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SABARMATI SYSTEM STUDIES - SYSTEM DESCRIPTION AND DATA STATUS

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PREFACE

For proper and efficient utilization of water resources it is required that the reservoirs must be operated in most judicious and scientific manner. Proper reservoir operation can optimize the benefits accruing from a reservoir and can decrease the disasters to the minimum possible. For this purpose, Irrigation Department, Govt. of Gujarat entered into an agreement with National Institute of Hydrology, Roorkee for preparation of Reservoir operation manuals for the hydraulic structures located in Gujarat in the Sabarmati Basin upto Ahmedabad. The work has been taken up as a consultancy project.

The present report deals with the detailed description of the Sabarmati basin. The various Hydraulic structures, their salient features and their other relevant details have been presented. Present guidelines for operation which are currently followed for various structures have also been described. Status regarding availability of data at NIH pertaining to this project has been presented in tabular form. Line diagram and Index map of the basin have been included for the sake of understanding the system and its components.

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1.0 INTRODUCTION

The Irrigation department, Govt. of Gujarat, Gujarat has requested the National Institute of Hydrology, Roorkee, to prepare Reservoir Operation Manual for dams located in the Sabarmati basin, i.e., Dharoi dam, Harnav dam & Harnav weir, Guhai dam, Hathmati dam & Hathmati weir and Wasna Barrage. This work has been entrusted to NIH through an agreement signed between Irrigation deptt., Govt. of Gujarat and National Institute of Hydrology. This work has been taken up by N.I.H. as a consultancy project.

The main objectives of the project are :

(a) To develop reservoir operation manual for Dharoi dam for flood control (i.e. flood forecasting and flood warning) as well as conservation purposes.

(b) To develop operation procedures for Harnav dam, Guhai dam, Hathmati dam, Hathmati weir, Harnav weir and Wasna barrage for irrigation purposes.

This work has been subdivided into two parts, first dealing with development of operation policies for nonmonsoon period and the other dealing with development of the policies for the monsoon period.

The aim of this report is to present a detailed description of the study area and the hydraulic structures of interest along with their salient features. The present policy of operation and management of these structures is also explained. The data available to carry out the above mentioned studies is also described.

2.0 DESCRIPTION OF THE SABARMATI BASIN

The Sabarmati river is one of the four main rivers which traverse the alluvial plains of Gujarat. It rises in the Aravalli hills at north latitude 24° 40' and east longitude 73°20' in the Rajasthan state at an elevation of 762 meters near the popular shrine of Amba Bhavani. After traversing a course of about 48 Km in Rajasthan, the river enters the Gujarat State. At the 51st Km of its run, the Wakal river joins it from the left near the village Ghonpankhari. Flowing in a generally south-west direction and winding among jungle covered hills over a bed strewn with shingles and boulders, at the 67th Km of its run, it receives the Sei river from the right near Mhauri and then the Harnav river from the left at about 103rd Km from the source, before it enters Dharoi reservoir. Emerging from the dam it passes through the plains and is joined on its left at about 170 Km from its source by the Hathmati river. Continuing to flow south-westwards, the river passes through Ahmedabad at about 165 Km downstream of Dharoi dam. Further 65 Km downstream, another tributary, the Watrak river joins it from the left. Flowing for a further distance of 68 Km, the river outfalls into the Gulf of Cambay in the Arabian sea.

The total length of the river from the head to its outfall into sea is 419 Km of which about 48 Km are in Rajasthan and the remaining 371 Km in Gujarat.

The river Sabarmati drains a total catchment area of 21085 sq. Km. The river meets the following tributaries during its course of flow: (i) Sei (catchment area 883 sq. Km) (ii) Wakal

(catchment area 1893 sq. Km) (iii) Harnav (catchment area 865 sq. Km) (iv) Hathmati (catchment area 1574 sq. Km) (v) Watrak (catchment area 8638 sq. Km). For the purpose of this project the catchment area of 10619 sq. km up to Wasna Barrage is of interest.

Up to the Dharoi reservoir, the main tributaries of river Sabarmati are Sei and Siri from the right side and Wakal and Harnav from the left side. On Sei river, a diversion dam has been constructed in Rajasthan and one such diversion dam has also been proposed on the river Wakal. On Harnav river, a storage dam as well as a diversion weir have been constructed. About 55 km downstream of Dharoi dam, a big tributary, Hathmati, meets the river Sabarmati. A reservoir, a pick up weir and a canal system have been constructed for getting the irrigation facilities from this tributary. The river Guhai meets the river Hathmati between the dam and the weir. Across the river Guhai, a storage dam has been constructed at Khandial.

The river Sabarmati runs in a valley with the ground rising on both sides. The drainage area assumes a shape of a fan lying within the east longitude 73° 48' to 71° 55' and north latitude 24° 54' to 22° 15' covering the part of Rajasthan state and parts of Sabarkantha, Ahmedabad, Banaskantha, Mehsana, Surendranagar and Kaira districts of Gujarat state. The topography of the Sabarmati basin can be considered to be hilly in the early reaches up to Dharoi after which the river flows mostly in plains. On an average the river empties 4477E million cubic meters (Mcm) of water in the Arabian sea annually. The studies

carried out by the Govt. of Gujarat reveal the possibilities of utilizing 9692.2 Mcm of water for irrigating 132420.07 ha of land and for power generation to the extent of 2899 KW at 60 % load factor. At times, the Sabarmati river sends down very heavy floods and some of these have caused devastation in Ahmedabad and villages lower down, destroyed crops, carried away cattle, changed the course of the delta channels and filled up harbour with silt. The highest known floods have occurred in 1875, 1941, 1950 and 1973.

2.1 SUB-BASINS OF THE SABARMATI BASIN

A brief description of various sub basins of the Sabarmati is given in the following:

2.1.1 SEI SUB-BASIN

The river Sei rises from the south western spurs of the Aravalli hills and mostly flows in Rajasthan state. The river is formed by the confluence of several nallas originating from the western slopes of Aravalli hills. The Sei river meets Sabarmati after traversing a course of 102 kms. The catchment area of Sei is 883 sq.Km. The catchment area of the basin is hilly with steep slopes. The average annual rainfall in the catchment is 675 mm. The total catchment area of Sei dam is 331.66 Sq. Km (128.0 Sq. Miles) & normal expected yield at dam site is 52.032 Mcm. Most of the runoff occurs in the monsoon season. The winter rainfall is very small. However, in good rainfall years, some flow remains in the river up to March-April.

A dam known as Sei dam has been constructed under a storage and diversion project which is located near village Teja Ka Bas

situated in the north of village Wekaria in Kotra tehsil of distt. Udaipur. This project is also known as Jawai reservoir project. The latitude and longitude of the dam site are 24° 23' N and 73° 11' 8" E [1]. The main objective of this project is to supply water for irrigation in Jawai command area.

2.1.2 WAKAL SUB-BASIN

The river Wakal rises from the south western spurs of the Aravalli hills at north latitude 24° 46' and east longitude 73° 23'. After traversing a course of 158 kms, it meets the river Sabarmati. The catchment area of Wakal is 1893 sq.Km. The basin is hilly, covered with forests. The basin covers the Sabarkantha district of Gujarat state and part of Udaipur district of Rajasthan state. A storage and diversion dam is also proposed on this river.

2.1.3 HARNAV SUB-BASIN

The river Harnav rises from Aravalli hills near village Ghadvas at north latitude 24° 12' and east longitude 73° 16'. After traversing 61 km, the Harnav river meets the river Sabarmati. The catchment area of Harnav river is 865 sq.Km. The catchment area in the first 32 km is hilly and thereafter the basin is plain. The average rainfall in the catchment area is 80 cm. The main tributaries of Harnav river are Kaluri and Kusumba rivers draining an area of 311 and 124 sq. km respectively. The catchment area up to the dam site is hilly and remaining portion is generally in plains [2].

For gauge & discharge measurements there are three gauging sites in the basin at Abhapur, Harnav I and Khedbrahma. One

storage reservoir and three pickup weirs, have been constructed across the river. Harnav dam, also known as Harnav II or Vanaj dam is located in distt. Sabarkantha and has dual purpose of flood control and irrigation. Three pickup weirs, i.e., Chhapra weir or Harnav I, Mamrechi weir and Kenyatta weir have also been constructed to cater for irrigation. All the three weirs are located downstream of Harnav dam and upstream of Khedbrahma.

2.1.4 HATHMATI SUB-BASIN

The river Hathmati rises from the Gujarat Malwa hills (South western foothills of the Rajasthan range) near Godad at north latitude 23° 55' and east longitude 73° 29' in Sabarkantha district [3]. After traversing a course of 98 Km, it meets the river Sabarmati near Ged, 20 Kms south west of Himatnagar in Sabarkantha distt. The catchment area of Hathmati river including its tributaries is 1574 sq.Km. The elongated catchment consists of 70 % hilly and thinly wooded jungles and about 30 % cultivated and inhabited lands. The two main tributaries of Hathmati are Bodoli and Guhai having catchment areas of 119 and 505 sq. km respectively. The catchment area up to the confluence of Guhai and Hathmati is a hilly region. The annual rainfall in the catchment is 86 cms.

On the Hathmati river, a dam namely, Hathmati dam and a pick up weir, namely Hathmati weir or Himatnagar weir have been constructed for getting the irrigation facilities from the tributary. The dam is located in district Sabarkantha and has the dual purpose of irrigation and flood control. The weir is located on the downstream of dam but upstream of confluence of river

Hathmati with Sabarmati. The purpose of the weir is irrigation only. On the Guhai river, a storage dam has been constructed for irrigation and flood control. Gauge and discharge measurements are taken in the basin at Bhiloda, Balochpur, Kadiadra and Himatnagar weir.

2.2 HYDRAULIC STRUCTURES OF THE BASIN

The major hydraulic structures located in the basin are described below:

2.2.1 DHAROI DAM

The most important structure located in Sabarmati basin is the Dharoi dam. This dam is located in district Mehsana, taluka Kheralu, village Dharoi at 165 km upstream of Ahmedabad city. The purposes of the reservoir are (i) to moderate the incoming floods so that the controlled discharge at Ahmedabad city does not exceed 14160 cumec (5 lakh cusec) up to the inflow rate of 21665 cumec (7.65 lakh cusec). Thereafter, if the inflow rate increases, the restricted outflow should be allowed up to 16992 cumec (6 lakh cusec) (ii) to meet water supply requirements for the cities of Ahmedabad and Gandhinagar (iii) irrigation requirements for the command area. Five major tributaries join the river Sabarmati upstream of Dharoi dam. These are Sei, Wakal, Siri, Dhamni and Harnav. A storage and diversion reservoir exists on Sei river for meeting irrigation requirements of Jawai command area in Rajasthan.

