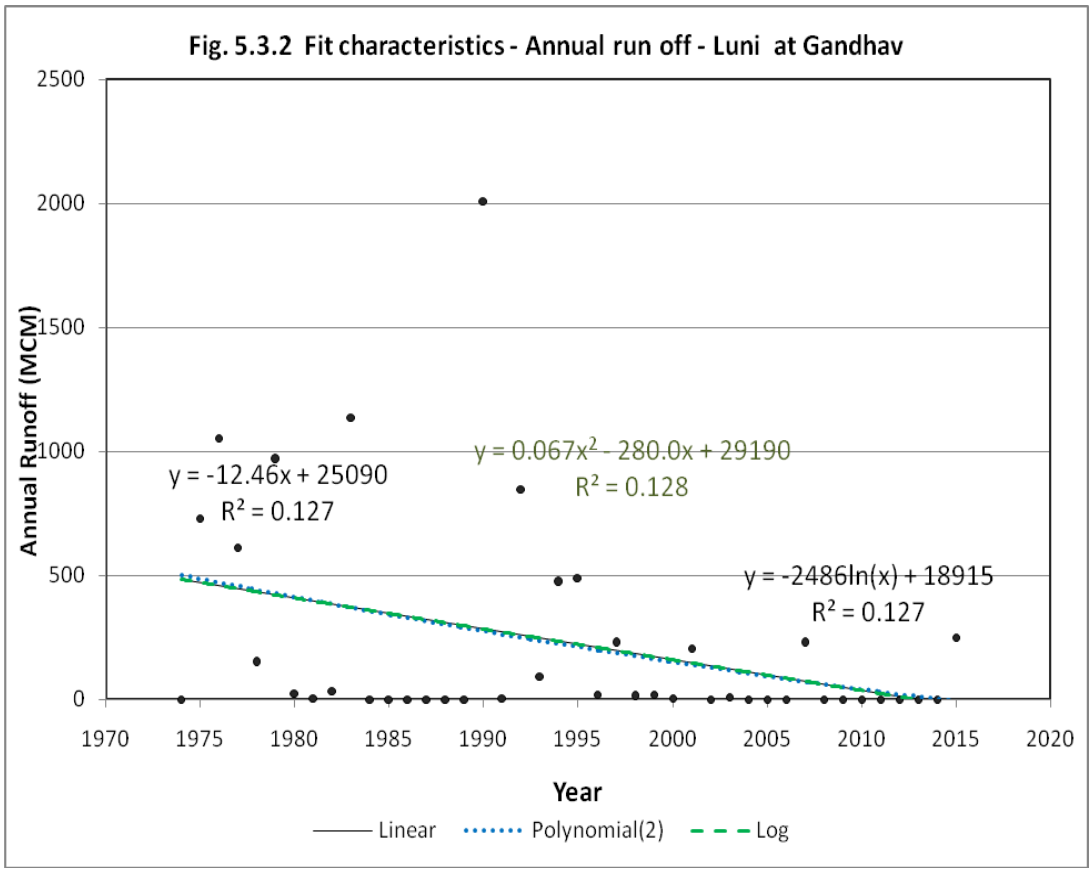


Fig. 5.3.2 Fit characteristics - Annual run off - Luni at Gandhav
Annual Runoff (MCM)
2500
2000
1500
1000
500
0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Year
y = -12.46x + 25090
R² = 0.127
y = 0.067x² - 280.0x + 29190
R² = 0.128
y = -2486ln(x) + 18915
R² = 0.127
Linear
Polynomial(2)
Log

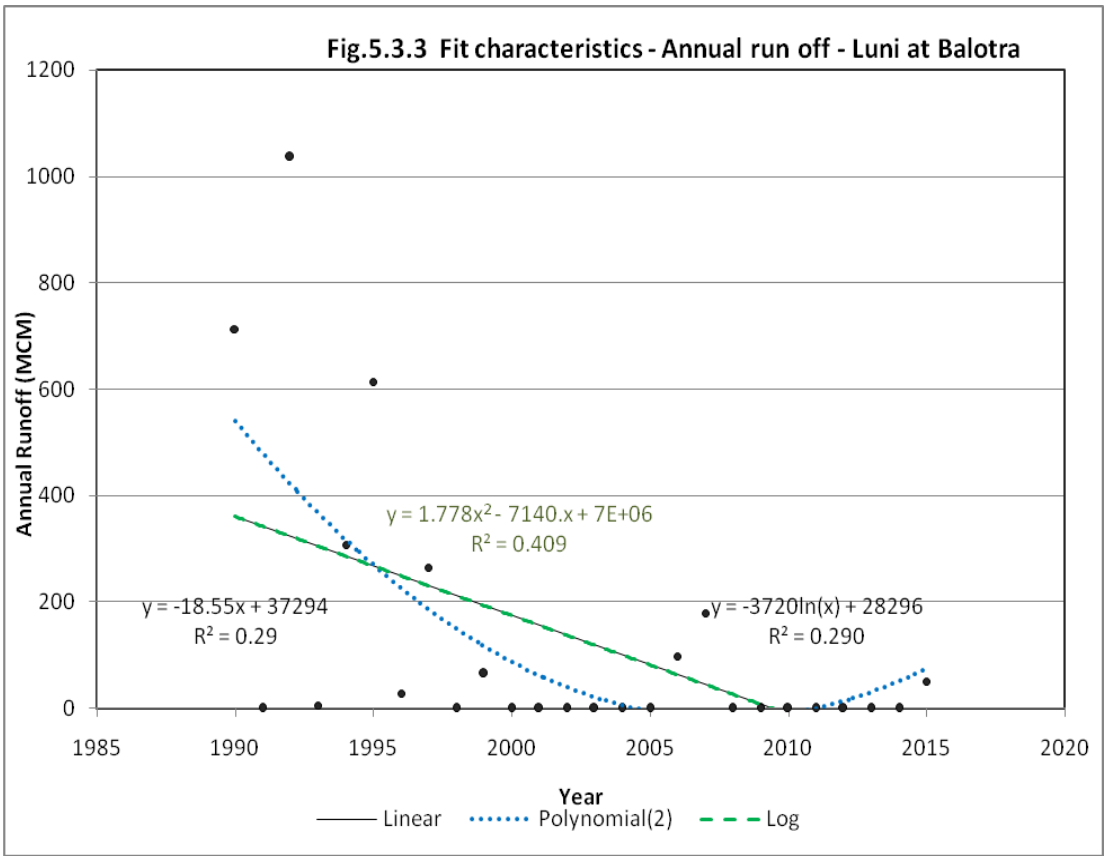


Fig.5.3.3 Fit characteristics - Annual run off - Luni at Balotra
Annual Runoff (MCM)
1200
1000
800
600
400
200
0
1985
1990
1995
2000
2005
2010
2015
2020
Year
y = 1.778x² - 7140.x + 7E+06
R² = 0.409
y = -18.55x + 37294
R² = 0.29
y = -3720ln(x) + 28296
R² = 0.290
Linear
Polynomial(2)
Log

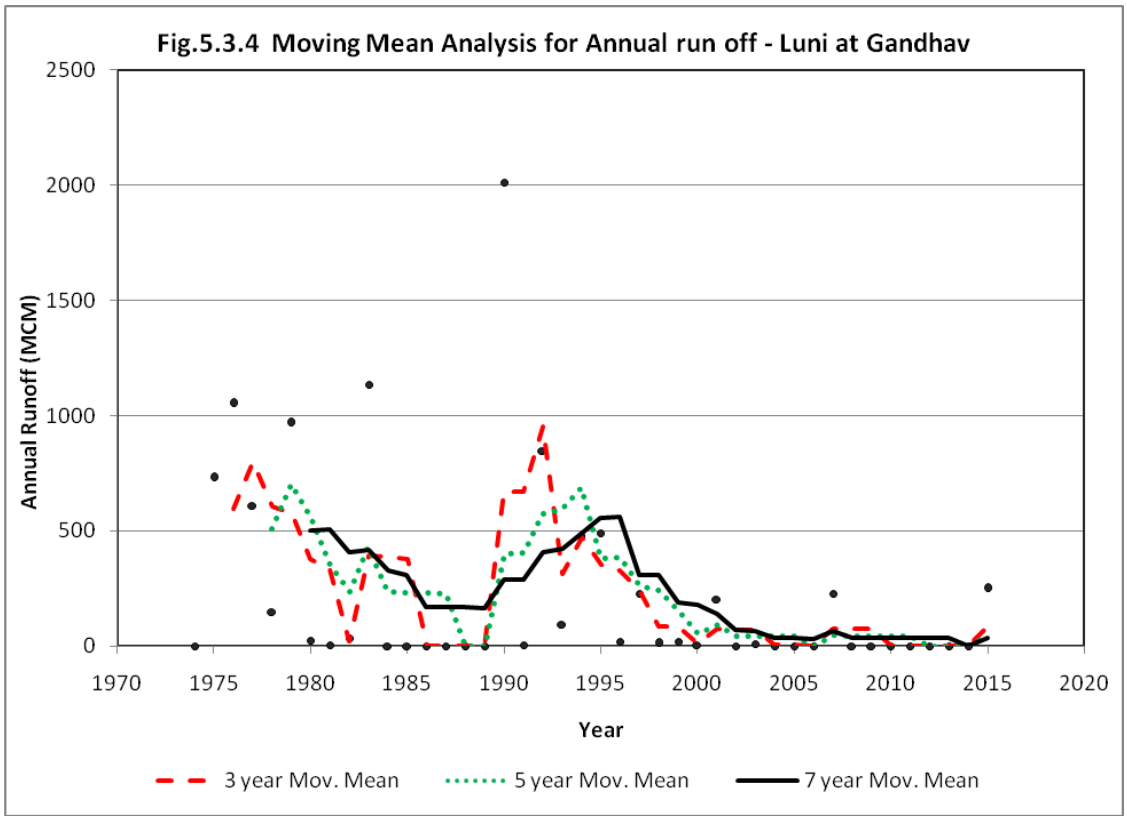


Fig.5.3.4 Moving Mean Analysis for Annual run off - Luni at Gandhav
Annual Runoff (MCM)
2500
2000
1500
1000
500
0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Year
3 year Mov. Mean
5 year Mov. Mean
7 year Mov. Mean

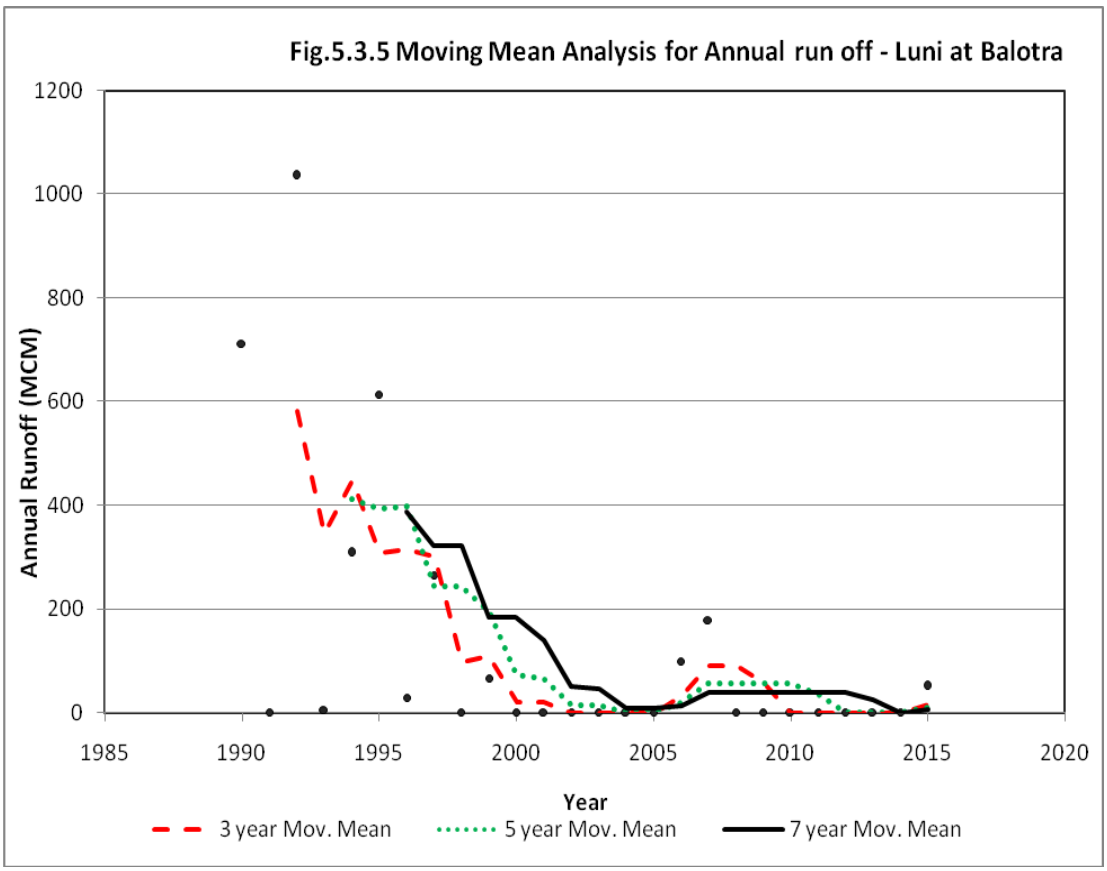


Fig.5.3.5 Moving Mean Analysis for Annual run off - Luni at Balotra
Annual Runoff (MCM)
1200
1000
800
600
400
200
0
1985
1990
1995
2000
2005
2010
2015
2020
Year
3 year Mov. Mean
5 year Mov. Mean
7 year Mov. Mean

5.4 Trend Analysis - Banas Basin

5.4.1 Introduction

Trends are important indicators of the temporal variability of runoff as computed from observed discharge at site. By analyzing the time sequence of the runoff, we assess the magnitude and significance of the temporal variability. The present surface runoff trend study involves analysis of the temporal variability of data sets on the observed discharges in Banas basin using available data of existing river gauging stations.