There is a gauge discharge site on river Sabarmati at Kheroj upstream of Dharoi dam. This site lies downstream of the confluence of Sei and Wakal river with Sabarmati. Other

tributaries namely Siri, Dhamni and Harnav join river Sabarmati between Kheroj and the dam site. The Siri river is being gauged at two sites Ganapipli and Sanali Ashram. Dhamni river is being gauged at Mumanvas. Harnav river is being gauged at Abhapur, Harnav weir and Khedbrahma.

The salient features of the dam which are of interest in this study are given in Annexure 1.1. For Dharoi reservoir the ordinates of inflow hydrograph for P.M.F. condition considering 3 mm per hour loss rate are given in Annexure 1.2. Monthly water utilization statistics for various purposes are given in Annexure 1.3. The safe carrying capacity of river downstream of the dam is 14160 cumec (5 lakh cusec). The elevation-area-capacity-spillway capacity table for Dharoi dam is given in Annexure 1.4.

The flood forecasting for Sabarmati river basin is being looked after by the Superintending Engineer, Western Rivers Circle, Nagpur through the Executive Engineer, Mahi Division (CWC), Ahmedabad. Various wireless stations at locations upstream of Ahmedabad have been established through which the information about rainfall and discharge in the river can be obtained. The locations where wireless stations have been established are : Sei dam, Kotra, Harnav weir, Kheroj bridge, Hathmati weir, Dharoi dam, Derol Bridge, Ahmedabad (Subhash bridge), Raska weir, Kheda town, Ratanpur, Watrak dam, Galiana road bridge, Mazam dam, Hathmati dam, Meshwo dam, Dakor road bridge, Kathlal road bridge, Harnav dam, Guhai dam, Waidy dam & S.E. (H.I.P.C.) Himatnagar.

The Dharoi reservoir moderates the inflow in the space provided in between FRL 189.585 m and HFL 193.60 m to protect the

downstream area. The reservoir operation in-charge is the Executive Engineer, Dharoi Head Works Division.

The Executive Engineer, Mahi Division, C.W.C., Ahmedabad calculates the inflow in Dharoi reservoir based on the rainfall and discharge data of the upstream stations and reports to the Superintending Engineer, AIPC, Superintending Engineer, PIPC, Executive Engineer, A.I. Division & Executive Engineer, Dharoi Head Works Division, Dharoi. Similarly the observed gauge and discharge data are also to be transmitted to the Superintending Engineer, Palanpur Irrigation Project Circle, Palanpur, Superintending Engineer, AIPC and Executive Engineer, Dharoi Head Works Division, Dharoi.

The inflow forecast for Dharoi Dam is to be issued when discharge is of the order of 567 cumec (20000 cusec) or more is expected to enter reservoir at any time. This data as well as gauge and discharge data observed at Subhash Bridge in Ahmedabad are necessary for deciding the operation of Dharoi spillway gates during floods. According to the present practice, the releases from Dharoi are to be finalized by the Ex. Engineer, Dharoi Head Works Division and A.E.N.W., Sub. Division, Dharoi in case of normal floods. However, in case of high flood of more than 5664 cumec (2.00 lakh cusec) the operation of gates and quantum of outflow are to be decided by them in consultation with Executive Engineer, Mahi division, CWC, Ahmedabad, Superintending Engineer, Palanpur Irrigation Project Circle, Palanpur and the Local officer i.e. Superintending Engineer, AIPC, Ahmedabad.

The travel time of low flood of 2123.76 cumec (75000 cusec)

from Dharoi dam to Derol gauging site is 8.00 hours and from Derol to Subhash bridge is 14.00 hours. Travel time for high flood of 4814.5 cumec (170000 cusec) from Dharoi dam to Derol gauging site is 5.00 hours and from Derol to Subhash bridge is 10.00 hours.

2.2.2 HARNAV DAM

In the head reaches of river Harnav, a gated dam has been constructed. Also known as Harnav II dam or Vanaj dam, the dam is located in distt. Sabarkantha and has dual purpose of flood control and irrigation. The salient features of the dam which are of interest in this study are given in Annexure 2.1. For Harnav reservoir, the ordinates of inflow hydrograph for S.P.F. condition are given in Annexure 2.2. Monthly water utilization statistics for various purposes are given in Annexure 2.3. The safe carrying capacity of river downstream of the dam is 1632 cumec. The elevation-area-capacity table for Harnav dam is given in Annexure 2.4. Spillway rating curve is given in Annexure 2.5.

Three weirs have been constructed between the dam site and Khedbrahma: (i) Mamrechi weir situated 3 km downstream of Harnav dam near Abhapur (ii) Kenyatta weir situated 12 Km d/s of Harnav dam at Attarsumba Ashram and (iii) Chhapra weir or Harnav weir situated 25 Km d/s of Harnav dam. The Mamrechi and Kenyatta weirs were constructed by the former princely states. The third weir namely Chhapra weir was constructed in 1958 as Harnav-I. There are three gauging sites on Harnav river at Khedbrahma (downstream of Harnav weir), at Abhapur (downstream of Harnav dam), and at Harnav weir. The river Harnav spills its water directly in the

Dharoi reservoir.

Since there is no raingauge station in the catchment area of the Harnav dam, estimation of inflow in the reservoir is made on the basis of rate of rise or fall of water level in the reservoir.

2.2.3 HARNAV WEIR

Also known as Harnav I or Chhapara weir, the weir is located in district Sabarkantha downstream side of Harnav dam and upstream of Khedbrahma. This single purpose project has been constructed to cater for irrigation. The weir has been completely filled up by sediment & debris. The Kusumba river joins the river Harnav in between Khedbrahma and Harnav weir. The salient features of the weir which are of interest in this study are given in Annexure 3.1. Monthly water utilization statistics for various purposes are given in Annexure 3.2.

2.2.4 HATHMATI DAM

The river Hathmati joins the river Sabarmati near Ged at a distance of 55 km downstream of Dharoi dam. In the head reaches of this river, a reservoir, a pick up weir and a canal system have been constructed for providing irrigation. The Hathmati dam is located near village Fatehpur, Taluka Bhiloda in distt. Sabarkantha and has dual purpose of irrigation and flood control. The dam was constructed in 1971-72. The dam is ungated. Along with Hathmati dam, one [illegible] dam and one Navalpur waste weir have also been constructed for providing necessary storage. The salient features of the dam which are of interest in this study are given in Annexure 4.1. For Hathmati reservoir the

ordinates of inflow hydrograph for P.M.F. condition are not available. The elevation-area-capacity table for Harnav dam is given in Annexure 4.2. Monthly water utilization statistics for various purposes are given in Annexure 4.3. The safe carrying capacity of river downstream of the dam is 2945 cumec.

2.2.5 HATHMATI WEIR

The Hathmati weir is located on the downstream of Hathmati dam and Guhai dam but upstream of confluence of river Hathmati with river Sabarmati. The weir was remodelled in 1972-73. It is an ogee shaped weir with sill level at 134.078 m and overflow section 306.367 m long. The catchment area of the weir is 1357 sq. km [3]. The catchment area is elongated. About 70% area consists of mostly hilly and thinly wooded jungles and remaining 30% is cultivated and inhabited land. The peak of the design flood for this project is 5409.12 cumec and HFL at 138.151 m. The design discharge of head regulator canal is 19.4 cumec.

The Derol gauging site is downstream of Dharoi dam. The Hathmati river joins the river Sabarmati downstream of Derol gauging site.

2.2.6 GUHAI DAM

The river Guhai joins the Hathmati river between Hathmati dam and Hathmati weir. The Guhai dam is located 39 kms from the source on Guhai river near village Khandial in Himatnagar taluka of distt. Sabarkantha. The latitude and longitude of the dam are 23° 42' 00" N and 73° 3' 24" E. Its purpose is irrigation and flood control.

The salient features of the dam which are of interest in this study are given in Annexure 5.1. For Guhai reservoir the ordinates of inflow hydrograph for P.M.F. condition are given in Annexure 5.2. Monthly water utilization statistics for various purposes are given in Annexure 5.3. The safe carrying capacity of river downstream of the dam is 4385 cumec. The elevation-area-capacity table for Guhai dam is given in Annexure 5.4. Spillway rating curve is given in Annexure 5.5.

The Khandial gauging site was located near the place where the Guhai dam is situated. Streamflow data up to 1975 are available at this site. At present gauge & discharge measurements are carried out at Kadiadra which is located upstream of Guhai dam and data from 1980 onwards are available for this site.

2.2.7 WASNA BARRAGE

It is located downstream of Ahmedabad for diversion of water to the existing Fatehwadi canal system. This barrage has been constructed to strengthen the existing irrigation facility at Ahmedabad. The salient features of the barrage which are of interest are given in Annexure 6.1. Water utilization statistics for various purposes are given in Annexure 6.2.

2.3 GENERAL DETAILS

A line diagram of the entire system is given in Fig. 1. The index map of Sabarmati basin up to Ahmedabad is given in Fig 2. The details of gauge and discharge sites in the Sabarmati basin are given in Table 1. The details of raingauge stations located in this basin whose data will be used in this project are given in Table 2. The monthwise availability of discharge data at

N.I.H. is given in Table 3.1 and the yearwise availability of discharge data is given in Table 3.2. The availability of rainfall data is given in Table 4. The availability of maps at N.I.H. is given in Annexure 7.

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3.0 PRESENT OPERATION GUIDELINES FOR RESERVOIRS IN THE SABARMATI SYSTEM

The following are the guidelines which are presently followed for gate operation for Sabarmati reservoir project :

(i) All the gates should be operated simultaneously with uniform opening.

(ii) The criteria for initial filling of the reservoir should be followed.

(iii) The policy of releasing an outflow approximately equal to rate of inflow should be followed provided conservation of storage is not required.

(A) Guidelines for Operation for Reservoir condition below full supply level:

When flood has started to impound the reservoir the following guidelines may be followed :

(i) Note the present reservoir elevation and its corresponding free discharge capacity at current elevation.

(ii) Fill the reservoir up to schedule rule level if current elevation is below the rule level.

(iii) Release outflow corresponding the inflow rate by gate operation either partially or under free discharge.

(iv) Repeat this procedure for making outflow approximately equal to inflow until reservoir elevation stops rising and the information received from wireless system indicates that the flood recession has been started.

(v) Operate gates at one to two hours interval and decrease outflow gradually when flood has started to recede and rate of rise in water level began to decrease. During the process of fall

in the water level in reservoir, take care that water level does not fall below prescribed rule level.

(vi) Close all the gates gradually when water level in the reservoir is again back to the rule level.

(vii) When there is no forecast station upstream of dam to provide information of inflows, the inflow rate can be decided from earlier observed rate of rise/fall in the reservoir water levels.

-Release outflow corresponding to inflow rate worked out if conservation of storage is not required.

-When water levels starts decreasing after the peak of inflow, the flood is on the recession and therefore decrease the outflow gradually.

-Close all the gates when inflow rate under observation becomes equal to base flow rate and ensure that no successive flood is incoming into the reservoir.

(B) Operation schedule for Reservoir water level condition at/above FRL

When floods start impound the reservoir full at FRL, following guidelines are observed :

(i) Open the gates partially by gradual intervals making outflow equal to inflow for floods not exceeding safe channel capacity. For floods higher than safe channel capacity, allow outflow nearly equal to inflow for levels higher than FRL.

(ii) Partial gate operation will cease and free discharge will be allowed by lifting gates fully for all inflows larger than the discharge capacity at full reservoir level or design flood. Under such circumstances, spillway would act as ungated under

free discharge condition of flow. MWL will be observed carefully and water level will be allowed to fall up to FRL again on the recession of flood.

(iii) See that reservoir level do not fall below the FRL at the end of flood event.

(iv) Information on outflow to be released need to be quickly and widely broadcasted on Radio/Television and via other media as a safety measure in the interest of the people located in the area downstream of dam.

3.1 OPERATION POLICY OF HATHMATI DAM

The command area of this project comprises of four zones:

i) Zone A: New area in Bhiloda & Himatnagar Taluka of Sabarkantha District under direct command of the reservoir.

ii) Zone B: Area of existing Hathmati canal system getting water through Himatnagar weir.

iii) Zone C: New area beyond Bokh between Sabarmati and Khari rivers in Sabarkantha, Gandhinagar and Ahmedabad Districts.

iv) Zone D: Command area of existing Khari cut canal system

Method of Supply of Water in Different Zones:

The main canal of zone A takes off from Hathmati main dam. The capacity of main canal in initial reach is 15.581 cumec. The escape is provided at chainage 1425 of main canal to release water in the river Hathmati for B, C and D zones.

One H.R. of 4.816 cumec capacity is also provided in Indrasi dam for releasing water for B, C and D zones. The water released from Hathmati reservoir either through Indrasi H.R. or through escape of main canal in the river Hathmati is picked up at

Himatnagar weir and diverted in the main canal of B-zone.

During floods, water of river Hathmati is diverted in the main canal of zone B at Himatnagar weir and water is stored in Limla dam which is filled through Bokh feeder taking off from Hathmati canal (zone B) and Karol dams which is being fed through Hathmati main canal and Karol feeder. This stored water is released through H.R. in river Khari for Khari cut canals (zone D) and the same is picked up at Raipur weir.

The main canal of zone C off takes from Bokh feeder of Hathmati main canal of zone B. As such, water diverted in main canal of zone B at Himatnagar weir is utilized in zone B, zones C and zone D.

3.2 PRESENT OPERATION POLICY OF WASNA BARRAGE

Wasna barrage is situated 4 Km downstream of Ahmedabad city. It consists of 30 span each of 60' (18.30 m) wide. The gate size of gate no. 1 to 24 is 98.30 m x 3.66 m, gate no. 25 to 28 is 18.30 m x 4.88 m and gate no. 29 and 30 is 18.30 m x 4.27 m.

All the gates can be operated electrically and manually. In case of power failure, the gates can be operated by diesel generator sets.

During monsoon when the gates are required to be operated due to high inflow, generally the water is released through central portion of the barrage, to avoid washout of dams. Other gates are operated just to flush the silt deposited upstream of the barrage.

The design discharge of canal is 47.49 cumec. When the

discharge in the river is more than 1416.03 cumec (50,000 cusec), the H.R. gates are required to be closed i.e. running of canal is stopped.

Normally, the pond R.L. of Wasna barrage is maintained at R.L. 137.00 and canal is run for max. discharge of 47.49 cumec or less as per the requirement of command. The additional inflow beyond R.L. 137.00 is diverted in the river downstream of Wasna barrage by operation of gates as mentioned above.

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ANNEXURES

Annexure 1.1

SALIENT FEATURES FOR DHAROI DAM

Location	Village - Dharoi Taluka - Kheralu District- Mehsana State - Gujarat
Latitude	24° 00' 00" N
Longitude	72° 52' 00" E
River	Sabarmati
Total Area of catchment at dam site	5540 sq.km.
Catchment area in Rajasthan territory	2900 sq.km.
Catchment area in Gujarat territory	2640 sq.km.
Catchment area for availability of water at Dharoi dam	3417 sq.km.
Catchment area harnessed by Harnav I & II	200 sq.km.
Net free catchment area at Dharoi for water planning	3217 sq.km.
Mean annual rainfall in the catchment	633 mm
50% reliable yield from net free catchment area	664.60 Mcum
75% reliable yield from net free catchment area	391.27 Mcum
90% reliable yield from net free catchment area	220.68 Mcum
98% reliable yield from net free catchment area	164.18 Mcum
Year of completion	1976
Dam Type	Earthen & Masonry
Maximum height above the lowest point of foundation	45.87 m
Length at the top of the dam	1207 m
Spillway type	Ogee
Spillway Length	219.46 m
Spillway max. dis. capacity at MWL RL 193.60	21982 cumec
Spillway restricted release	16992 cumec
Reservoir Area at Full level	107.45 sq.km.
Gross storage capacity	907.88 Mcum
Dead storage LWL	131.99 Mcum
Live storage capacity	775.89 Mcum
Canal length	44 km.(right), 29.52 km. (left)
Capacity	20 cumec (right) 5 cumec (Left)
Gross command area	81754 ha (right) 15670 ha (Left)
Cultural command area	70454 ha (right) 12145 ha (Left)

Maximum observed flood on 2.9.1973	14158 cumec
Maximum probable flood	27176 cumec
River bed level	158.50 m
Sill R.L. of B.P.O.	170.69 m
Sill R.L. of Canal H.R.	175.87 m
Crest level of Spillway	178.92 m
F.R.L.	189.59 m
H.F.L.	193.60 m
Top of Dam	195.07 m
Evaporation losses for 75% reliable year	137.78 Mcum
Evaporation losses for 98% reliable year	78.95 Mcum

Annexure 1.2

THE ORDINATES OF INFLOW HYDROGRAPH FOR P.M.F. CONDITIONS
3 MM/HOUR LOSS RATE FOR DHAROI RESERVOIR

Time	P.M.F.ordinates (10**3 cft/s)	Time	P.M.F.ordinates (10**3 cft/s)	
0	20.00	44	815.74	
2	30.18	46	924.69	
4	56.46	48	959.73	peak(27176 m/s)
6	88.77	50	922.08	
8	121.40	52	846.23	
10	153.17	54	759.19	
12	183.24	56	670.55	
14	211.88	58	579.98	
16	238.22	60	491.60	
18	261.81	62	406.24	
20	281.84	64	328.77	
22	298.46	66	262.60	
24	312.45	68	207.74	
26	323.52	70	165.36	
28	338.13	72	130.69	
30	361.29	74	101.84	
32	389.63	76	76.25	
34	424.43	78	55.05	
36	467.22	80	37.52	
38	523.49	82	25.78	
40	602.60	84	21.14	
42	697.69	86	20.00	

Annexure 1.3

WATER UTILIZATION STATISTICS FOR VARIOUS PURPOSES IN Mcum FOR DHAROI RESERVOIR PROJECT

(A) Irrigation Demands (in Mcum)

a) RBMC - Annual Irrigation 45546 Ha (112500 acre)

Month.	Jan	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec,.	Total
Irrigation requirement	34.517	29.641	-	-	-	5.280	1.184	3.035	15.235	25.879	35.136	25.035	174.942

b) LBMC - Annual Irrigation 11130 Ha (27500 acre)

Month.	Jan	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec,.	Total
Irrigation requirement	7.50	6.648	0.066	-	-	1.598	0.320	1.106	4.551	5.216	6.967	5.20	39.172
Total	42.017	36.289	0.066	0.00	0.00	6.878	1.504	4.141	19.786	31.095	42.103	30.235	214.114

(B) Water supply demand (Mcm) for Ahmedabad and Gandhinagar

Month.	Jan	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec,.	Total
WS Demand	18.960	20.550	26.545	25.689	26.545	22.018	18.960	-	-	-	18.349	18.960	196.576
Total Demd	60.977	56.839	26.611	25.689	26.545	28.896	20.464	4.141	19.786	31.095	60.452	49.195	410.690

(C) Lake Losses (Annual) - 1.17 laft = 144.32 Mcum

Evaporation depth month wise in m.

Month.	June	July	Aug.	Sept.	Oct.	Nov.	Dec,.	Jan.	Feb.	March	April	May
Evapo.depth	0.2164	0.1524	0.1524	0.1524	0.1524	0.1524	0.1524	0.1402	0.1402	0.1890	0.2409	0.3048

Annexure 1.4

ELEVATION-AREA-CAPACITY-SPILLWAY CAPACITY TABLE FOR DHAROI DAM

R.L. m	Area		Capacity		Free discharging capacity of spillway in Cumec all gates operative
	Original area in M.sq.m.	Revised area after 50 years M.sq.m.	Original Capacity in Mcm	Revised Capacity after 50 years Mcm	
163.07	2.143	0.195	4.070	0.024	-
164.59	3.642	1.282	8.509	0.156	-
166.12	5.583	3.159	14.372	4.890	-
167.64	7.525	4.724	25.998	9.681	-
170.59	11.037	8.043	54.266	29.078	-
173.74	15.171	11.929	93.731	58.898	-
176.78	21.851	18.525	147.997	103.203	-
179.83	35.405	32.189	235.560	180.844	279.23
182.88	53.624	50.643	368.758	304.596	2704.73
185.93	75.974	73.359	569.906	497.225	6719.93
188.96	101.171	100.133	841.110	763.135	12022.37
189.59	105.621	105.521	907.709	829.415	13225.79
190.50	113.314	113.314	1004.375	926.847	15035.94
192.02	125.047	125.047	1186.436	1108.144	18427.08
193.55	138.602	137.673	1397.456	1309.163	21982.90

Annexure 2.1

SALIENT FEATURES FOR HARNAV DAM

Location	Village - Vanaj Taluka - Vijaynagar District- Sabarkantha State - Gujarat
Latitude	23° 59' 00"N
Longitude	73° 18' 00"E
River	Harnav
Area of catchment	116 sq.km.
Annual average rainfall	787 mm
Max. rainfall	1391 mm
Min. rainfall	240 mm
Mean annual runoff in the catchment	243.77 Mcum
50% reliability	22.76 Mcum
60% reliability	17.47 Mcum
75% reliability	11.65 Mcum
90% reliability	4.29 Mcum
Year of completion	1990
Dam Type	Composite rolled, filled type
Maximum height above the lowest point of foundation	41.65 m
Total Length at the road level of the dam	406 m
Spillway type	Ogee shape gated spillway
Spillway Length	43.00 m
Spillway max. dis.(moderate-outflow)	1909 cumec
Reservoir Area at Full level	3.10 sq.km.
Gross storage capacity	21.67 Mcum
Live storage capacity	19.97 Mcum
Gross command area	6058 ha
Cultural command area	4040 ha
Annual irrigation	3440 ha

RESERVOIR DATA

Reservoir capacity	
Dead storage	1.70 Mcum
Live storage	19.97 Mcum
F.R.L.	332.0 m
H.F.L.	332.25 m
Top of Dam	336.85 m
Evaporation losses	2.6 Mcum
Max. probable flood	2140 cumec
Spillway crest level	323.77 m
Annual Irrigation	3440 Ha.