5.4.2 Methodology

In the analysis of the trends of runoff on Banas River and its major tributary Balaram, annual runoff is computed and analyzed. The analysis is carried out for four (4) river gauging stations with sufficiently long and continuous data sets that are fairly representatively distributed across Banas river Basin.

Overall five stations have been considered in this study. The length of the data sets of river gauging station varies from 26 to 45 years. Subsequently, time series are analysed on various statistical parameters, fitting of mathematical equations, observing moving means for various period so as to find out if there are any trends in the annual runoff data.

5.4.3 Time series analysis

Time series is defined as a sequence of values arrayed in order of their occurrence which can be characterized by statistical properties. Time series analysis may be used to test the variability, homogeneity and trend of a stream flow series or simply to give an upright list the characteristics of the series as graphically displayed. Significant movements of time series are the secular, periodic, cyclic and irregular trends. A time series may display a tendency to increase or decrease, over a specified period. Such a series provides an interesting illustration because if the trend is usually predominant, virtually no other movements are discernible.

Various methods exist for analysis of time series such as moving averages, residual series, residual mass curves and balance. Trends may also be revealed by determining if observed stream flow follows some mathematical equation as a function of time.

In this chapter, first statistical parameters have been computed for time series data of annual runoff at different sites in Banas basin. It is also ascertained if any

mathematical equation can be fitted to the time series to assess predictability. Finally, the data is analysed by the method of moving means for various periods.

5.4.4 Availability of annual run off Data

There are 4 G&D sites in Banas Basin. Availability of annual runoff data for these sites is summarized in **Table -1** and superimposed graph of annual runoff is given under **Fig. 5.4.1.**

Table-1: Availability of Data

Sl.No.	Site name	River/Tributaries	Data availability	Total years
1	Chitrasani	Balaram	1990-91 to 2015-16	26
2	Abu Road	Banas	1989-90 to 2015-16	27
3	Kamalpur	Banas	1971-72 to 2015-16	45
4	Sarotry	Banas	1989-90 to 2015-16	27

The data is placed at **Annexure-4** and shown in line diagram in **Plate.2.4.2.**

5.4.5 Analysis

5.4.5.1 Statistical Analysis

Various statistical parameters of the time series of available data are given below in **Table-2**.

Table-2: Statistical parameters of Annual Runoff series at various sites

GD station	Data length (years)	Mean (MCM)	Median (MCM)	SD (MCM)	Coeff. Of variation
Chitrasani	26	36.27	15.04	46.15	1.27
Abu Road	27	114.29	43	161.96	1.41
Kamalpur	45	324.47	104	628.72	1.94
Sarotry	27	295.58	112.15	533.0	1.80

5.4.5.2 Fit characteristics

In order to find out if any mathematical equation represents the time series as a function of time, fitting of various types of equations viz. linear, logarithmic, exponential and polynomial have been attempted. Results of such fits are given in the **Table- 3** and shown in **Fig.5.4.2 through 5.4.5**.

Table-3: Fit Characteristics

Sl.No.	Site	Function Type	Fitted Equation	R^2
	BANAS BASIN			
1	Chitrasani	Linear	$y = -0.0715x + 179.4$	0.0001
		Logarithmic	$y = -151.4\ln(x) + 1187.3$	0.0002
		Polynomial	$y = 0.3695x^2 - 1480x + 1E+06$	0.1682
		Exponential	$y = 2E-06e^{0.0078x}$	0.001
2	Abu Road	Linear	$y = -4.2965x + 8716$	0.0449
		Logarithmic	$y = -8613\ln(x) + 65593$	0.045
		Polynomial	$y = 0.4907x^2 - 1969x + 2E+06$	0.0732
		Exponential	$y = 2E+16e^{-0.017x}$	0.007
3	Kamalpur	Linear	$y = -12.341x + 24933$	0.061
		Logarithmic	$y = -24613\ln(x) + 187332$	0.061
		Polynomial	$y = 0.0821x^2 - 339.91x + 351511$	0.061
4	Sarotry	Linear	$y = -16.49x + 33310$	0.06
		Logarithmic	$y = -3305\ln(x) + 25156$	0.06
		Polynomial	$y = 1.649x^2 - 6619x + 7E+06$	0.089
		Exponential	$y = 5E+22e^{-0.02x}$	0.012

5.4.5.3 Moving Mean Analysis

In statistics, a moving mean (average), also called rolling average, rolling mean or running average, is a type of finite impulse response filter used to analyze a set of data points by creating a series of averages of different subsets of the full data set.

The first element of the moving average is obtained by taking the average of the initial fixed subset of the number series. Then the subset is modified by "shifting forward", that is excluding the first number of the series and including the next number following the original subset in the series. This creates a new subset of numbers, which is averaged. This process is repeated over the entire data series. The plot line connecting all the (fixed) averages is the moving average. A moving average is a set of numbers, each of which is the average of the corresponding subset of a larger set of data points. A moving average may also use unequal weights for each data value in the subset to emphasize particular values in the subset.

A moving average is commonly used with time series data to smooth out short-term fluctuations and highlight longer-term trends or cycles.

In the present analysis, moving means have been computed for 3, 5 and 7 year periods for various sites of Banas River Basin and shown in **Fig.5.4.6 through 5.4.9**.

5.4.6 Interpretation

5.4.6.1 Fitting of various statistical/mathematical models viz linear, logarithmic, exponential and polynomial reveals that values of R^2 is almost same i.e., 0.061 for Kamalpur, for rest of the sites R^2 ranges from 0.0001 to 0.168 for Chitrasani, from 0.012 to 0.089 for Sarotry, and from 0.007 to 0.073 for Abu Road. The values of R^2 are quite close to 0 indicating absence of any significant trend.

5.4.6.2 Moving mean analaysis of annual runoff performed over sites in Banas basin reveals elements of periodicities present in the data. Significant cyclicalness is observed in the data of site Kamalpur which has relatively longer time series in comparison with other sites. Though the moving mean analysis has brought out signatures of periodicities present in the data, only longer time series at all the sites may help conclude presence of definite cyclic nature of annual runoff data of Banas basin. .

5.4.7 Conclusion

Statistically speaking, the annual runoff of river Banas and its tributary Balaram, in general, appears to be a random variable; however moving mean analysis reveals elements of cyclicalness. A longer set of time series data may help identify trends in annual runoff, if any, on definitive basis.

Annexure - 4

Annual Runoff at various sites over Banas Basin

Year	Chitrasani	Abu Road	Kamalpur	Sarotry
1971			0	
1972			0	
1973			524	
1974			12	
1975			754	
1976			977	
1977			2360	
1978			416	
1979			194	
1980			180	
1981			129	
1982			261	
1983			108	
1984			134	
1985			9	
1986			0	
1987			0	
1988			46	
1989		13	34	35
1990	53	436	648	888
1991	11	20	1	66
1992	110	500	865	924
1993	38	79	984	237
1994	158	430	3275	2612
1995	33	58	59	135
1996	6	33	0	47
1997	19	65	226	209
1998	4	23	12	70
1999	0	4	0	19
2000	0	4	4	6
2001	6	26	4	27
2002	0	1	0	4
2003	12	63	112	114
2004	1	9	39	16
2005	6	52	11	112
2006	103	496	551	720
2007	47	190	214	325
2008	4	10	18	16
2009	5	14	43	6
2010	26	42	78	72
2011	123	257	96	523
2012	18	149	117	253
2013	29	61	104	115
2014	9	9	94	57
2015	120	43	257	374
MEAN	36.27	114.29	324.47	295.58
MEDIAN	15.04	43.00	104.00	112.15
STANDARD DEVAIATION	46.15	160.96	628.72	533.00
CO-EFFICIENT OF VARIATION	1.27	1.41	1.94	1.80

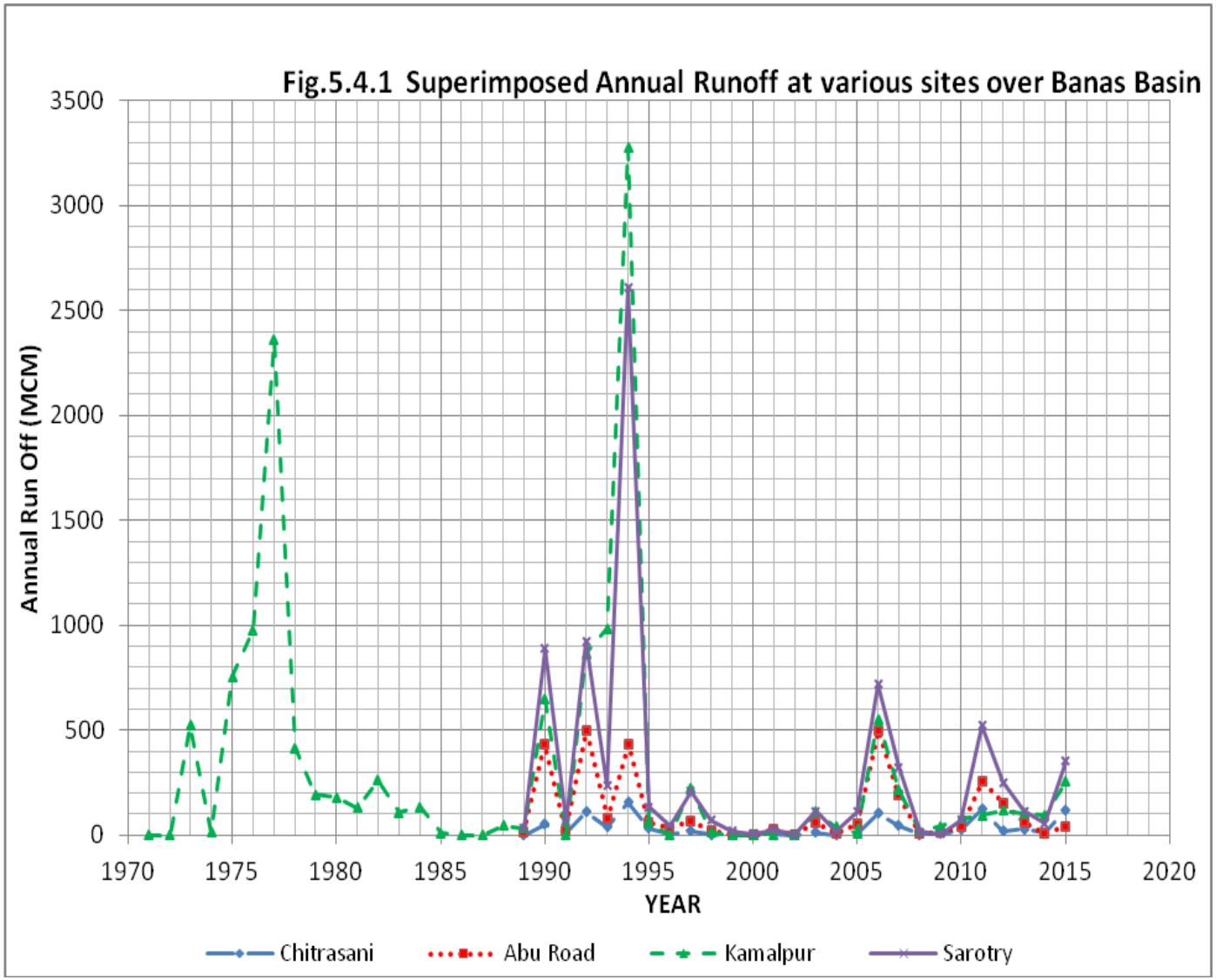


Fig.5.4.1 Superimposed Annual Runoff at various sites over Banas Basin
Annual Run Off (MCM)
3500
3000
2500
2000
1500
1000
500
0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
YEAR
Chitrasani
Abu Road
Kamalpur
Sarotry

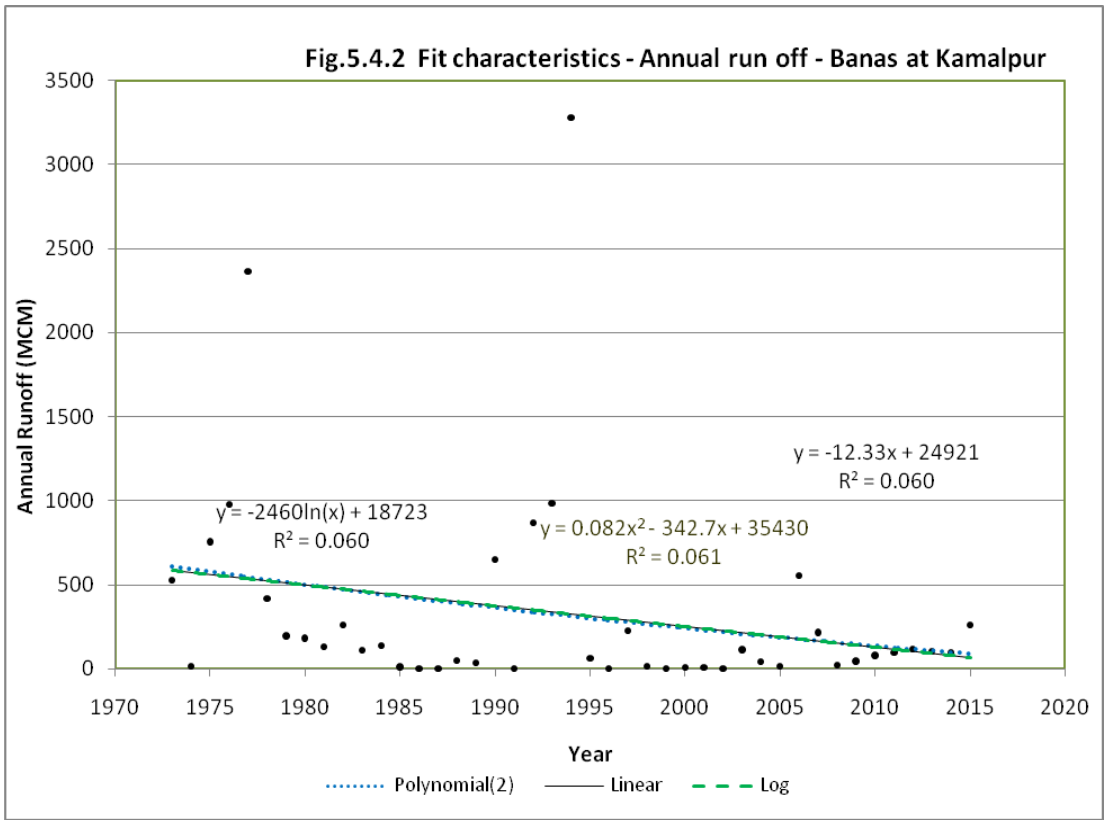


Fig.5.4.2 Fit characteristics - Annual run off - Banas at Kamalpur
Annual Runoff (MCM)
3500
3000
2500
2000
1500
1000
500
0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Year
y = -12.33x + 24921
R² = 0.060
y = -2460ln(x) + 18723
R² = 0.060
y = 0.082x² - 342.7x + 35430
R² = 0.061
Polynomial(2)
Linear
Log