Annexure 2.2

THE ORDINATES OF INFLOW HYDROGRAPHS FOR S.P.F. CONDITIONS FOR HARNAV II RESERVOIR

Time	S.P.F.ordinates (cft/s)	Time	S.P.F.ordinates (cft/s)	
0	450.00	32	13058.90	
1	650.00	33	13832.80	
2	1790.00	34	14655.00	
3	3882.00	35	15812.20	
4	4542.00	36	16537.40	
5	4962.00	37	18239.40	
6	5242.00	38	21027.20	
7	5488.00	39	22606.40	
8	5743.00	40	23957.90	
9	5997.60	41	24701.60	
10	6144.60	42	25805.40	
11	6255.60	43	29302.80	
12	6337.60	44	36904.41	
13	6437.40	45	46314.60	
14	6656.30	46	62177.10	
15	6997.60	47	75409.09	(PEAK)
16	7102.30	48	59870.60	
17	7169.80	49	27313.10	
18	7245.20	50	27395.40	
19	7454.40	51	18120.80	
20	7799.90	52	14085.10	
21	7962.40	53	10980.00	
22	8290.50	54	8527.40	
23	8888.40	55	6599.90	
24	9332.20	56	5042.40	
25	9684.90	57	3812.70	
26	10186.40	58	2779.30	
27	10930.30	59	1834.80	
28	11219.00	60	1057.40	
29	11416.80	61	648.00	
30	11516.90	62	503.00	
31	12112.60	63	450.00	

ANNEXURE - 2.3

WATER REQUIREMENT IN MCUM AT HARNAV RESERVOIR PROJECT II

Name of Crops	Area in Acres	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total Req. in Mcum	Remarks
KHARIF															
Paddy	340	-	-	-	-	-	-	-	0.498	0.498	0.249	-	-	1.245	
Maize	2720	-	-	-	-	-	-	-	1.246	1.246	-	-	-	2.492	
Groundnut	1020	-	-	-	-	-		-	0.563	0.563	-	-	-	1.126	
Bajri,Jawar & Cereals	680	-	-	-	-	-	-	-	0.311	0.311	-	-	-	0.622	
Green Manure	340	-	-	-	-	-	-	-	0.156	0.156	-	-	-	0.312	
RABI															
Wheat	1360	1.60	0.80	-	-	-	-	-	-	-	0.80	0.80	1.60	5.60	
Oilseeds & Pulses	680	0.335	0.336	-	-	-	-	-	-	-	-	0.336	0.336	1.343	
Vegetables	170	0.17	-	-	-	-	-	-	-	-	0.086	0.173	0.172	0.604	
TWO SEASONAL															
Cotton	680	-	-	-	-	-	-	-	-	0.335	0.336	0.336	0.336	1.343	
Castor	340	0.167	0.167	-	-	-	-	-	-	-	0.167	0.167	0.167	0.835	
Vegetables	170	0.084	0.084	-	-	-	-	-	-	0.084	0.085	0.169	0.169	0.675	
Total	8500	2.36	1.38						2.774	3.193	1.723	1.981	2.78	16.197	

Water requirement in Mcum

June to Sept. =	5.967
October =	1.723
Nov. to May =	8.507
Total =	16.197

Annexure 2.4

ELEVATION-AREA-CAPACITY TABLE FOR HARNAV DAM

Sr. No.	Elevation (m)	Area in M.sq.m.	Capacity (Mcm)
1.	311.00	0.097	0.0892
2.	314.00	0.200	0.5257
3.	317.00	0.390	1.3957
4.	320.00	0.728	3.0459
5.	323.00	1.066	5.7196
6.	326.00	1.499	9.5496
7.	329.00	1.989	14.7576
8.	332.00	2.626	21.6676
9.	335.00	3.802	31.2556
10.	340.00	5.366	54.0516

Annexure 2.5

SPILLWAY RATING CURVE FOR HARNAV DAM

R.L.(m)	Discharge (cumec)
323.77	0.00
324.68	58.64
325.60	170.46
326.51	320.07
327.43	502.56
328.34	715.31
329.26	955.71
330.17	1220.34
331.09	1509.15
332.00	1820.27
332.30	1927.60
332.61	2037.30
332.91	2149.35

Annexure 3.1

SALIENT FEATURES FOR HARNAV WEIR (HARNAV I)

Location	Village - Chhapra Taluka - Vijaynagar District- Sabarkantha State - Gujarat
Latitude	23° 59' 00"
Longitude	73° 18' 00"
River	Harnav
Area of catchment	427 sq.km.
Mean annual runoff in the catchment	750 mm
Year of completion	1959
Dam Type	Sand and gravel
Spillway type	Pickup weir
Spillway Length	191 m
Spillway max. dis.	2407 cumec at R.L. 237.56 M
Canal length	9.6 km.
Capacity	8.5 cumec
Gross command area	4047 ha
Cultural command area	2671 ha
Irrigated command area	n.a.
Crest R.L.	234.75 m
Max. flood level	239.39 m

Annexure 3.2

WATER UTILIZATION STATISTICS FOR HARNAV WEIR

Year	Month	Inflow in Mcft	Rainfall in mm	Total water available	Actual irrigation done				Water utilized			
					Kharif	Rabi	H.W	Total	Kharif	Rabi	H.W	Total
1983-84	June	7.21	126.07									
	July	51.76	535.01									
	Aug	20.99	481.71	Kharif								
	Sep	5.15	93.30	95.10								
	Oct	0.89	100.60									
	Nov	-	-	Rabi								
	Dec	-	-	82.15	338	214	-	522	12.72	68.20	-	80.92
	Jan	-	-	H.W.								
	Feb	-	-	19.330								
	Mar	-	-									
	Apr	-	-									
	May	-	-									
1984-85	June	-	47.07									
	July	-	307.60									
	Aug	21.70	715.10	Kharif								
	Sep	14.66	155.20	95.10								
	Oct	7.93	-									
	Nov	-	-	Rabi								
	Dec	-	-	85.10	339	221	-	511	15.90	78.10	-	94.00
	Jan	-	-	H.W.								
	Feb	-	-	16.152								
	Mar	-	-									
	Apr	-	-									
	May	-	-									
1985-86	June	-	-									
	July	22.23	260.70									
	Aug	47.45	146.50	Kharif								
	Sep	-	-	76.393								
	Oct	1.87	127.20									
	Nov	-	-	Rabi								
	Dec	-	-	56.04	324	210	-	534	54.65	49.47	-	104.12
	Jan	-	-	H.W.								
	Feb	-	-	-								
	Mar	-	-									
	Apr	-	-									
	May	-	-									
1986-87	June	-	102.60									
	July	-	162.30									
	Aug	62.90	112.40	Kharif								
	Sep	-	2.60	73.20								
	Oct	-	-									
	Nov	-	-	Rabi								
	Dec	-	-	32.99	219	-	-	238	39.33	-	-	39.33
	Jan	-	-	H.W.								
	Feb	-	-	20.19								
	Mar	-	-									
	Apr	-	-									
	May	-	-									

SALIENT FEATURES FOR HATHMATI DAM

Location	Village - Fatehpur Taluka - Bhiloda District- Sabarkantha State - Gujarat
Latitude	23° 42' 00"
Longitude	73° 13' 00"
River	Hathmati
Length of river	98 kms.
Catchment area at dam	595 sq. km
Mean annual runoff in the catchment	123 Mcum
Mean annual rainfall	864 mm
Year of completion	1971
Dam Type	Earthen dam with 241.40 m long masonry spillway in saddle
Maximum height above the lowest point of foundation	23.62 m
Length of top of earthen dam for Hathmati dam	933 m
Length at top of earthen dam for Indrasi dam	476m
Spillway Type	Ogee type ungated
Spillway Length	241.40 m
Spillway Max. Discharge	2943 cumec
Reservoir Area at Full level	37.50 sq.km.
Gross storage capacity	161 Mcum
Effective storage capacity	153 Mcum
Canal length	104 km.
Capacity	16 cumec
Gross command area	73817 ha
Cultural command area	51667 ha
Irrigated command area	27195 ha

RESERVOIR DATA

Gross storage capacity	161.31 Mcum
Dead storage	8.34 Mcum
Live storage	153.00 Mcum
F.R.L. for Hathmati dam	180.74 m
H.F.L.	183.18 m
Top of Dam for Indrasi dam	185.36 m

WASTE WEIR (NAVALPUR)

Type of H.R.	Head wall type , 2 No. in Hathmati dam (1.83m x 1.21m) 2 No. in Indrasi dam (1.52 x 1.21m)
Crest level	180.74 m
Shape	Ogee type ungated
Length of spillway	241.40 m
Discharge capacity of Spillway at H.F.L.	2943.20 Cumec

Annexure 4.2

ELEVATION-AREA-CAPACITY TABLE FOR HATHMATI DAM

Sr. No.	Elevation (m)	Area in M.sq.m.	Capacity (Mcm)
1.	161.85	0.000	0.000
2.	163.07	0.093	0.453
3.	164.29	0.186	0.680
4.	166.73	0.418	1.586
5.	169.16	1.115	2.718
6.	171.60	3.995	7.929
7.	174.04	9.104	21.068
8.	176.48	16.072	46.666
9.	178.92	24.434	93.785
10.	181.36	34.932	175.338
11.	183.79	42.921	283.168

Annexure 4.3

WATER UTILIZATION STATISTICS FOR HATHMATI DAM

Name of project	Year	Season	(Planned demand for whole project) Annual Irrigation in Ha.	Fortnightly water reqmt.	Water supply	(Actual Performance) Actual Irrigation done in Ha. A+B+C Zone	D Zone	Fortnightly Water Consumed in MM3 A+B+C Zone	D Zone	Water Supply	Remarks
Hathmati reservoir project	1989-90	Kharif									
		June-IInd	18090	10.79	-	-	1093	-	-	-	
		July-1st		6.74	-	-		-	-	-	
		IInd		0.09	-	-		-	-	-	
		August-1st		5.55	-	-		-	-	-	
		IInd		14.85	-	-		-	-	-	
		Sept.1st		25.69	-	-		-	-	-	
		IInd		21.44	-	-		-	45.68	-	
		Oct.1st		26.09	-	-		-	45.59	-	
		Total A	18090	111.24	-	-	1093	-	91.27	-	
		Rabi.									
		Oct.IInd	9105	27.31	-	796	-	-	-	-	
		Nov.1st		-	-		-	-	-	-	
		IInd		-	-		-	-	-	-	
		Dec.1st		-	-		-	3.07	-	-	
		IInd		121.85	-		-	-	-	-	
		Jan.1st			-		-	2.02	-	-	
		IInd		-	-		-	1.37	-	-	
		Feb.1st		-	-		-	-	-	-	
		Total B	9105	149.16	-	796	-	6.46	-	-	
		Hot weather from Feb.II to May IInd		9.06 (16/2 to 31/5)	-	-	-	-	-	-	
		June 1st		1.24	-	-	-	-	-	-	
		Total C.		10.30	-	-	-	-	-	-	
		Grand Total	27195	270.70	-	796	1093	6.46	91.27	-	
N.R.P. exit	1991	Kharif.									
		June-IInd	18090	10.79	-	213	5640	-	-	-	Due to favou
		July 1st		6.74	-			-	-	-	rable natural
		IInd		0.09	-			-	-	-	condition
		Aug. 1st		5.55	-			-	-	-	of rainfall
		IInd		14.85	-			-	-	-	sawing of
		Sept.1st		25.69	-			0.54	-	-	paddy was
		IInd		21.44	-			0.73	3.86	-	lesser
		Oct. 1st		26.09	-			0.78	4.07	-	
		Total A	18090	111.24	-	213	5640	2.05	12.01	-	

	Rabi.(including two seasonal 2428 Ha.)									
	Oct. IInd	9105	27.31	-	3442	-	-	4.08	-	
	Nov. 1st		-	-		-	4.08	-	-	
	IInd		-	-		-	4.38	-	-	
	Dec. I		121.85 (1/11 to 15/2)	-		-	7.73	-	-	
	IInd		-	-		-	7.43	-	-	
	Jan. I		-	-		-	8.24	-	-	
	IInd		-	-		-	7.52	-	-	
	Feb. 1st		-	-		-	6.38	-	-	
	Total B	9105	149.16	-	3442	-	45.76	-	-	
	Hot Weather									
	Feb. IInd	2428 (Two sea-	-	-	-	-	-	-		
	March 1st	sonal)	9.06 (16/2 to 31/5)	-	270	-	1.32	-	-	
	IInd		-	-		-	1.28	-	-	
	April 1st		-	-		-	1.15	-	-	
	IInd		-	-		-	0.88	-	-	
	May 1st		-	-		-	0.60	-	-	
	IInd		-	-		-	-	-	-	
	June 1st		1.24	-		-	-	-	-	
	Total C	2428	10.32	-	270	-	5.23	-	-	
	Grand Total	27195	270.70	-	3935	5640		12.01	-	
H.R.P. 1991-92	Kharif									
	June IInd	18090	10.79	-	2028	5540	-	-	-	
	July 1st	-	6.74	-		-	-	-	-	
	IInd	-	0.09	-		-	-	-	-	
	Aug. 1st		5.55	-		-	1.95	-	-	
	IInd		14.85	-		-	4.90	-	-	
	Sept.1st		25.69	-		-	3.47	3.42	-	
	IInd		21.44	-		-	6.58	4.68	-	
	Oct. 1st		26.09	-		-	6.86	4.05	-	
	Total A	18090	111.24	-	2028	5540	23.76	12.15	-	
	Rabi(Including two seasonal 2428 HA.)									
	Oct.IInd	9105	27.31	-	2204	-	-	-	-	
	Nov.1st		-	-		-	1.50	-	-	
	IInd		-	-		-	3.55	-	-	
	Dec.1st		121.85 (1/11 to 15/2)	-		-	4.50	-	-	
	IInd		-	-		-	4.75	-	-	
	Jan.1st		-	-		-	5.26	-	-	
	IInd		-	-		-	3.31	-	-	

Feb.1st		-	-			2.73	-	-
Total B	9'35	149.16	-	2204	-	25.40	-	-
Hot Weather								
Feb.1st to May IInd	2428 (Two seasonal)	9.06 (16/2 to 31/5)	-	-	-	-	-	-
June 1st	-	1.24	-	-	-	-	-	-
Total C		10.30	-	-	-	-	-	-
Grand Total	27195	270.70	-	4232	5540	49.16	12.15	-

Annexure 5.1

SALIENT FEATURES FOR GUHAI DAM

Location	Village -Khandial Taluka -Himatnagar District-Sabarkantha State -Gujarat
Latitude	23° 00' 42" N
Longitude	73° 03' 24" E
River	Guhai
Length of river	39 kms (up to dam site) 48 kms (up to confluence with Hathmati river
Area of catchment	422.17 sq. km.
Free catchment area at dam site	415.15 sq.km.
Annual runoff in the catchment	
at 60% reliability	75.447 Mcum
at 75% reliability	56.449 Mcum
Year of completion	1990
Dam type	Composite
Maximum height of dam from river bed	23.85 m
Length at the top of the dam	3970 m
Spillway Type	Ogee
Spillway Length	89 m
Crest R.L.	164.77 m
River bed level	155.00 m
Top width of bridge	5.638 m
Max. height of dam	23.85 m
Spillway Max. Discharge at HFL	4138 cumecs
Max. probable flood	5787 cumecs
Reservoir Area at Full level	17.13 sq.km.
Gross storage capacity	62.34 Mcum
Live storage capacity	57.04 Mcum
Canal length	19 km.
Type of canal	Lined canal
Capacity	5 cumecs
Gross command area	14494 ha
Cultural command area	11465 ha

RESERVOIR DATA

Reservoir capacity	
Dead storage	5.30 Mcum
Live storage	57.04 Mcum
F.R.L.	173.00 m
H.F.L.	173.77 m
Top of Dam	178.07 m
Max. Probable Flood	5787 Cumecs
Max. observed Flood	2558 Cumecs

Annexure 5.2

THE ORDINATES OF INFLOW HYDROGRAPHS FOR P.M.F. CONDITIONS FOR GUHAI RESERVOIR

Time	P.M.F.ordinates (cft/s)	Time	P.M.F.ordinates (cft/s)
0	1630	36	56818
2	3445	38	58922
4	11547	40	65305
6	14172	42	78423
8	17073	44	91782
10	19200	46	121582
12	23709	48	204371
14	25177	50	127541
16	26341	52	56839
18	27959	54	44620
20	31815	56	34933
22	33405	58	26707
24	36746	60	20138
26	39508	62	14634
28	44292	64	10148
30	48560	66	6150
32	50359	68	2726
34	52399	70	1630

MONTHLY WATER REQUIREMENT OF PROPOSED CROPS FOR GUHAI RESERVOIR PROJECT

TYPE OF SEASON	NAME OF CROPS	AREA IN HA.	WATER REQUIREMENT IN MCUM											
			JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
KHARIF	Groundnut	1422	-	-	-	-	-	-	-	-	2.388	2.109	-	-
	Maize	427	-	-	-	-	-	-	-	0.028	0.795	-	-	-
	Paddy	355	-	-	-	-	-	0.047	0.965	0.652	1.039	-	-	-
	Misc.	569	-	-	-	-	-	-	-	0.356	0.800	-	-	-
RABI	Wheat	353	2.215	2.039	-	-	-	-	-	-	-	-	1.694	1.237
	Oilseeds	356	0.907	0.525	-	-	-	-	-	-	-	-	0.707	0.423
TWC	Hy.Cotton	1778	4.716	-	-	-	-	-	-	-	2.798	7.244	5.884	4.376
SEASONAL	Vegetable	71	0.072	-	-	-	-	-	-	-	0.048	0.229	0.194	0.147
TOTAL		5931	7.910	2.564	-	-	-	0.047	0.965	1.036	7.966	9.582	8.479	6.263

Total annual water requirement = 44.702 mm for Irrigation

ANNEXURE 5.4

ORIGINAL ELEVATION-AREA-CAPACITY TABLE GUHAI RESERVOIR

Sr. No.	Elevation (m)	Area in M.sq.m.	Capacity (Mcm)
1	154.93	0.0000	0.0000
2	156.00	0.0276	0.0077
3	158.00	0.2184	0.2211
4	160.00	0.5472	0.9611
5	162.00	0.9891	2.4751
6	164.00	2.0889	5.4841
7	166.00	3.7076	11.1851
8	168.00	6.1754	20.9571
9	170.00	8.7284	35.7971
10	172.00	12.0972	56.5771
11	173.00	14.1000	68.7500
12	174.00	16.2820	84.8671
13	176.00	21.4608	122.4771
14	178.00	27.2646	171.0171
15	180.00	32.7246	230.9071

REVISED ELEVATION-AREA-CAPACITY TABLE OF HALF LIFE OF RESERVOIR OF 25 YEARS

Sr. No.	Elevation (m)	Area in M.sq.m.	Capacity (Mcm)
1	159.09	0.0000	0.0000
2	160.00	0.1272	0.1761
3	162.00	0.5191	0.8001
4	164.00	1.5889	2.8391
5	166.00	3.9176	7.5301
6	168.00	5.6954	16.3221
7	170.00	8.2984	30.2521
8	172.00	11.8072	50.3121
9	173.00	14.1000	62.3460
10	174.00	16.2820	78.4571
11	176.00	21.4608	116.6600
12	178.00	27.2646	169.6000
13	180.00	32.7246	224.4971

SPILLWAY RATING CURVE FOR GUHAI RESERVOIR

R.L. (m)	Discharge (cumec)
164.77	0
165.69	155.73
166.60	335.97
167.52	630.39
168.43	989.34
169.34	1407.25
170.26	1881.57
171.17	2407.21
172.09	2979.21
173.00	3597.58
173.31	3814.21
173.61	4035.17
173.92	4260.75
174.22	4491.33

Annexure 6.1

SALIENT FEATURES FOR WASNA BARRAGE

Location	Village - Wasna Taluka - City District- Ahmedabad State - Gujarat
Latitude	22° 59' 00"
Longitude	72° 33' 00"
River	Sabarmati
Total area of catchment	10619 sq.km.
Mean annual runoff in the catchment	720 Mcum
Mean annual rainfall in the catchment	73.61 cm
Year of completion	1976
Dam Type	Barrage
Maximum height above the lowest point of foundation	20.75m
Length at the top of the dam	611 m
Barrage type	Ogee shaped
Barrage Length	611 m
Maximum flood	21000 cumec
Pond capacity at R.L. 41.77m	5.35 Mcum
Annual irrigation	25101 ha
Canal length	6.9 km.
Canal Capacity	45.35 cumec (up to 200 m) 33.98 cumec (Beyond 200 m)
Cultural command area	25101 ha
Irrigated command area	25101 ha
Canal F.S.L. at head	41.15 m
River bed level	38.10 m