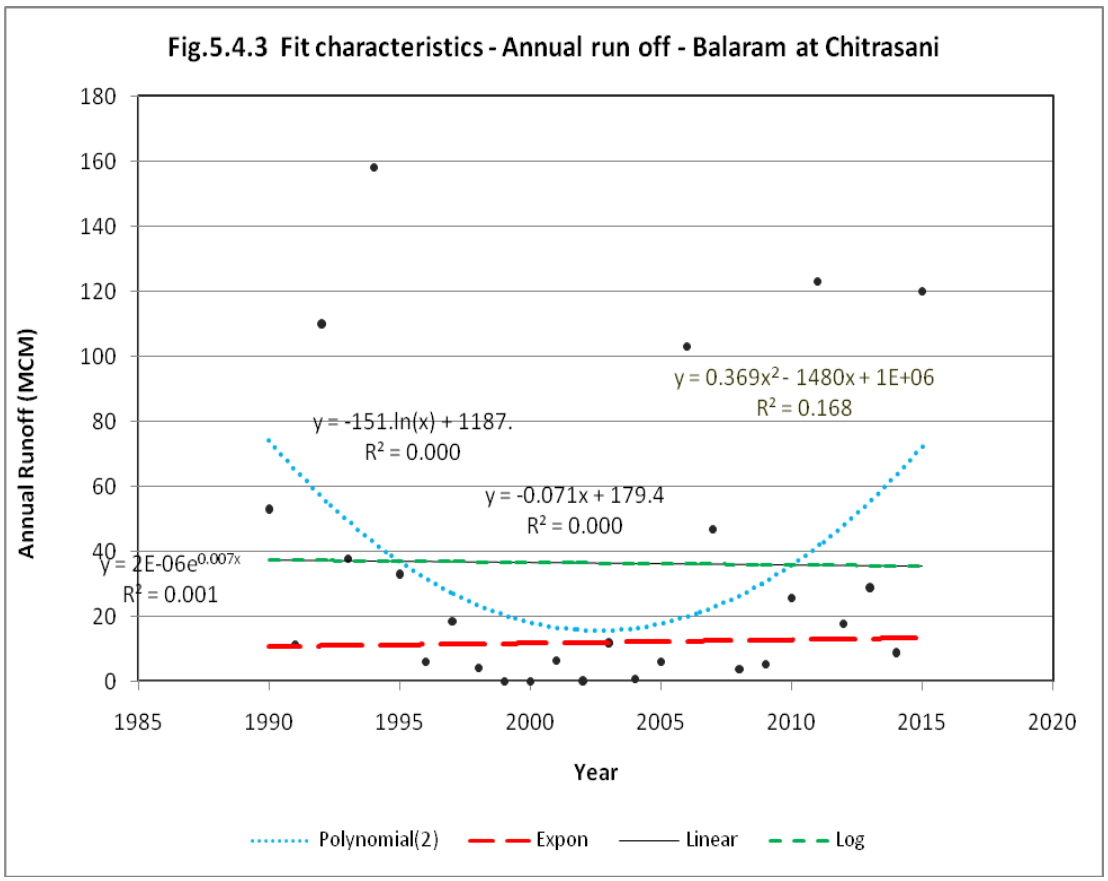


Fig.5.4.3 Fit characteristics - Annual run off - Balaram at Chitrasani
Annual Runoff (MCM)
180
160
140
120
100
80
60
40
20
0
1985
1990
1995
2000
2005
2010
2015
2020
Year
y = 0.369x² - 1480x + 1E+06
R² = 0.168
y = -151.ln(x) + 1187.
R² = 0.000
y = -0.071x + 179.4
R² = 0.000
y = 2E-06e^0.007x
R² = 0.001
Polynomial(2)
Expon
Linear
Log

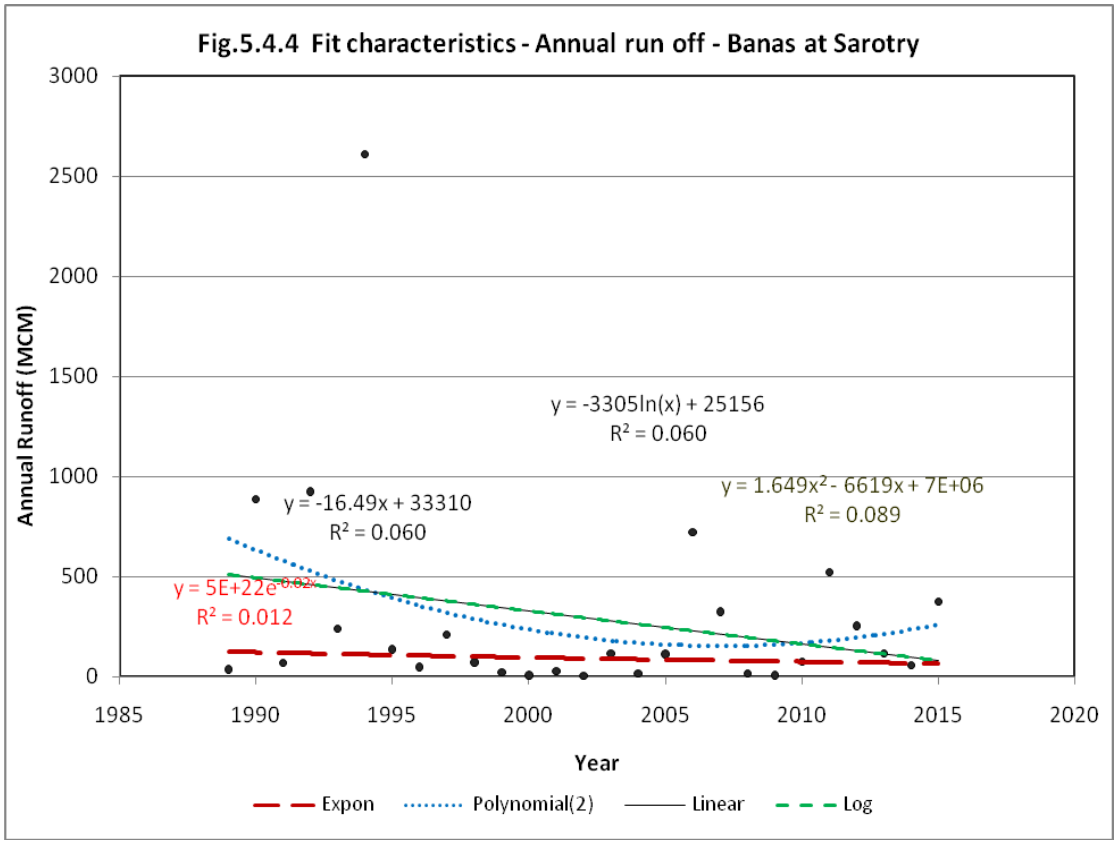


Fig.5.4.4 Fit characteristics - Annual run off - Banas at Sarotry
Annual Runoff (MCM)
Year
y = -3305ln(x) + 25156
R² = 0.060
y = -16.49x + 33310
R² = 0.060
y = 1.649x² - 6619x + 7E+06
R² = 0.089
y = 5E+22e^-0.02x
R² = 0.012
Expon
Polynomial(2)
Linear
Log

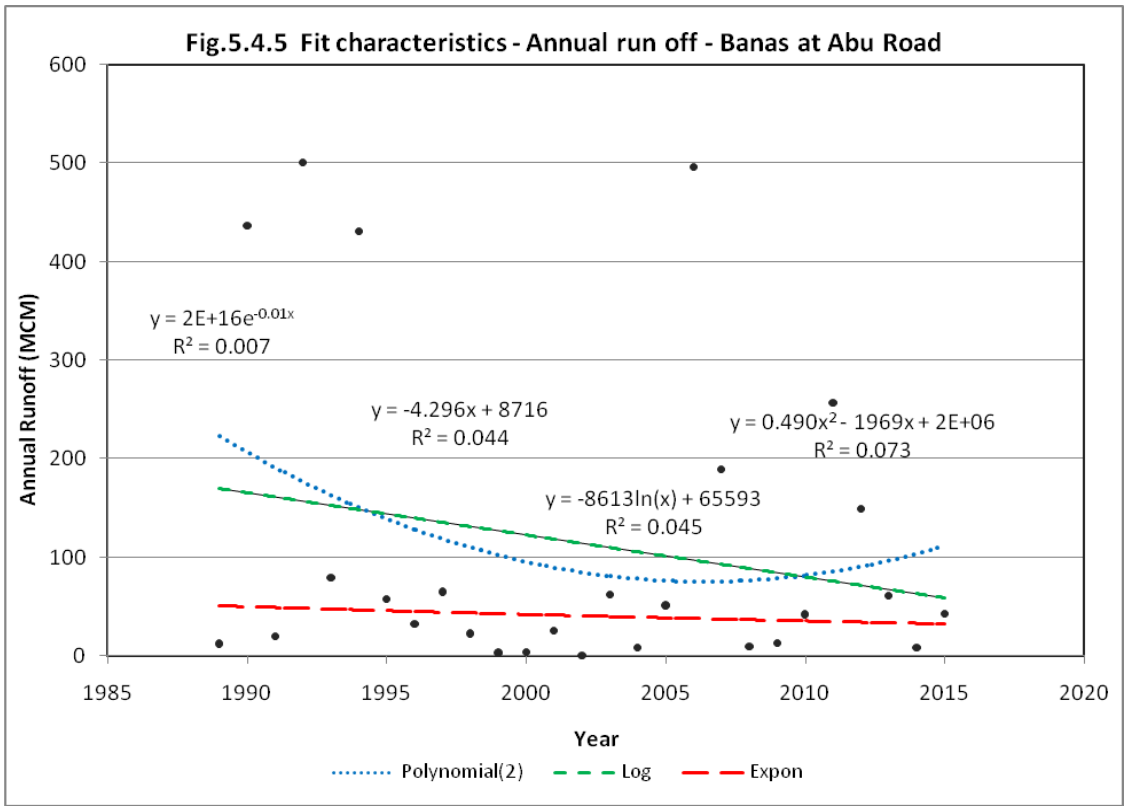


Fig.5.4.5 Fit characteristics - Annual run off - Banas at Abu Road
Annual Runoff (MCM)
Year
y = 2E+16e^-0.01x
R² = 0.007
y = -4.296x + 8716
R² = 0.044
y = 0.490x² - 1969x + 2E+06
R² = 0.073
y = -8613ln(x) + 65593
R² = 0.045
Polynomial(2)
Log
Expon

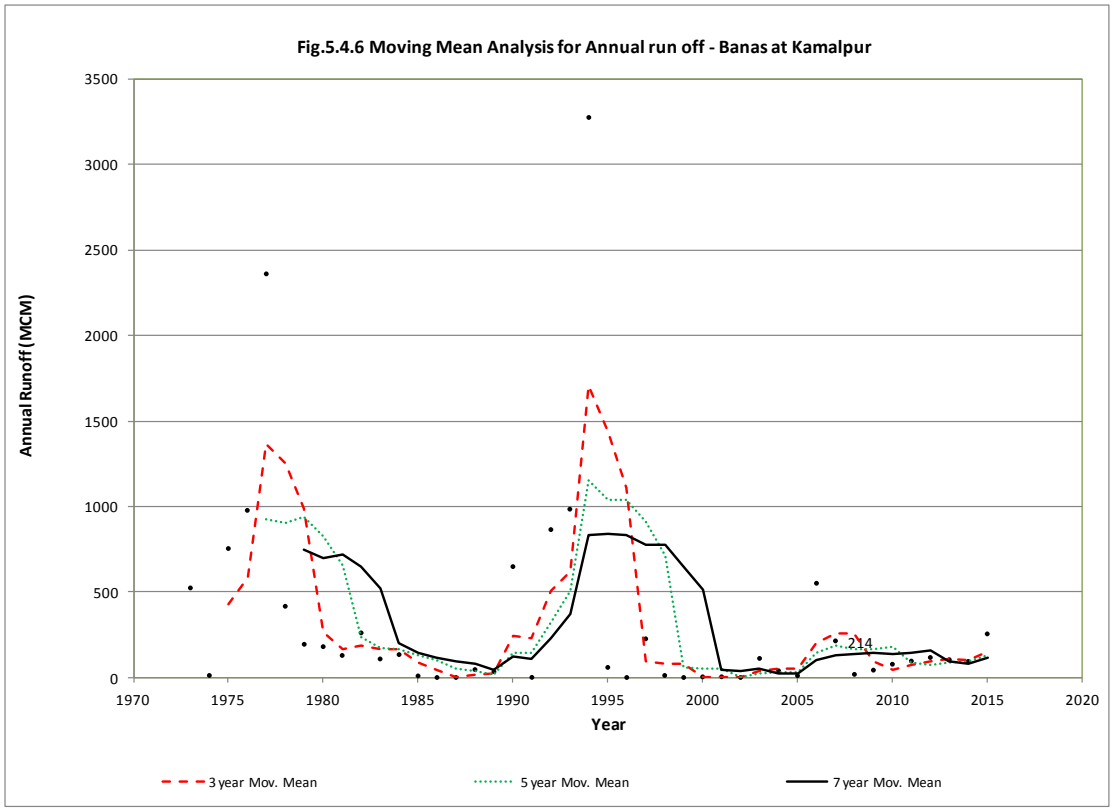


Fig.5.4.6 Moving Mean Analysis for Annual run off - Banas at Kamalpur

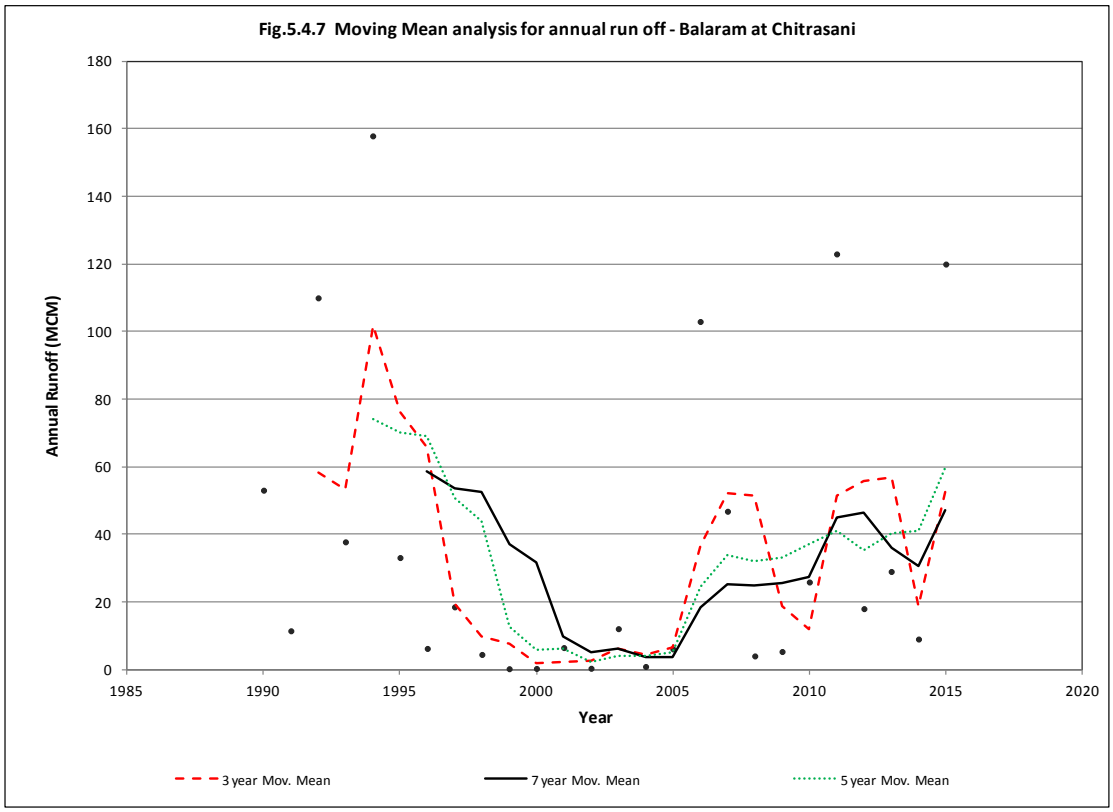


Fig.5.4.7 Moving Mean analysis for annual run off - Balaram at Chitrasani

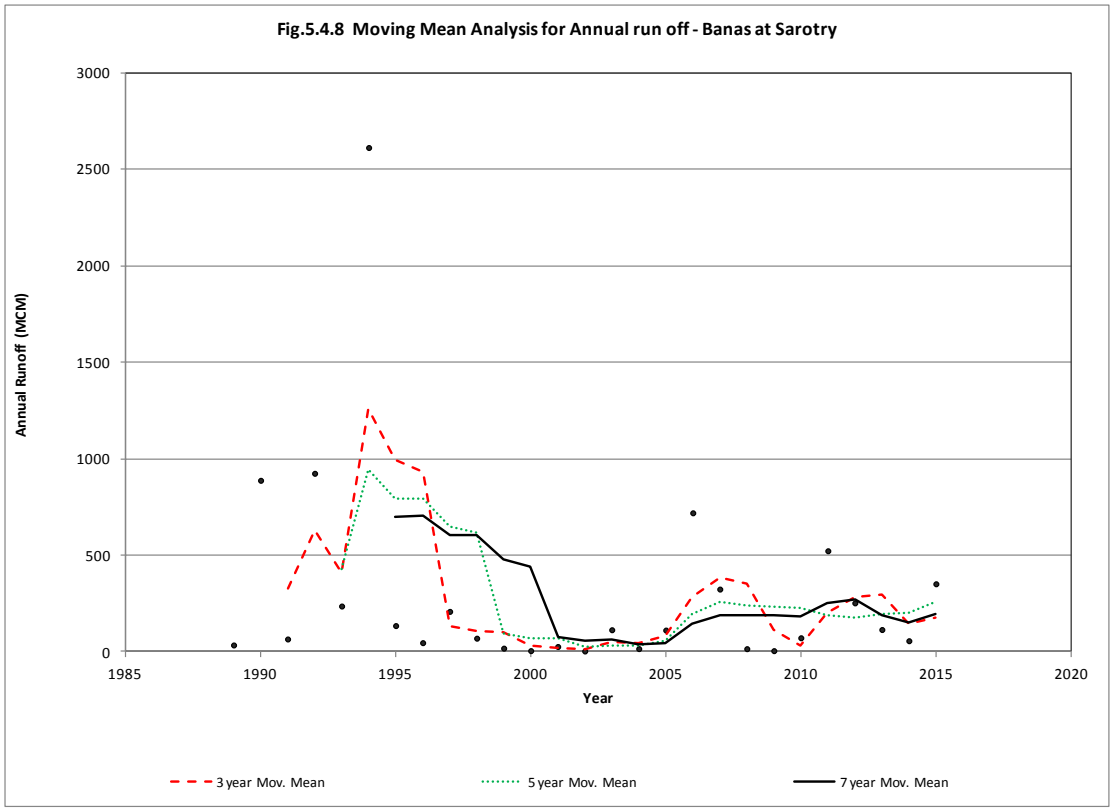


Fig.5.4.8 Moving Mean Analysis for Annual run off - Banas at Sarotry
Annual Runoff (MCM)
3000
2500
2000
1500
1000
500
0
1985
1990
1995
2000
2005
2010
2015
2020
Year
3 year Mov. Mean
5 year Mov. Mean
7 year Mov. Mean

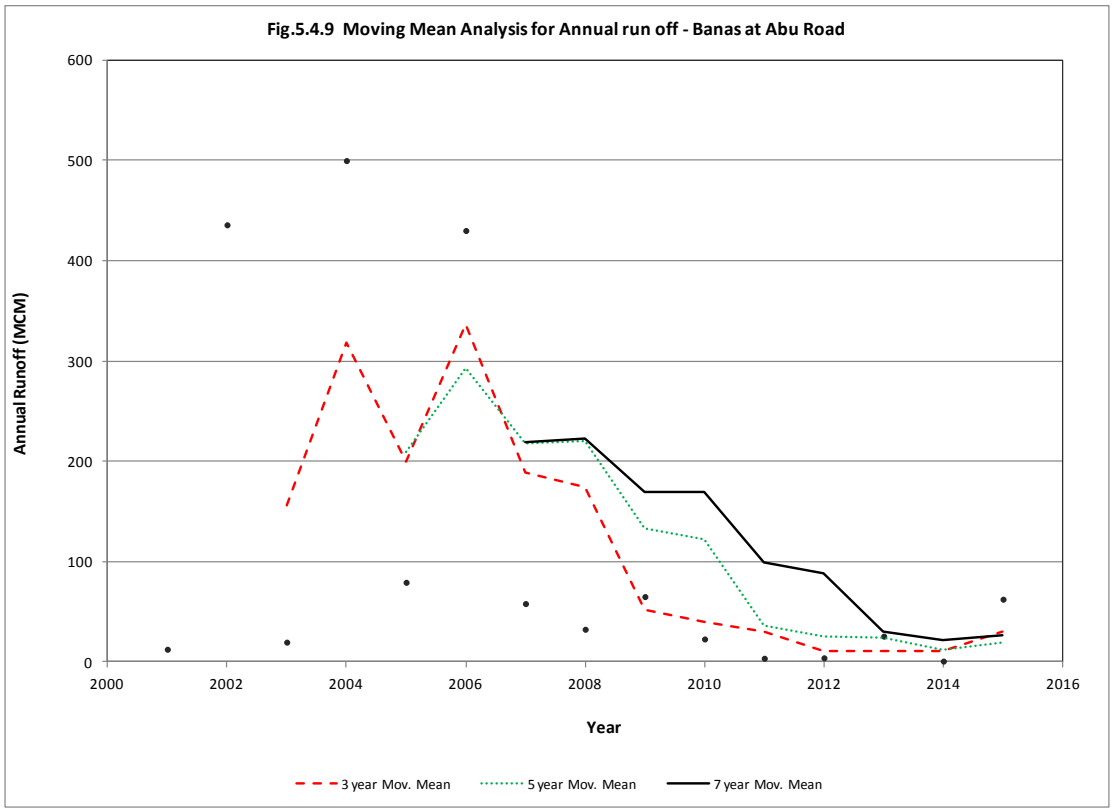


Fig.5.4.9 Moving Mean Analysis for Annual run off - Banas at Abu Road
Annual Runoff (MCM)
600
500
400
300
200
100
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
Year
3 year Mov. Mean
5 year Mov. Mean
7 year Mov. Mean

5.5 Trend Analysis - Shetrunji Basin

5.5.1 Introduction

Trends are important indicators of the temporal variability of runoff as computed from observed discharge at site. By analyzing the time sequence of the runoff, we assess the magnitude and significance of the temporal variability. The present surface runoff trend study involves analysis of the temporal variability of data sets on the observed discharges in Shetrunji basin using available data of existing river gauging stations.

5.5.2 Methodology

In the analysis of the trends of runoff on Shetrunji River annual runoff is computed and analyzed. The analysis is carried out for one (1) river gauging stations with sufficiently long and continuous data sets that are fairly representatively distributed across Sherunji river Basin.

Overall one station has been considered in this study. The data set of river gauging station is 45 years. Subsequently, time series are analysed on various statistical parameters, fitting of mathematical equations, observing moving means for various period so as to find out if there are any trends in the annual runoff data.

5.5.3 Time series analysis

Time series is defined as a sequence of values arrayed in order of their occurrence which can be characterized by statistical properties. Time series analysis may be used to test the variability, homogeneity and trend of a stream flow series or simply to give an upright list the characteristics of the series as graphically displayed. Significant movements of time series are the secular, periodic, cyclic and irregular trends. A time series may display a tendency to increase or decrease, over a specified period. Such a series provides an interesting illustration because if the trend is usually predominant, virtually no other movements are discernible.

Various methods exist for analysis of time series such as moving averages, residual series, residual mass curves and balance. Trends may also be revealed by determining if observed stream flow follows some mathematical equation as a function of time.

In this chapter, first statistical parameters have been computed for time series data of annual runoff at different sites in Shetrunji basin. It is also ascertained if any mathematical equation can be fitted to the time series to assess predictability. Finally, the data is analysed by the method of moving means for various periods.

5.5.4 Availability of annual run off Data

There is 1 G&D site in Shetrunji Basin. Availability of annual runoff data for this site is summarized in **Table -1** and graph of Annual runoff for the entire year is given in **Fig.5.5.1.**

Table-1: Availability of Data

Sl.No.	Site name	River/Tribu.	Data availability	Total years
1	Lowara	Shetrunji	1971-72 to 2015-16	45

The data is placed at **Annexure-5** and shown in line diagram in **Plate.2.5.2.**

5.5.5 Analysis

5.5.5.1 Statistical Analysis

Various statistical parameters of the time series of available data are given below in **Table-2**.

Table-2: Statistical parameters of Annual Runoff series at various sites

GD station	Data length (years)	Mean (MCM)	Median (MCM)	SD (MCM)	Coeff. Of variation
Lowara	45	278	177	302.13	1.09

5.5.5.2 Fit characteristics

In order to find out if any mathematical equation represents the time series as a function of time, fitting of various types of equations viz. linear, logarithmic, exponential and polynomial have been attempted. Results of such fits are given in the **Table- 3** and shown in **Fig 5.5.2.**

Table-3: Fit Characteristics

Sl.No.	Site	Function Type	Fitted Equation	R^2
	SHETRUNJI BASIN			
1	Lowara	Linear	y = 7.344x - 14359	0.101
		Logarithmic	y = 14618ln(x) - 11077	0.101
		Polynomial	$y = 0.279x^2 - 1105.x + 1E+06$	0.121

5.5.5.3 Moving Mean Analysis

In statistics, a moving mean (average), also called rolling average, rolling mean or running average, is a type of finite impulse response filter used to analyze a

set of data points by creating a series of averages of different subsets of the full data set.