STATEMENT SHOWING WATER UTILIZATION -FOR WASNA BARRAGE

Name of project	year	season	(Planned demand for whole project) Annual Irrigation in Ha.	Fortnightly water reqmt. Mcum	Water supply	(Actual Performance) Actual Irrigation done in Ha.	Fortnightly Water Consumed in MM3	Water Supply	Remarks
Fatehwadi System	1989-90	KHARIF							
		June F1	25500	-	-	-	-		
		F2		0.33	-	-	-		
		July F1		0.88	-	-	-		
		F2		29.48	-	-	-		
		Aug. F1		29.57	-	26120	-		
		F2		24.36	-	-	-		
		Sept. F1		29.22	-	-	-		
		F2		40.90	-	-	45.7*	-	
		Oct. F1		32.39	-	-	45.62	-	
		F2		10.45	-	-	-		
	1990-91	KHARIF							
		June F1		-	-	-	-		
		F2		0.33	-	-	-		
		July F1		0.88	-	-	-		
		F2		29.48	-	-	-		
		Aug. F1		29.57	-	15011	-	-	
		F2		24.36	-	-	-		
		Sept. F1		29.22	-	-	-		
		F2		40.99	-	-	-		
		Oct. F1		32.39	-	-	25.35	-	
		F2		10.45	-	-	5.8*	-	
	1991-92	KHARIF							
		June F1		-	-	2552*	-	-	
		F2		0.33	-	-	-		
		July F1		0.88	-	-	-		
		F2		29.28	-	-	-		
		Aug. F1		29.57	-	-	-		
		F2		24.36	-	-	-		
		Sept. F1		29.22	-	-	23.74	-	
		F2		40.90	-	-	44.55	-	
		Oct. F1		32.39	-	-	50.11	-	
		F2		10.45	-	-	14.55	-	

Annexure 7

LIST OF MAPS AVAILABLE AT NIH

A General

1. Index map of Gujarat showing river gauging stations, scale 1 mm = 1 km (approx.),
2. Map showing locations of raingauge and rivergauge stations of Gujarat,
3. Index map of Sabarmati basin, scale 1" = 16 miles.

B Dharoi Project

1. Index map of Dharoi dam (scale 1:250000) showing basin boundary, major rivers, state boundary.
2. Submergence plan of Dharoi project, 1" = 1 miles.
3. Elevation-Area-capacity curve.
4. Spillway rating curve.
5. Downstream river basin map from village Dharoi to Wasna barrage,
6. Cross section for left bank main canal scale 1:100,
7. Typical cross section showing the land width of Sulai minor scale 1 cm = 1 m,
8. Typical cross section and details of lining for branch canal no. 1. Not to scale.
9. Detailed typical cross section of hydraulically pressed tiles for distribution of S.R.B.M.C. scale 1 cm = 10 cm,
10. Cross section showing the land width of branch canal no. 1, scale 1:1.
11. Observed rainfall hyetograph and observed flood hydrograph at Dharoi for 1973 flood.
12. Cropping pattern for command of Dharoi reservoir project.
13. Index plan showing the catchment area and command area of Sabarmati project, Scale 1 inch = 4 miles.

C. Hathmati Sub basin

1. Index map of Hathmati & Meshwa reservoir project showing dam & weir, main canal, tributary, minor, submergence area catchment & command area, river etc., Scale 1"=4 miles.

2. Record plan of remodelling the existing Hathmati weir, detailed drawing of Hathmati weir. Scale 3 cm= 1m & 1cm= 1m.

3. Hathmati dam, area capacity curve, Scale : X-axis 1cm= 10 msft, Y-axis 1cm= 4 ft.

4. Cross section of Hathmati dam showing piezometer & settlement gauge installation, scale 1"= 20 ft.

5. Record plan of Hathmati dam.

6. Record plan of Navalpur waste weir 14.(Hathmati) scale 1"= 8 ft.

7. L.S. & C.S. of tail channel of Navalpur waste weir scale 1"=100 ft. Horizontal, 1"=10 ft. Vertical

8. L.S. along alignment of tail channel.

9. Combined index map of Hathmati A, B, C zones.

10. Index map showing irr. schemes of k.c.c. Systems (Hathmati D zone).

11. Review of Hydrology, Area capacity curve (Hathmati).

D Indrasi Dam

1. Cross section of Indrasi dam showing location of piezometers and settlement gauge installation , scale 1"= 20 ft.

2. Record plan of Indrasi dam.

E Guhai Dam

1. Index map of Guhai reservoir project. scale 1"= 4 miles.

2. Map showing irrigability classification in Guhai reservoir Scale 1 inch = 1 mile.

3. Cross section of earthen dam (Guhai) scale 1cm= 0.5m.

4. Details of spillway (Guhai) scale 1 cm = 1 m

5. Plan showing 8 hectors block for Khanusa minor.

6. Area capacity curve for Guhai reservoir, Scale Hor. 2 cm=20 mcmt, Ver. 2cm=2m,

7. Spillway rating & storage indication curve Guhai reservoir. scale 1cm= 20 x 1000 cusec.

8. Area capacity curve at Khandial. scale Hor: 2cm = 20 mcmt
Ver: 2cm = 2 m.

9. Spillway rating and storage induction curve spillway gates, 6 no. of size 41' x 27'.
10. Two-hour unit hydrograph of Guhai river at Guhai dam site.

F Harnav Stage - I

1. Index map of Harnav river scheme stage-I, key plan for the pick up weir & head regulator. scale 1"= 50 ft.
2. Thiessen polygon plan. 1" = 4 miles.
3. Detailed drawing of pick up weir at Chhapra site.
4. Inflow and outflow curves of Harnav.
5. Map showing soil classification, scale 1"= 1 mile.
6. Index plan of Harnav stage I, scale 1"=1 mile.
7. Map showing permeability, scale 1"= 1 mile.
8. Map showing catchment & command area of Harnav project scale 1"= 1 mile.
9. One-hour synthetic unitgraph of Harnav river at Harnav dam site.
10. Depth-area-duration curve for the storm of 27 & 28th July 1972.
11. Storm 150 height max. 1 day 8 Km Aug. 8th., 1973.
12. -do- 1 Sept. 1973.
13. -do- 2 Sept. 1973.
14. Percentage distribution curve for SPF & MPF for Harnav.
15. Storm Isohyetal max. 2 days - Sep. 1 & 2, 1973.
16. Inflow hydrograph, period 1 hourly.
17. Storage indication curve, with 2 gates of size 41'x 27' operative.
18. Inflow hydrograph & routed outflow hydrograph for SPF & MPF.
19. Key plan for pick up weir.

G Harnav Stage - II

1. Index plan for Harnav project
2. General lay-out plan stage-II.

3. C.S. of earthen dam on saddle,& Earth dam in envelope portion. scale 1cm= 2m & 1cm = 5m.

4. Plan showing details of spillway, section & bucket gate size 41' x 27'. scale 1cm =4m.

5. Plan showing details of NOF guide walls, key etc. gate size 41' x 27'. scale 1cm= 2m.

6. Dam vicinity plan, stage II, scale 1"= 660'.

7. Submergence map, stage II, scale 1"= 660'.

8. General layout of earthen saddle dam, scale 1cm = 4m.

9. Index map showing catchment & command area, stage II, scale 1"= 1 mile.

10. Thiessen polygon plan, scale 1"= 4 miles.

11. Area capacity graph.

12. Area capacity graph at Vanaj dam site .

13. Index map of Harnav II

14. Survey map of Harnav scheme, stage II, scale 1"= 1 mile.

15. Rating curve

16. Pre monsoon c.s. of river Harnav 1981. scale Hor. 1cm= 20 cusec. Ver: 1 cm = 0.20 m.

H Wasna Barrage

1. Index map of Fatehwadi canal system.

TABULAR DATA AVAILABLE AT NIH

A. Guhai

1. Water requirements of proposed crops in Guhai reservoir project
2. Reservoir operation table (20 years) for Guhai reservoir
3. Hydrological data, Guhai dam.
4. Submergence data, Guhai dam.
5. Technical data, financial data, Guhai dam.
6. Statement showing monthwise flow in cusec of river Guhai at Khandial gauging site.

B. Harnav Reservoir Project Dam Site at Vanaj

1. Harnav-II Bar chart study at Vanaj dam.
2. Monthwise evaporation losses.
3. Statement showing the gross utilization, losses, net utilization and irrigation potential for various alternatives of carry over studies.
4. Statement showing the minimum observed daily discharge and 70% dependable discharge during the months July to December for the period of 9 years from 1961 to 1970 except 1966.
5. Statement showing the utilisable flow at 70% dependable of minimum flow during each month from the free catchment of 126 sq. miles at Chhapra weir site.
6. Soil survey report.
7. Statement showing cropwise irrigation done during the period of 13 years i.e. 1958-59 to 1970-71.
8. Statement showing the water requirement for different blocks of command area.
9. Cropping pattern and water requirement at field and at H.R. for a block of 125 acres.
10. Fortnightly water requirement in inches at H.R. for a block of 125 acres.
11. Computation of total water requirement in acre ft. at H.R. for a block of 125 acres.
12. Monthly water requirement for 8500 acres.

13. Copy of the letter of agronomist (I.A.) giving the details of total delta and number of waterings.

14. Canal capacity for each irrigation block

15. Fixing of H.F.L. for each alternative

16. Design year working table.

17. Monthwise distribution of evaporation losses.

18. Bi-seasonal reservoir working table for 52 years 1919 to 1970.

19. Statement showing monthwise flow in cusec of river Khari at Raipur weir site for 1963-1980.

20. Evaporation data of Wakal dam and project feasibility report of Wakal and Sei dams

21. Evaporation losses monthwise stage-II, Harnav

22. Fixing of F.R.L. for various gross utilization studies Harnav project

23. Seasonal reservoir working table for 61 years from 1918 to 1978 (Harnav)

24. Area capacity table, Harnav

25. Statement showing the net value before irrigation and after irrigation.

26. Statement showing the sale of water rates for various crops.

27. Revenue from water rates from irrigation command statement no.1 to 7.

28. Statement showing monthwise inflow, diversion and spills in cusec observed at Weir on river Harnav from 1973 to 1982.