The first element of the moving average is obtained by taking the average of the initial fixed subset of the number series. Then the subset is modified by "shifting forward", that is excluding the first number of the series and including the next number following the original subset in the series. This creates a new subset of numbers, which is averaged. This process is repeated over the entire data series. The plot line connecting all the (fixed) averages is the moving average. A moving average is a set of numbers, each of which is the average of the corresponding subset of a larger set of data points. A moving average may also use unequal weights for each data value in the subset to emphasize particular values in the subset.

A moving average is commonly used with time series data to smooth out short-term fluctuations and highlight longer-term trends or cycles.

In the present analysis, moving means have been computed for 3, 5 and 7 year periods for various sites of Shetrunji River Basin and shown in **Fig. 5.5.3**.

5.5.6 Interpretation

5.5.6.1 Fitting of various statistical/mathematical models viz linear, logarithmic, exponential and polynomial reveals that values of R^2 range from 0.101 to 0.121 for Lowara. The value of R^2 is much less than1, indicating absence of any significant trend.

5.5.6.2 There is only one site having 45 years of annual runoff data. Moving mean analysis shows elements of periodicity in the data. As we increase the period of moving mean, the yearly variations are smoothened out and periodicity begins to be evident. A longer time series data is required to conclude existence of periodicity.

5.5.7 Conclusion

Statistically speaking, the annual runoff of river Shetrunji River in general, appears to be a random variable; however moving mean analysis shows rising trend from year 2000 onwards. A longer set of time series data may help identify trends in annual runoff, if any on definitive basis.

Annual Runoff (MCM) at site Lowara over Shetrunji basin **Annexure- 5**

Year	Shetrunji at Lowara
1971	290
1972	0
1973	334
1974	238
1975	56
1976	42
1977	147
1978	24
1979	401
1980	387
1981	154
1982	241
1983	906
1984	26
1985	12
1986	113
1987	21
1988	485
1989	197
1990	205
1991	66
1992	118
1993	156
1994	314
1995	52
1996	118
1997	35
1998	208
1999	21
2000	2
2001	105
2002	414
2003	132
2004	196
2005	1055
2006	629
2007	1269
2008	1061
2009	177
2010	572
2011	506
2012	54
2013	379
2014	127
2015	440
MEAN	278
MEDIAN	177
SD	302
CO-EFFICIENT OF VARIATION	1.089

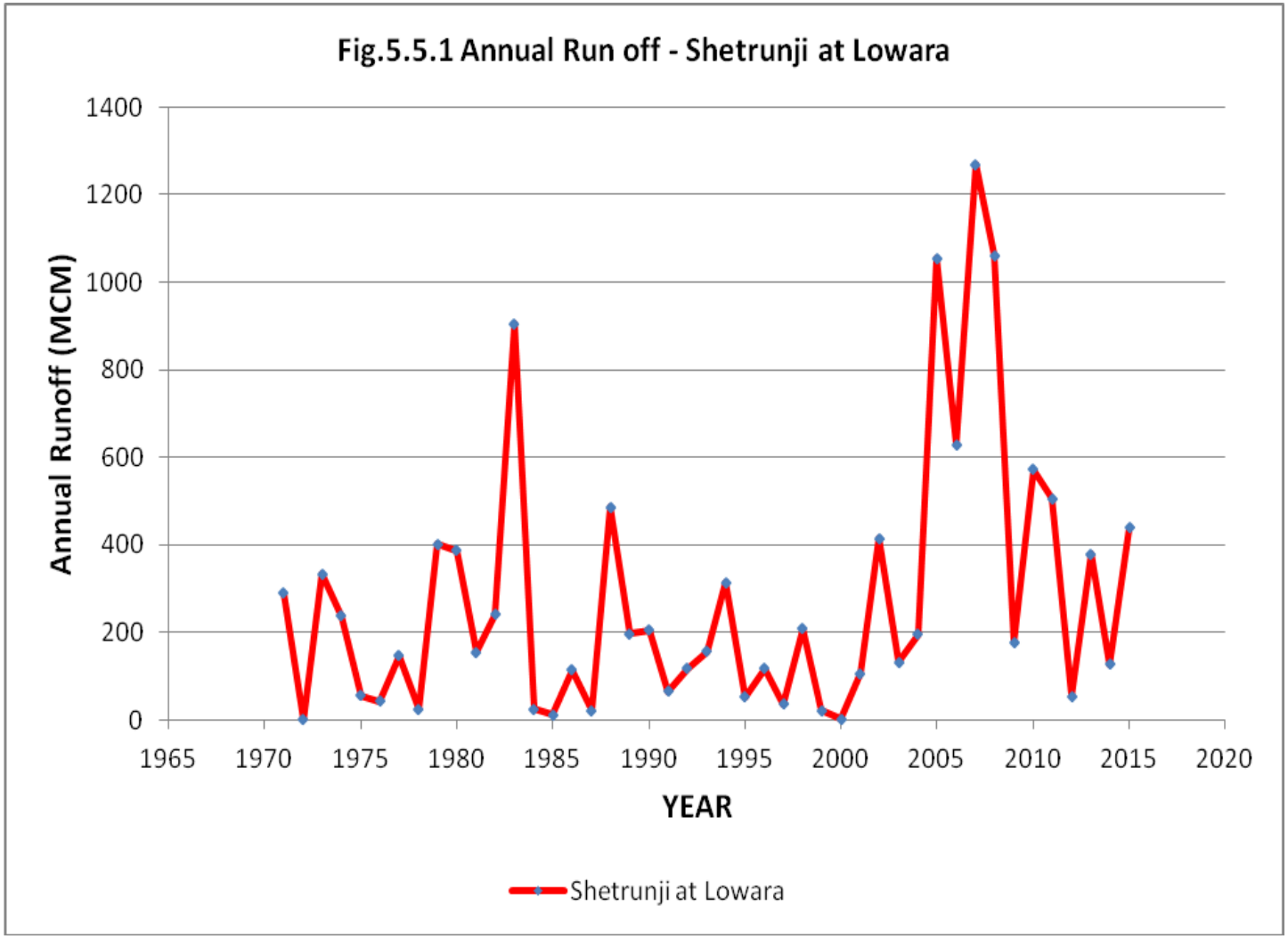


Fig.5.5.1 Annual Run off - Shetrunji at Lowara
Annual Runoff (MCM)
1400
1200
1000
800
600
400
200
0
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
YEAR
Shetrunji at Lowara

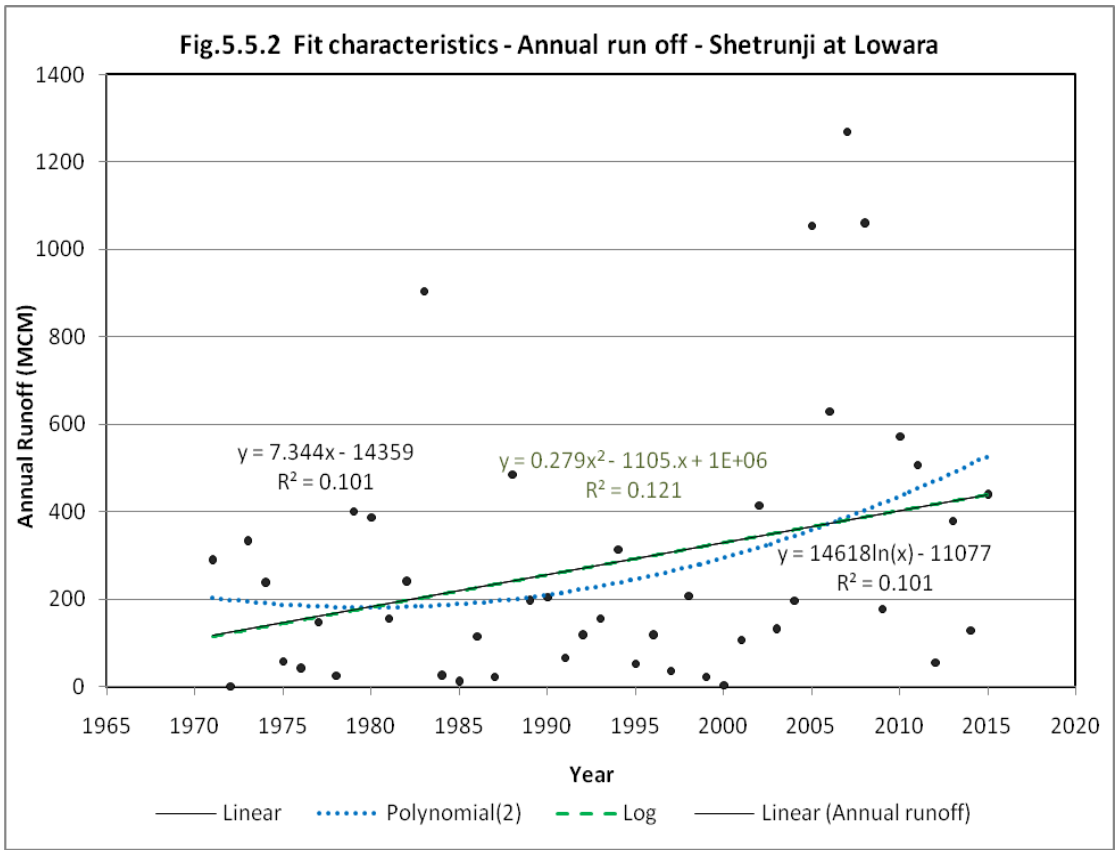


Fig.5.5.2 Fit characteristics - Annual run off - Shetrunji at Lowara
Annual Runoff (MCM)
Year
y = 7.344x - 14359
R² = 0.101
y = 0.279x² - 1105.x + 1E+06
R² = 0.121
y = 14618ln(x) - 11077
R² = 0.101
Linear
Polynomial(2)
Log
Linear (Annual runoff)

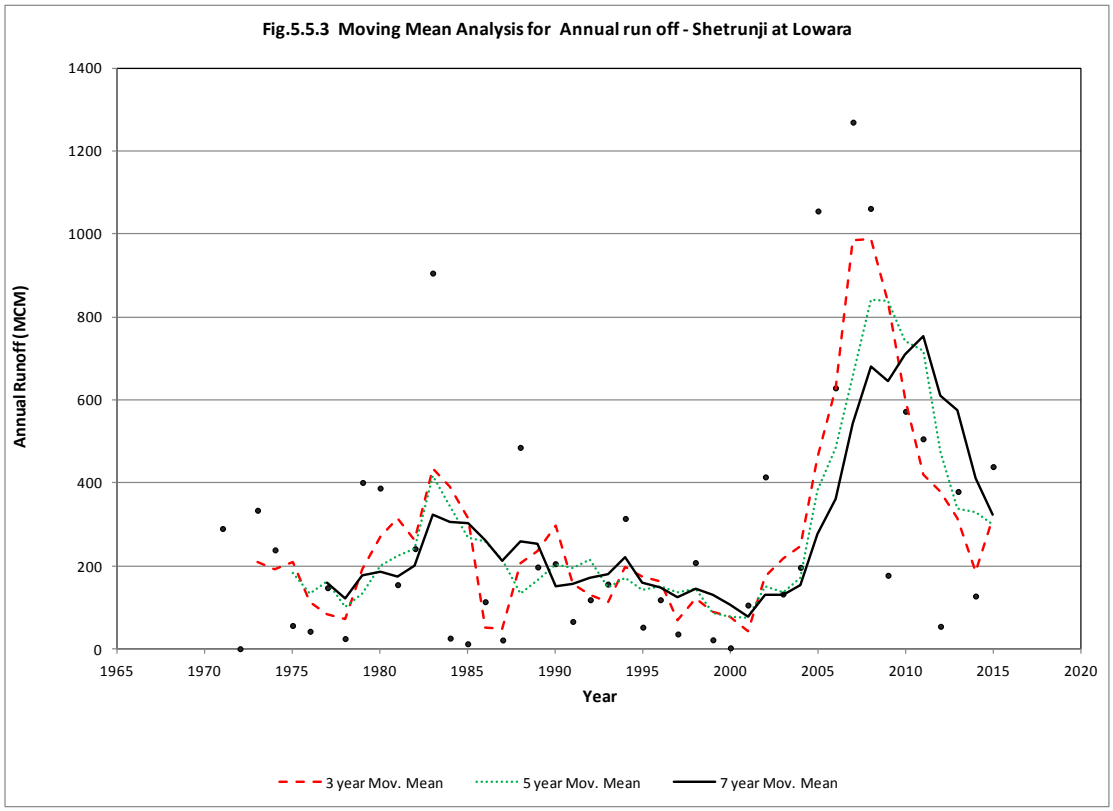


Fig.5.5.3 Moving Mean Analysis for Annual run off - Shetrunji at Lowara
Annual Runoff (MCM)
Year
3 year Mov. Mean
5 year Mov. Mean
7 year Mov. Mean

5.6 Trend Analysis - Bhadar Basin

5.6.1 Introduction

Trends are important indicators of the temporal variability of runoff as computed from observed discharge at site. By analyzing the time sequence of the runoff, we assess the magnitude and significance of the temporal variability. The present surface runoff trend study involves analysis of the temporal variability of data sets on the observed discharges in Bhadar basin using available data of existing river gauging stations.

5.6.2 Methodology

In the analysis of the trends of runoff on Bhadar River, annual runoff is computed and analyzed. The analysis is carried out for one (1) river gauging stations with sufficiently long and continuous data sets that are fairly representatively distributed across Bhadar river Basin.

Overall one station has been considered in this study. The length of the data sets of river gauging station is 45 years. Subsequently, time series are analysed on various statistical parameters, fitting of mathematical equations, observing moving means for various period so as to find out if there are any trends in the annual runoff data.

5.6.3 Time series analysis

Time series is defined as a sequence of values arrayed in order of their occurrence which can be characterized by statistical properties. Time series analysis may be used to test the variability, homogeneity and trend of a stream flow series or simply to give an upright list the characteristics of the series as graphically displayed. Significant movements of time series are the secular, periodic, cyclic and irregular trends. A time series may display a tendency to increase or decrease, over a specified period. Such a series provides an interesting illustration because if the trend is usually predominant, virtually no other movements are discernible. Various methods exist for analysis of time series such as moving averages, residual series, residual mass curves and balance. Trends may also be revealed by determining if observed stream flow follows some mathematical equation as a function of time.

In this chapter, first statistical parameters have been computed for time series data of annual runoff at different sites in Bhadar basin. It is also ascertained if any mathematical equation can be fitted to the time series to assess predictability. Finally, the data is analysed by the method of moving means for various periods.

5.6.4 Availability of annual run off Data

There is one G&D site in Bhadar Basin. Availability of annual runoff data for this site is summarized in **Table -1** and annual runoff graph for the entire data series is given in **Fig. 5.6.1.**

Table-1: Availability of Data

Sl.No.	Site name	River/Tribu.	Data availability	Total years
1	Ganod	Bhadar	1971-72 to 2015-16	45

The data is placed at **Annexure-6** and shown in line diagram in **Plate. 2.6.2.**

5.6.5 Analysis

5.6.5.1 Statistical Analysis

Various statistical parameters of the time series of available data are given below in **Table-2**.

Table-2: Statistical parameters of Annual Runoff series at various sites

GD station	Data length (years)	Mean (MCM)	Median (MCM)	SD (MCM)	Coefficient Of Variation
Ganod	45	458	201	583.9	1.274

5.6.5.2 Fit characteristics

In order to find out if any mathematical equation represents the time series as a function of time, fitting of various types of equations viz. linear, logarithmic, exponential and polynomial have been attempted. Results of such fits are given in the **Table- 3** and shown in **Fig.5.6.2.**

Table-3: Fit Characteristics

Sl.No.	Site	Function Type	Fitted Equation	R^2
	BHADAR BASIN			
1	Chitrasani	Linear	$y = -2.25x + 4942.7$	0.0026
		Logarithmic	$y = -4498\ln(x) + 34633$	0.0026
		Polynomial	$y = 0.2123x^2 - 848.34x + 848037$	0.0056

5.6.5.3 Moving Mean Analysis

In statistics, a moving mean (average), also called rolling average, rolling mean or running average, is a type of finite impulse response filter used to analyze a

set of data points by creating a series of averages of different subsets of the full data set.

The first element of the moving average is obtained by taking the average of the initial fixed subset of the number series. Then the subset is modified by "shifting forward", that is excluding the first number of the series and including the next number following the original subset in the series. This creates a new subset of numbers, which is averaged. This process is repeated over the entire data series. The plot line connecting all the (fixed) averages is the moving average. A moving average is a set of numbers, each of which is the average of the corresponding subset of a larger set of data points. A moving average may also use unequal weights for each data value in the subset to emphasize particular values in the subset.

A moving average is commonly used with time series data to smooth out short-term fluctuations and highlight longer-term trends or cycles.

In the present analysis, moving means have been computed for 3, 5 and 7 year periods for various sites of Bhadar River Basin and shown in **Fig. 5.6.3.**

5.6.6 Interpretation

5.6.6.1 Fitting of various statistical/mathematical models viz linear, logarithmic, exponential and polynomial reveals that values of R^2 range from 0.0026 to 0.0056 for Ganod. The values of R^2 are quite close to 0 indicating absence of any significant trend.

5.6.6.2 Moving mean analysis of 45 year data at the only site in Bhadar basin reveals elements of cyclicalness. As the period of moving mean is increased, periodicity with a relatively longer base begin to appear. As is evident from the moving mean plot, a longer time series may help establish such periodical trend.

5.6.7 Conclusion

Statistically speaking, the annual runoff of river Bhadar River in general, appears to be a random variable; however elements of cyclicalness cannot be ruled out on the strength of moving mean analysis. A longer set of time series data may help identify trends in annual runoff, if any.

****

Annexure - 6

Annual Runoff (MCM) at site Ganod over Bhadar basin

Year	Bhadar at Ganod
1971	546
1972	229
1973	86
1974	86
1975	166
1976	442
1977	442
1978	148
1979	1888
1980	1419
1981	799
1982	198
1983	2293
1984	383
1985	12
1986	57
1987	3
1988	1728
1989	295
1990	170
1991	83
1992	373
1993	38
1994	835
1995	42
1996	419
1997	125
1998	36
1999	8
2000	3
2001	74
2002	80
2003	138
2004	79
2005	252
2006	795
2007	2052
2008	800
2009	201
2010	703
2011	632
2012	0
2013	1089
2014	0
2015	381
MEAN	458
MEDIAN	201
STANDARD DEVAIATION	583.91
CO-EFFICIENT OF VARIATION	1.274

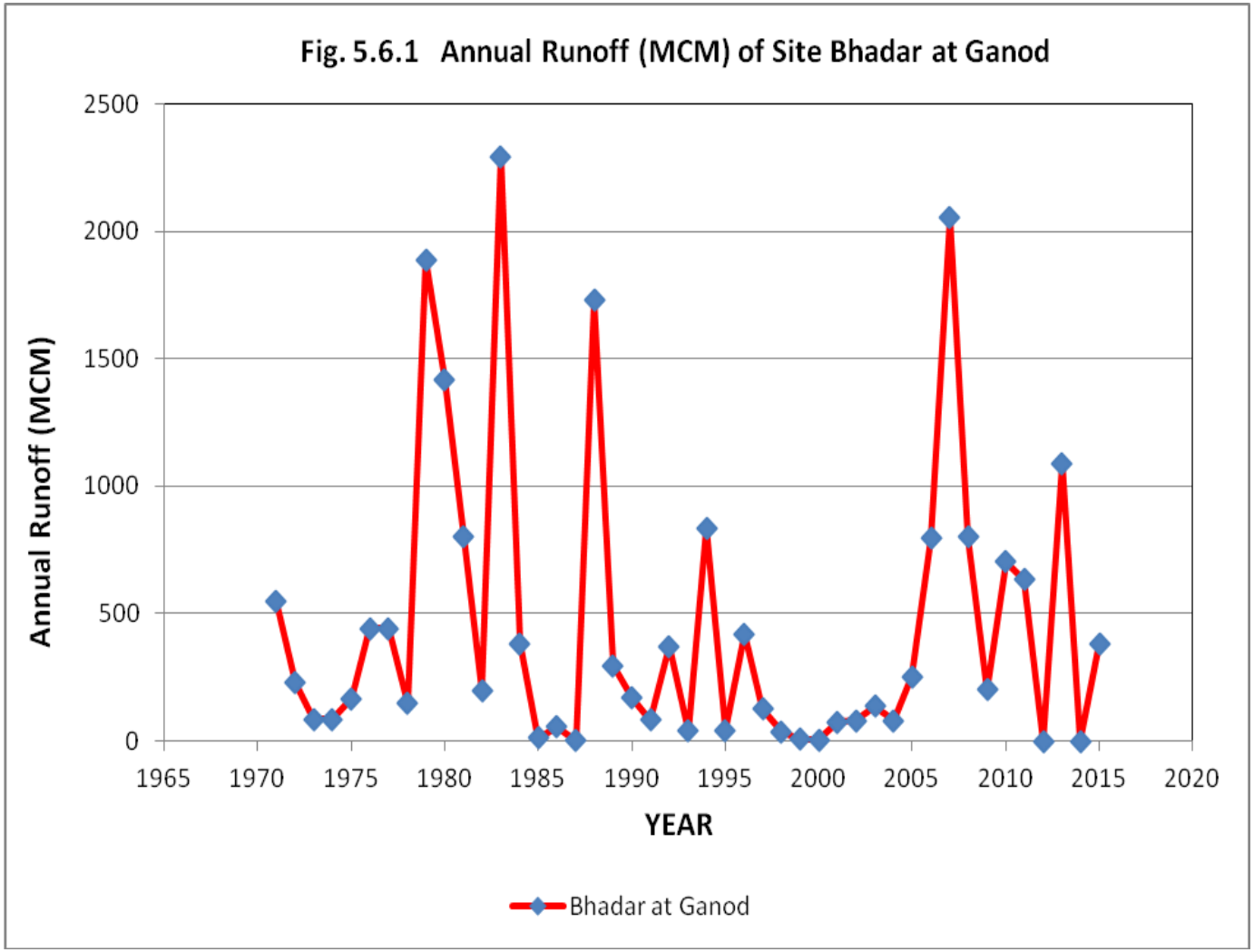


Fig. 5.6.1 Annual Runoff (MCM) of Site Bhadar at Ganod
Annual Runoff (MCM)
2500
2000
1500
1000
500
0
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
YEAR
Bhadar at Ganod

Fig.5.6.2 Fit characteristics - Annual run off - Bhadar at Ganod

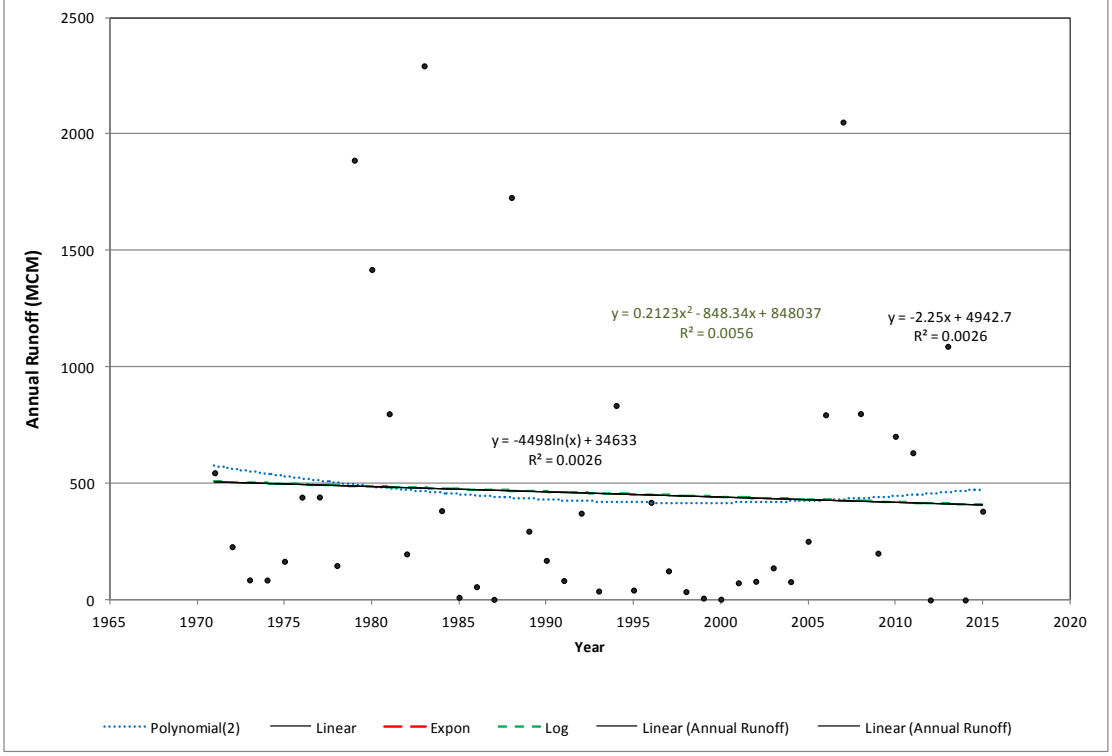
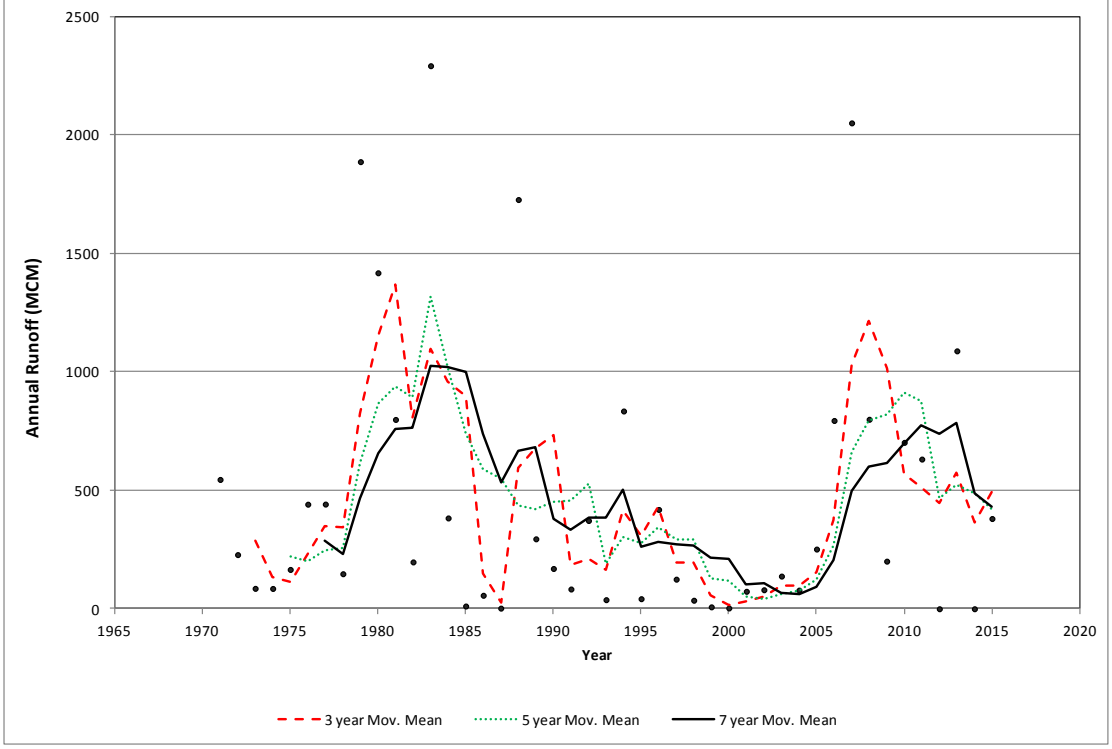


Fig.5.6.3 Moving Mean Analysis for Annual run off - Bhadar at Ganod



5.7 Trend Analysis - Machhu Basin

5.7.1 Introduction

Trends are important indicators of the temporal variability of runoff as computed from observed discharge at site. By analyzing the time sequence of the runoff, we assess the magnitude and significance of the temporal variability. The present surface runoff trend study involves analysis of the temporal variability of data sets on the observed discharges in Machhu basin using available data of existing river gauging stations.