29. Statement showing monthwise flow in cusec observed at Khedbrahma gauge site on river Harnav from 1961 to 1979.

30. Computation for storms indication curve statement no. 1.

31. Flood routing by modified puls method for 2 gates of size 41' x 27', statement no. 2.

C. Miscellaneous Data of Dharoi Project

1. Physical programme of work in Guhai reservoir.

2. Construction schedule (Guhai)

3. Guhai reservoir, providing H.R. on right bank ch. 2070 m.

4. L.S. of right bank Guhai main canal from ch - 0 to 6480 m, scale 1 cm = 90 m (Hor), 1 cm = 1 m (Vert.)

5. -do- 6300 m to 1287 m

6. -do- 1270 m to 1863 m

7. -do- 18450 m to 20070 m

8. Barchart study at Vanaj dam site

9. Map showing position of auger bores & open wells (Harnav)

10. Map showing depth to murum sub stratum (Harnav scheme)

11. Two day storm of 27-28 July 1927 (Dakor) scale 1"= 8 miles

12. Two day storm 2-3 July 1941 (Dharmpur) scale 1" = 16 miles

13. Storm isohyetal max. 2-day 1-2 Sept.1973 scale 1" = 16 inches.

14. Harnav reservoir project Vol. I.

15. Details of crop wise annual irrigation (Harnav).

16. Statement showing the existing and proposed crop patterns (Harnav).

17. Benefit cost ratio (Harnav).

***

TABLES

Table 1

Details of Gauging sites in Sabarmati basin

STATION NAME	LONGIT.	LATIT.	GAUGING METHOD	DISCHARGE OBSERVING METHOD	R.L.ZERO A.G.R. GAUGE(m)	CATCHMENT AREA (Sq. km.)	RIVER SLOPE	'N' VALUE	DISTANCE FROM ORIGIN	DISTANCE FROM DAM SITE	SITE INSTALL IN YEAR	A.G.R. INSTALL IN YEAR
GANDHINAGAR	72°42'	23°13'	A.G.R.	C.M.	56.35	5497	0.0001	0.026-0.035	185 km	103 km	1979	1979
SUBHASHBRIDGE	72°37'	23°03'	"	"	41.00	6057.37	0.0003	"	220 "	137 "	1952	1979
DEROL	72°50'	23°35'	"	"	90.33	2990.94	1:2500	"	130 "	48 "	1982	1982
KHEROJ	73°1'	23°35'	"	"	212.68	3481.00	1:2500	"	40 "	35 "	1982	1982
KHEDBRAHMA	73°22'	24°02'	"	"	193.41	439.00	1:1150	0.030-0.050	51 "	32 "	1961	1980
ABHAPUR	73°15'	24°00'	"	"	283.66	125.00	0.0005	"	20 "	5 "	1980	1982
KADIADRA	73°05'	23°03'	"	"	200.21	48.03	1:1000	0.026-0.035	10 "	2 "	1983	1980
BHILODA	73°01'	23°47'	"	"	128.02	275.36	1:1670	0.030-0.050	32 "	8 "	1982	1982
BALOCHPUR	73°01'	23°38'	"	"	141.69	572.67	1:2000	0.026-0.035	64 "	24 "	1982	1982
SANALIASHRAM	72°57'	24°32'	"	"	94.49	326.00	1:4000	"	18 "	- "	1984	1984
RAMPUR	73°40'	23°39'	"	"	146.69	477.01	1:1000	"	36 "	7 "	1980	1980
DHAROI	24°00'	72°52'	Closed after dam construction			5540.00	NA	NA	95 "	0 "	1935	NA

Table 2

Details of Raingauge Stations in Sabarmati basin

STATION NAME	DISTRICT	LONGITUDE	LATITUDE	INST.YEAR	STATION TYPE
AHMEDABAD	AHMEDABAD	72°38'0"	23°08'0"	1976	SRRG
ASLALI	"	72°35'0"	22°55'0"	1961	ORG
BABSAR COLONY	SABARKANTHA	73°08'0"	23°48'0"	NA	NA
BADOLI	"	73°07'0"	23°50'0"	NA	NA
BAREJA	AHMEDABAD	72°40'0"	22°50'0"	1971	ORG
BHILODA	SABARKANTHA	73°08'0"	23°48'0"	1961	ORG
CHANDOLA	AHMEDABAD	72°38'35"	23°00'15"	1976	ORG
CHANDOP	SABARKANTHA	72°02'30"	24°18'48"	1970	SRRG
CHANGODAR	AHMEDABAD	72°26'0"	22°55'0"	1976	ORG
CHHAPRA WEIR	SABARKANTHA	73°10'0"	24°01'0"	1976	ORG
DAKOR	"	73°09'0"	22°45'0"	NA	NA
DHAROI	MEHSANA	73°05'0"	24°08'0"	1962	ORG
GANDHINAGAR	AHMEDABAD	72°43'0"	23°14'0"	1976	SRRG
GUNVA	SABARKANTHA	73°02'0"	24°18'0"	1970	SRRG
HADAD	BANASKANTHA	72°58'0"	24°16'0"	1964	SRRG
HIMATNAGAR	SABARKANTHA	73°52'30"	23°37'0"	1982	SRRG
IDAR	"	73°00'0"	23°51'0"	1961	ORG
KALOL	MEHSANA	72°30'0"	23°14'0"	NA	NA
KHEDBRAHMA	SABARKANTHA	73°03'0"	24°02'0"	1970	SRRG
KUNDLA CAMPO	"	73°04'40"	23°51'45"	1970	SRRG
L IMLA DAM	"	72°51'0"	23°24'0"	1961	ORG
MANSA	MEHSANA	72°45'0"	23°25'0	NA	ORG
PAL	SABARKANTHA	73°57'15"	23°22'20"	1967	SRRG
PARSODA CAMPO	"	72°10'0"	24°02'0"	1970	SRRG
POSINA	"	72°02'15"	24°22'45"	1962	ORG
PRANTIJ	"	72°52'0"	23°26'0"	1961	ORG
RAIPURWEIR	AHMEDABAD	72°45'0"	23°06'8"	1978	ORG
RANSIPUR	MEHSANA	72°48'0"	23°40'0"	1961	SRRG
SABLI	SABARKANTHA	73°06'0"	23°44'0"	1969	SRRG
SADRA	AHMEDABAD	72°44'0"	23°21'0"	NA	NA
TARANGAHILL	MEHSANA	72°56'0"	23°45'0"	1980	SRRG
VIJAPUR	"	72°45'0"	23°30'0"	1961	ORG
VIJAYNAGAR	SABARKANTHA	73°15'0"	24°00'0"	NA	NA
VIRPUR	"	72°56'0"	23°44'0"	1970	SRRG

Table 3.1

Status of Monthwise Discharge Data of Sabarmati Basin Available at N.I.H.

STATION NAME	1962 JFMAMJJASOND	1963 JFMAMJJASOND	1964 JFMAMJJASOND	1965 JFMAMJJASOND	1966 JFMAMJJASOND	1967 JFMAMJJASOND	1968 JFMAMJJASOND	1969 JFMAMJJASOND	1970 JFMAMJJASOND	1971 JFMAMJJASOND
ABHAPUR						2222222222222	2222222222222	2222222222222	2222222222222	2222222222222
AHMEDABAD				2222222222222	2222222222222	2222222222222	2222222222222	2222222222222	2222222222222	2222222222222
BALOCHPUR										
BHILODA										
DEROL										
DHAROI	2222222222222	2222222222222	2222222222222	2222222222222	2222222222222	2222222222222	2222222222222	2222222222222	2222222222222	2222222222222
GANDHINAGAR										
KADIADRA										
KHANDIAL	2222222222222	2222222222222	2222222222222	2222222222222					2222222222222	2222222222222
KHEDBRAHMA	2222222222222	2222222222222	2222222222222	2222222222222	2222222222222	2222222222222	2222222222222	2222222222222	2222222222222	2222222222222
KHEROJ										
RAMPUR										

STATION NAME	1972 JFMAMJJASOND	1973 JFMAMJJASOND	1974 JFMAMJJASOND	1975 JFMAMJJASOND	1976 JFMAMJJASOND	1977 JFMAMJJASOND	1978 JFMAMJJASOND	1979 JFMAMJJASOND	1980 JFMAMJJASOND	1981 JFMAMJJASOND
ABHAPUR	2222222222222	2222222222222	2222222222222	2222222222222	2222222222222	2222222222222	2222222222222	3333333333333	3333333333333	4444444444444
AHMEDABAD	2222222222222	2222222222222	2222222222222	2222222222222	2222222222222	2222222222222	2222222222222	2222222222222	3333333333333	4444444444444
BALOCHPUR										
BHILODA										
DEROL					2222222222222	2222222222222	3333333333333			4444444444444
DHAROI	2222222222222	2222222222222	2222222222222	2222222222222	2222222222222	2222222222222				
GANDHINAGAR								4444444444444		4444444444444
KADIADRA									3333333333333	4444444444444
KHANDIAL	2222222222222	2222222222222	2222222222222	2222222222222						
KHEDBRAHMA	2222222222222	2222222222222	2222222222222	2222222222222	2222222222222	2222222222222	2222222222222	2222222222222	3333333333333	3333333333333
KHEROJ		1111111111111	1111111111111	1111111111111	1111111111111	1111111111111	1111111111111		1111111111111	1111111111111
RAMPUR									4444444444444	4444444444444

STATION NAME	1982 JFMAMJJASOND	1983 JFMAMJJASOND	1984 JFMAMJJASOND	1985 JFMAMJJASOND	1986 JFMAMJJASOND	1987 JFMAMJJASOND	1988 JFMAMJJASOND	1989 JFMAMJJASOND	1990 JFMAMJJASOND	
ABHAPUR	4444444444444	4444444444444	4444444444444	4444444444444	4444444444444	2222222222222	2222222222222	2222222222222	22222	
AHMEDABAD	4444444444444	4444444444444	4444444444444	4444444444444	2222222222222	2222222222222	2222222222222	2222222222222	22222	
BALOCHPUR	2222222222222	2222222222222	2222222222222	2222222222222	2222222222222	2222222222222	2222222222222	2222222222222	22222	
BHILODA	4444444444444	4444444444444	4444444444444	4444444444444	4444444444444	2222222222222	2222222222222	2222222222222	22222	
DEROL	4444444444444	4444444444444	4444444444444	4444444444444	2222222222222	1111111111111	1111111111111	2222222222222	22222	
DHAROI	4444444444444									
GANDHINAGAR	4444444444444	4444444444444		4444444444444	4444444444444	1111111111111	1111111111111	2222222222222	22222	
KADIADRA	4444444444444	4444444444444	4444444444444	4444444444444	4444444444444	4444444444444	4444444444444	4444444444444	44444	
KHANDIAL										
KHEDBRAHMA	4444444444444	4444444444444	4444444444444	4444444444444	4444444444444	2222222222222	2222222222222	2222222222222	22222	
KHEROJ	1111111111111	1111111111111	1111111111111	1111111111111	1111111111111	2222222222222	2222222222222	3333333333333	33333	
RAMPUR	4444444444444	4444444444444	4444444444444	4444444444444	4444444444444	2222222222222	2222222222222	2222222222222	22222	

NOTE: 1-Daily Discharge data
2-Data available twice daily
3-Data available thrice daily
4-Data available four times daily
*-twice daily is also available
+-Four times daily is also available

Table 3.2

Status of Yearwise Discharge Data of Sabarmati Basin Available at N.I.H.