5.7.2 Methodology

In the analysis of the trends of runoff on Machhu River, annual runoff is computed and analyzed. The analysis is carried out for one (1) river gauging station with sufficiently long and continuous data sets that are fairly representatively distributed across Machhu river Basin.

Overall one station has been considered in this study. The length of the data sets of river gauging station is 45 years. Subsequently, time series are analysed on various statistical parameters, fitting of mathematical equations, observing moving means for various period so as to find out if there are any trends in the annual runoff data.

5.7.3 Time series analysis

Time series is defined as a sequence of values arrayed in order of their occurrence which can be characterized by statistical properties. Time series analysis may be used to test the variability, homogeneity and trend of a stream flow series or simply to give an upright list the characteristics of the series as graphically displayed. Significant movements of time series are the secular, periodic, cyclic and irregular trends. A time series may display a tendency to increase or decrease, over a specified period. Such a series provides an interesting illustration because if the trend is usually predominant, virtually no other movements are discernible.

Various methods exist for analysis of time series such as moving averages, residual series, residual mass curves and balance. Trends may also be revealed by determining if observed stream flow follows some mathematical equation as a function of time.

In this chapter, first statistical parameters have been computed for time series data of annual runoff in Machhu basin. It is also ascertained if any mathematical equation can be fitted to the time series to assess predictability. Finally, the data is analysed by the method of moving means for various periods.

5.7.4 Availability of annual runoff Data

There are one G&D site in Machhu Basin. Availability of annual runoff data for these sites is summarized in **Table -1** and Graph of annual run off for entire data series is given in **Fig. 5.7.1.**

Table-1: Availability of Data

Sl.No.	Site name	River/Tribu.	Data availability	Total Years
1	Gungan	Machhu	1971-72 to 2015-16	45

The data is placed at **Annexure-7** and shown in line diagram in **Plate 2.7.2**.

5.7.5 Analysis

5.7.5.1 Statistical Analysis

Various statistical parameters of the time series of available data are given below in

Table-2.

Table-2: Statistical parameters of Annual Runoff series at various sites

GD station	Data length (years)	Mean (MCM)	Median (MCM)	SD (MCM)	Coefficient. Of Variation
Gungan	45	173	49	214.4	1.24

5.7.5.2 Fit characteristics

In order to find out if any mathematical equation represents the time series as a function of time, fitting of various types of equations viz. linear, logarithmic, exponential and polynomial have been attempted. Results of such fits are given in the **Table- 3** and shown in **Fig. 5.7.2.**

Table-3: Fit Characteristics

Sl.No.	Site	Function Type	Fitted Equation	R^2
	MACHHU BASIN			
1	Gungan	Linear	y = 0.1506x - 126.88	9.00E-05
		Logarithmic	y = 296.92ln(x) - 2082.5	8.00E-05
		Polynomial	$y = 0.0488x^2 - 194.19x + 193524$	0.0013

5.7.5.3 Moving Mean Analysis

In statistics, a moving mean (average), also called rolling average, rolling mean or running average, is a type of finite impulse response filter used to analyze a

set of data points by creating a series of averages of different subsets of the full data set.

The first element of the moving average is obtained by taking the average of the initial fixed subset of the number series. Then the subset is modified by "shifting forward", that is excluding the first number of the series and including the next number following the original subset in the series. This creates a new subset of numbers, which is averaged. This process is repeated over the entire data series. The plot line connecting all the (fixed) averages is the moving average. A moving average is a set of numbers, each of which is the average of the corresponding subset of a larger set of data points. A moving average may also use unequal weights for each data value in the subset to emphasize particular values in the subset.

A moving average is commonly used with time series data to smooth out short-term fluctuations and highlight longer-term trends or cycles.

In the present analysis, moving means have been computed for 3, 5 and 7 year periods for various sites of Machhu River Basin and shown in **Fig. 5.7.3.**

5.7.6 Interpretation

5.7.6.1 Fitting of various statistical/mathematical models viz linear, logarithmic, exponential and polynomial reveals that values of R^2 range from 8.0E-05 to 0.0013 for Gungan. The values of R^2 are quite close to 0 indicating absence of any significant trend.

5.7.6.2 Moving mean analysis has been carried out with 3 year, 5 year and 7 year moving means. It is seen from the moving mean plot, that no conclusion at present can be drawn regarding existence of any cyclic trend.

5.7.7 Conclusion

Statistically speaking, the annual runoff of river Machhu River, and its four important tributaries Beti, Asoi, Machhori and Maha, in general, appears to be a random variable; however elements of cyclicalness cannot be ruled out on the strength of moving mean analysis. A longer set of time series data may help identify trends in annual runoff, if any.

Annexure - 7

Annual Runoff (MCM) at site Gungan over Machhu Basin

Year	Machhu at Gungan
1971	233
1972	27
1973	0
1974	0
1975	197
1976	468
1977	314
1978	46
1979	49
1980	413
1981	304
1982	146
1983	477
1984	132
1985	36
1986	111
1987	14
1988	670
1989	185
1990	49
1991	4
1992	47
1993	2
1994	678
1995	17
1996	29
1997	249
1998	17
1999	1
2000	8
2001	7
2002	6
2003	13
2004	16
2005	431
2006	112
2007	613
2008	289
2009	7
2010	573
2011	634
2012	0.000
2013	119
2014	14
2015	42
MEAN	173
MEDIAN	49
STANDARD DEVAIATION	214.41
CO-EFFICIENT OF VARIATION	1.24

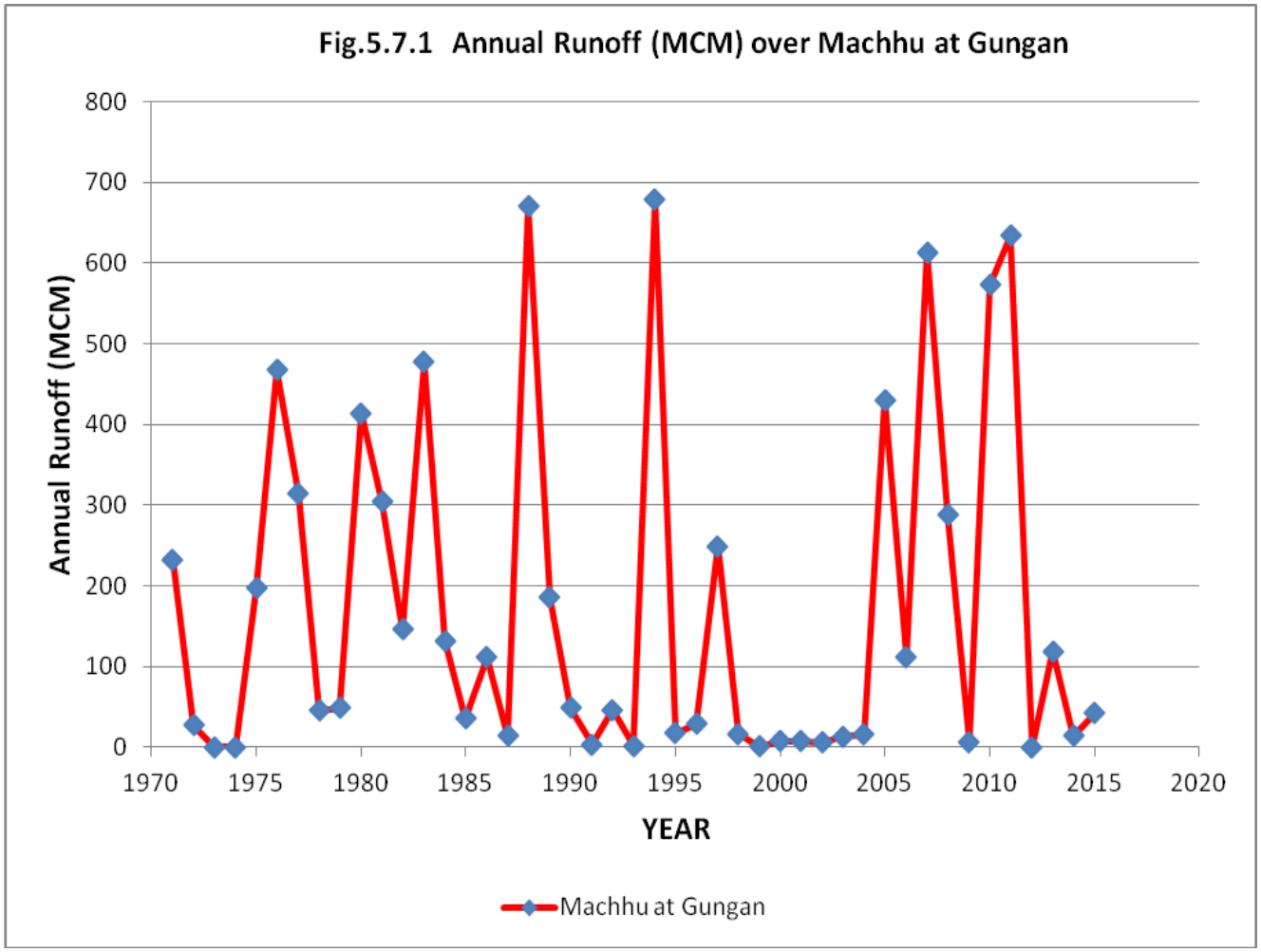


Fig.5.7.1 Annual Runoff (MCM) over Machhu at Gungan
Annual Runoff (MCM)
800
700
600
500
400
300
200
100
0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
YEAR
Machhu at Gungan

Fig.5.7.2 Fit characteristics - Annual run off - Machhu at Gungan

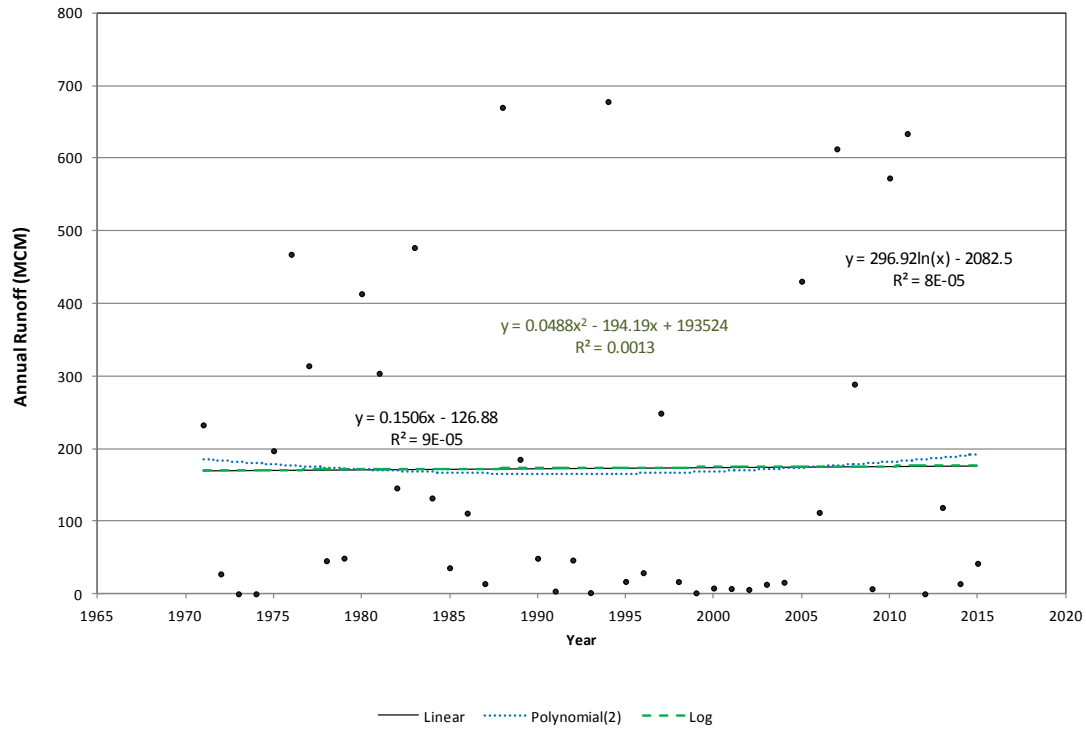
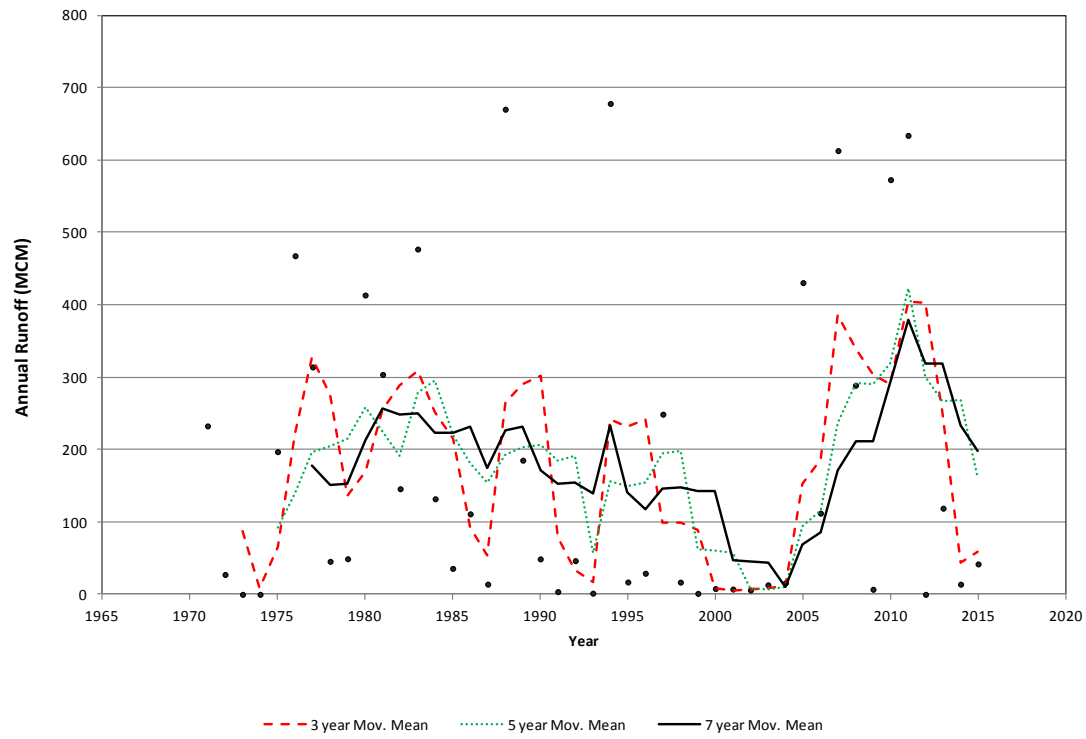


Fig.5.7.3 Moving Mean Analysis for Annual run off - Machhu at Gungan



5.8 Trend Analysis -Rupen Basin

5.8.1 Introduction

Trends are important indicators of the temporal variability of runoff as computed from observed discharge at site. By analyzing the time sequence of the runoff, we assess the magnitude and significance of the temporal variability. The present surface runoff trend study involves analysis of the temporal variability of data sets on the observed discharges in Rupen basin using available data of existing river gauging stations.

5.8.2 Methodology

In the analysis of the trends of runoff on Rupen River, annual runoff is computed and analyzed. The analysis is carried out for one (1) river gauging station with sufficiently long and continuous data sets that are fairly representatively distributed across Rupen River Basin.

Overall one station has been considered in this study. The length of the data sets of river gauging station is 26 years. Subsequently, time series are analysed on various statistical parameters, fitting of mathematical equations, observing moving means for various period so as to find out if there are any trends in the annual runoff data.

5.8.3 Time series analysis

Time series is defined as a sequence of values arrayed in order of their occurrence which can be characterized by statistical properties. Time series analysis may be used to test the variability, homogeneity and trend of a stream flow series or simply to give an upright list the characteristics of the series as graphically displayed. Significant movements of time series are the secular, periodic, cyclic and irregular trends. A time series may display a tendency to increase or decrease, over a specified period. Such a series provides an interesting illustration because if the trend is usually predominant, virtually no other movements are discernible. Various methods exist for analysis of time series such as moving averages, residual series, residual mass curves and balance. Trends may also be revealed by determining if observed stream flow follows some mathematical equation as a function of time.

In this chapter, first statistical parameters have been computed for time series data of annual runoff in Rupen basin. It is also ascertained if any mathematical equation can be fitted to the time series to assess predictability. Finally, the data is analysed by the method of moving means for various periods.

5.8.4 Availability of annual run off Data

There is one G&D site in Rupen Basin. Availability of annual runoff data for these sites is summarized in **Table -1** and the graph of annual runoff for the entire data is given in **Fig. 5.8.1.**

Table-1: Availability of Data

Sl.No.	Site name	River/Tribu.	Data availability	Total Years
1	Sapawada	Rupen	1990-91 to 2015-16	26

The data is placed at **Annexure-8** and shown in line diagram in **Plate 2.8.2**

5.8.5 Analysis

5.8.5.1 Statistical Analysis

Various statistical parameters of the time series of available data are given below in **Table-2**.

Table-2: Statistical parameters of Annual Runoff series at various sites

GD station	Data length (years)	Mean (MCM)	Median (MCM)	SD (MCM)	Coefficient. Of Variation
Sapawada	26	72	31	78.6	1.09

5.8.5.2 Fit characteristics

In order to find out if any mathematical equation represents the time series as a function of time, fitting of various types of equations viz. linear, logarithmic, exponential and polynomial have been attempted. Results of such fits are given in the **Table- 3** and shown in **Fig.5.8.2.**

Table-3: Fit Characteristics

Sl.No.	**Site**	**Function Type**	**Fitted Equation**	**R^2**
1	**RUPEN BASIN**			
	Sapawada	Linear	$y = 0.0118x + 48.7627$	0
		Logarithmic	$y = 21.7007\ln(x) - 92.6185$	0
		Polynomial	$y = 0.0838x^2 - 335.5835x + 3,36,058.8263$	0.003

5.8.5.3 Moving Mean Analysis

In statistics, a moving mean (average), also called rolling average, rolling mean or running average, is a type of finite impulse response filter used to analyze a

set of data points by creating a series of averages of different subsets of the full data set.

The first element of the moving average is obtained by taking the average of the initial fixed subset of the number series. Then the subset is modified by "shifting forward", that is excluding the first number of the series and including the next number following the original subset in the series. This creates a new subset of numbers, which is averaged. This process is repeated over the entire data series. The plot line connecting all the (fixed) averages is the moving average. A moving average is a set of numbers, each of which is the average of the corresponding subset of a larger set of data points. A moving average may also use unequal weights for each data value in the subset to emphasize particular values in the subset.

A moving average is commonly used with time series data to smooth out short-term fluctuations and highlight longer-term trends or cycles.

In the present analysis, moving means have been computed for 3, 5 and 7 year periods for various sites of Rupen River Basin and shown in **Fig.5.8.3.**

5.8.6 Interpretation

5.8.6.1 Fitting of various statistical/mathematical models viz linear, logarithmic, exponential and polynomial reveals that values of R^2 range from 0.00 to 0.003 for Sapawada. The values of R^2 are quite close to 0 indicating absence of any significant trend.

5.8.6.2 Moving mean analysis has been carried out with 3 year, 5 year and 7 year moving means. It is seen from the moving mean plot, that no conclusion at present can be drawn regarding existence of any cyclic trend.

5.8.7 Conclusion

Statistically speaking, the annual runoff of Rupen River, in general, appears to be a random variable; however elements of cyclicalness cannot be ruled out on the strength of moving mean analysis. A longer set of time series data may help identify trends in annual runoff, if any.

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Annual Runoff (MCM) at site Sapawada over Rupen basin

Year	Rupen at Sapawada
1990	104
1991	8
1992	55
1993	226
1994	159
1995	25
1996	0
1997	112
1998	24
1999	1
2000	4
2001	17
2002	0
2003	32
2004	29
2005	230
2006	223
2007	200
2008	70
2009	19
2010	81
2011	29
2012	0.182
2013	76
2014	4
2015	153
MEAN	72
MEDIAN	31
STANDARD DEVAIATION	78.63
CO-EFFICIENT OF VARIATION	1.09

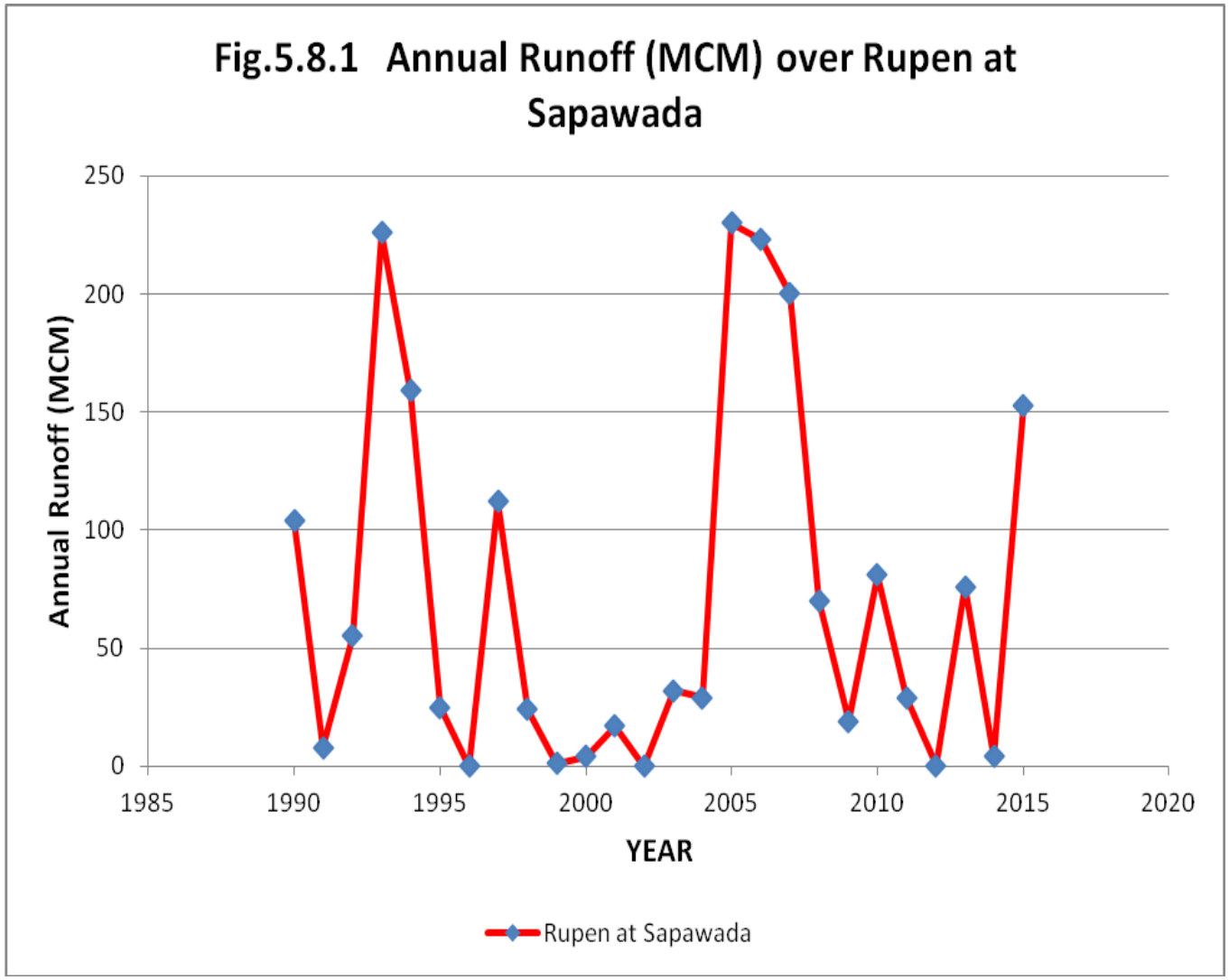
Fig.5.8.1 Annual Runoff (MCM) over Rupen at Sapawada
250
200
150
100
50
0
Annual Runoff (MCM)
1985
1990
1995
2000
2005
2010
2015
2020
YEAR
Rupen at Sapawada

Fig.5.8.2 Fit characteristics - Annual run off - Rupen at Sapawada

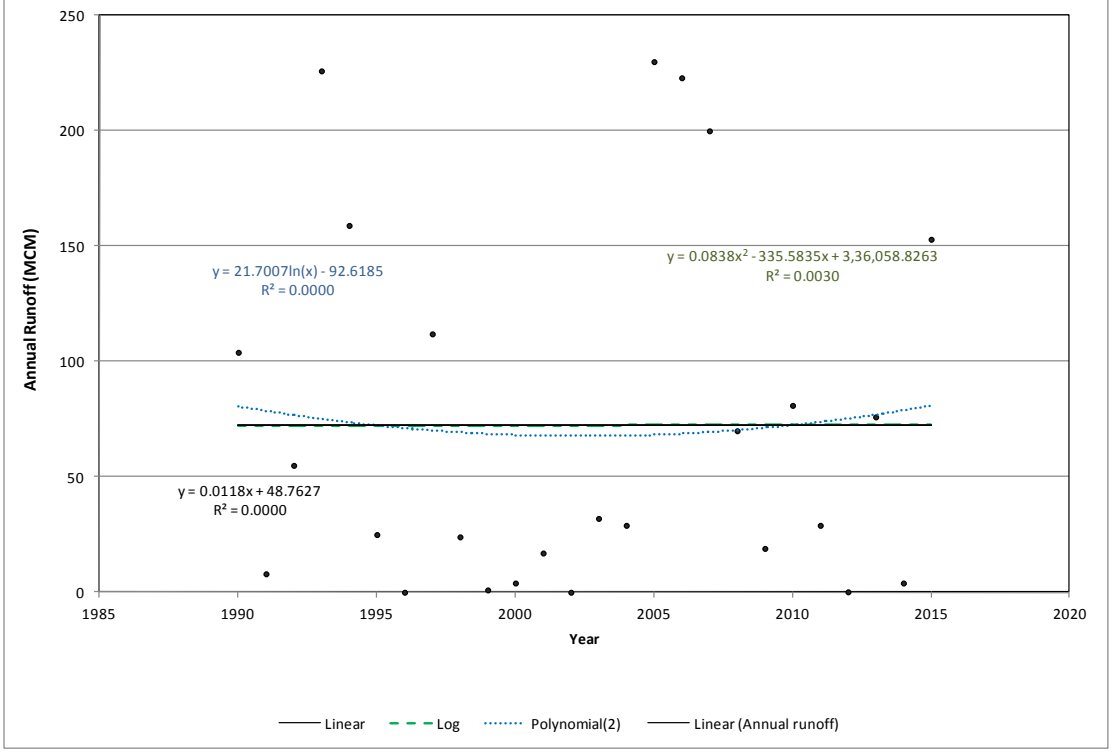

Fig.5.8.3 Moving Mean Analysis for Annual run off - Rupen at Sapawada