STATION NAME	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
ABHAPUR						Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q
AHMEDABAD				Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q
BALOCHPUR																					Q	Q	Q	Q		Q	Q	Q	Q
BHILODA																					Q	Q	Q	Q		Q	Q	Q	Q
DEROL															Q	Q	Q	Q			Q	Q	Q	Q		Q	Q	Q	Q
DHAROI	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q													
GANDHINAGAR																		Q		Q	Q	Q		Q	Q	Q	Q	Q	Q
KADIADRA																			Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q
KHANDIAL	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q												
KHEDBRAHMA	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q
KHEROJ												Q	Q	Q	Q	Q	Q		Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q
RAMPUR																			Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q

NOTE : Q - Discharge data available

Table 4

Availability of Rainfall Data at N.I.H.

STATION NAME	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
ASLALI	D	D	D	D	D																			D					
BABSAR COLONY											D	D	D	D	D	D	D	D	D	D	D								
BAREJA	D		D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	
BHILODA	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	
BIKARANI	D	D	D	D	D	D	D	D	D								D	D	D	D	D	D	D	D	D				
CHANDOLA	D		D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D		D	D	D	D	D	
CHANDOP									D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	
CHANGODAR					D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	
CHHAPRA WEIR													D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	
DANTA				D	D	D	D	D	D	D			D	D	D	D	D	D	D	D	D	D	D	D	D				
DHAROI	D	D	D	D		D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	
GANDHINAGAR													D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	
GOGUNDA				D	D		D		D	D	D	D	D		D			D	D	D	D	D	D						
GUNVA									D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	
HADAD OR			D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	C	D	D	D	D				
HADAD SR																				H	H	H	H	H	H				
HIMATNAGAR	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	
IDAR	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	
JHADOL							D		D						D			D	D	D	D	D	D	D	D				
KHEDBRAHMA	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	
KHEROJ																					H	H	H	H	H				
KOTRA				D	D		D		D	D	D	D	D				D	D	D	D	D	D	D	D	D				
KUNDLA CAMPO									D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	
LIMLA DAM	D		D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	
PAL		D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	
PARSODA CAMPO									D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	
POSINA	D	D	D	D	D	D				D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	
PRANTIJ	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	
RAIPURWEIR	D		D		D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	
RANSIPUR	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	
SABLI								D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D				
SADRA				D	D	D	D	D	D	D			D	D	D	D	D	D	D	D	D	D	D	D	D				
SANALIASHRAM									D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D				
TARANGAHILL	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	
TRIPAL				D	D		D		D	D		D							D	D	D	D	D	D	D				
VIJAPUR	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	
VIJAYNAGAR				D	D	D	D	D	D	D			D	D	D	D	D	D	D	D	D	D	D	D	D				
VIRPUR									D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D				

FIGURES

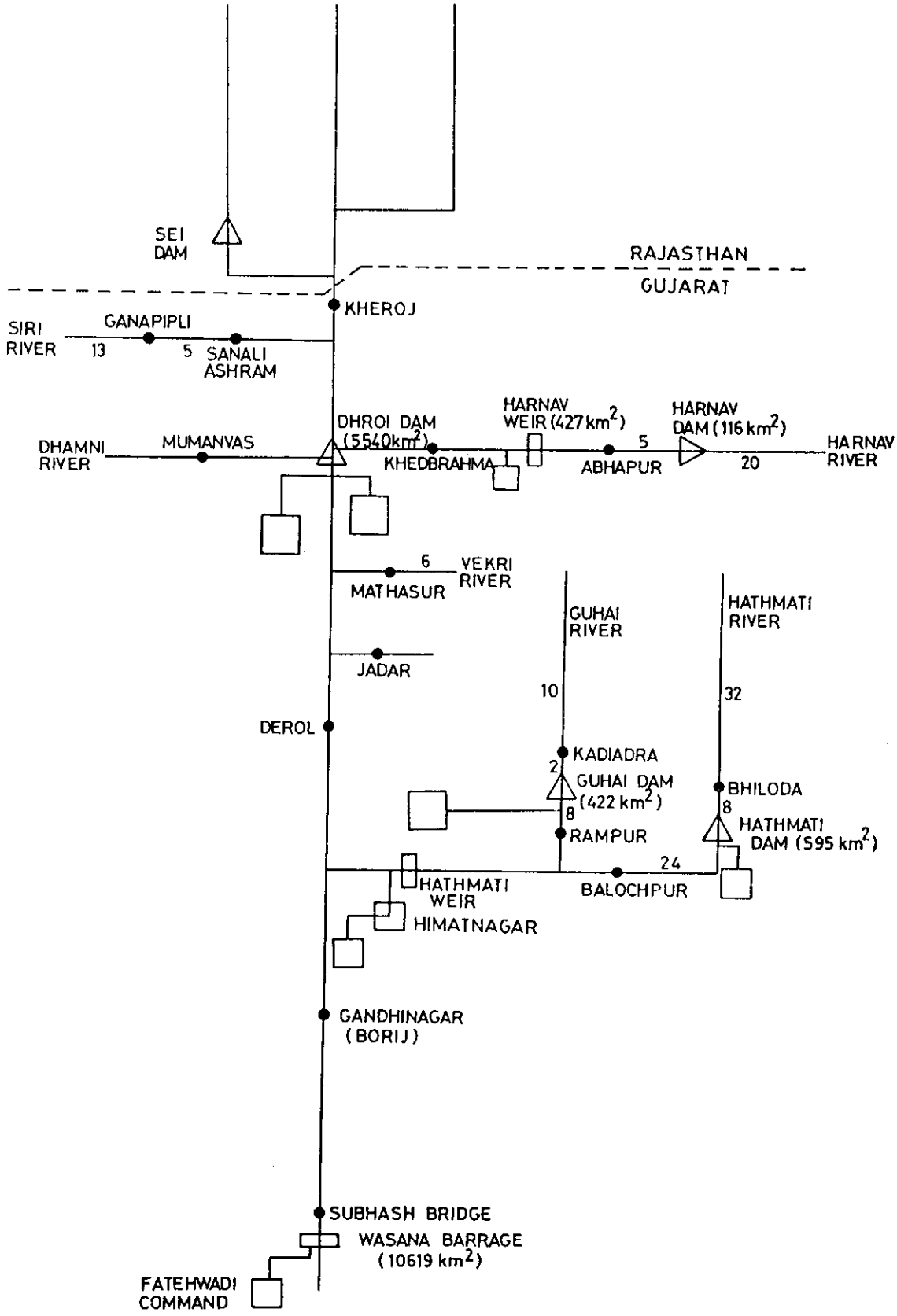
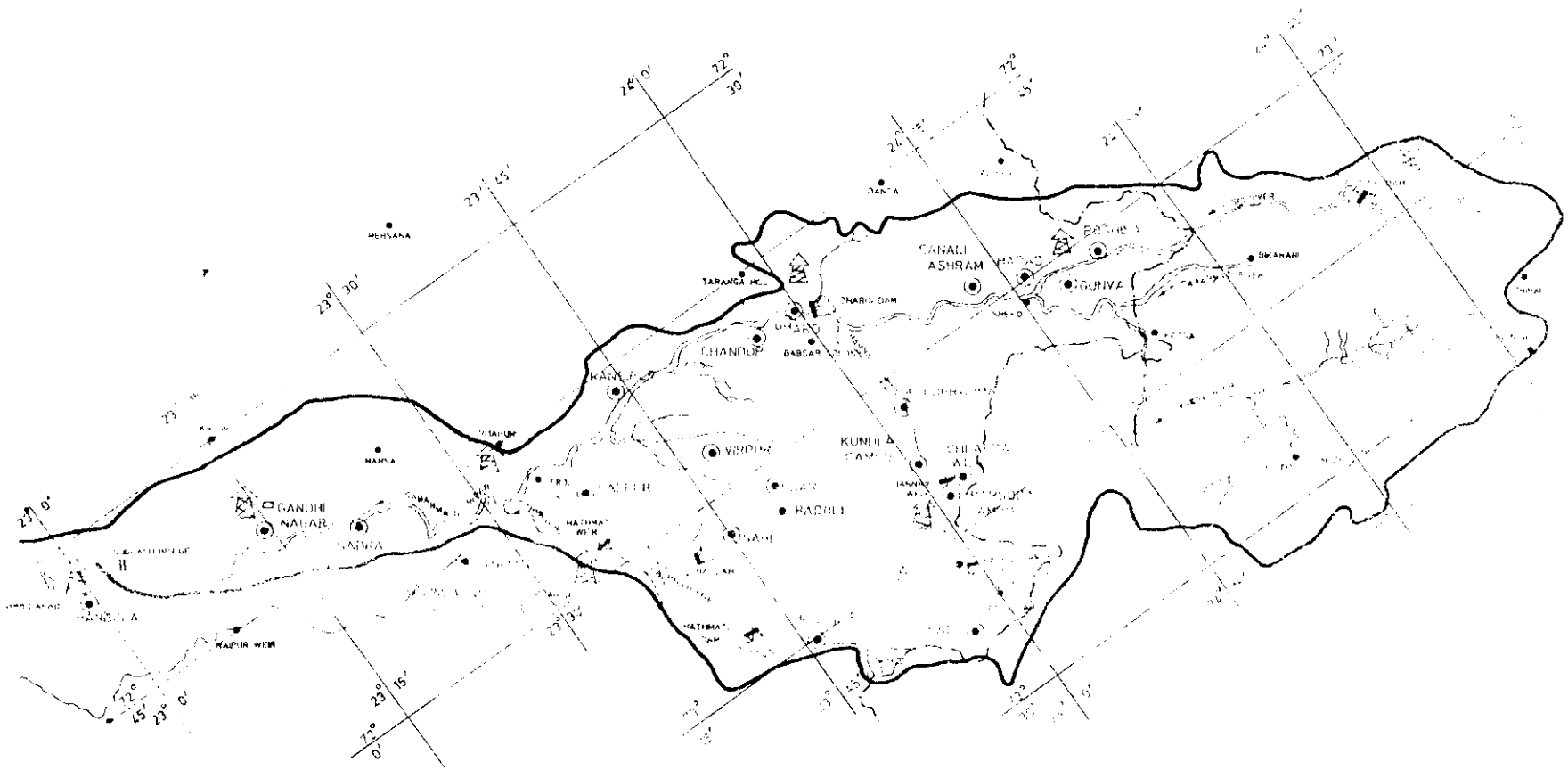


FIG.1 LINE DIAGRAM – SABARMATI BASIN UPTO WASNA BARRAGE (AHMEDABAD)

FIG. 2 INDEX MAP SABARMATI BASIN UP TO AHMEDABAD



LEGEND

1. RIVERS WITH TRIBUTARIES
2. [illegible] STATION
3. GAUGES STATION
4. RAINGAUGE STATIONS (ORDINARY)
5. RAINGAUGE STATIONS (SELF RECORDING)