

GOVERNMENT OF MADHYA PRADESH
Narmada Valley Development Department

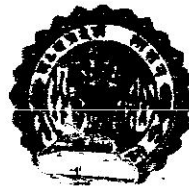


INDIRASAGAR (NARMADA SAGAR) PROJECT
STATUS REPORT

DECEMBER '1995

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INDIRA SAGAR PROJECT
KHANDWA

GOVERNMENT OF MADHYA PRADESH
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1.0 NARMADA BASIN :

1.01 Introduction :

There are seven major river basins in the State of Madhya Pradesh (see map 1). The Narmada Basin occupies nearly one fifth of the area of the State.

Narmada river is the fifth largest river of India, which is known as the "Life Line" of Madhya Pradesh. It originates from Amarkantak in District Shahdol of Madhya Pradesh. Out of its total length of 1,312 Kms., it runs for about 1112 Kms. in the State of Madhya Pradesh through the districts of Shahdol, Mandla, Jabalpur, Hoshangabad, Khandwa, Khargone, Dhar and Jhabua. More than 80 lakhs of the population of Madhya Pradesh is living along the river and its tributaries.

1.02 Basic features of the Narmada Basin :

(a)	<u>Length of the river</u>	<u>Km.</u>	<u>Percent</u>
	- in Madhya Pradesh	1077	82.1
	- in Maharashtra	74	5.6
		(35 Km common with Madhya Pradesh and 39 Km common with Gujarat)	(common)
	- in Gujarat	161	12.3
	- in Rajasthan	Nil	-
	- Total	<u>1312</u>	<u>100</u>
(b)	<u>Catchment area</u>	<u>Sq.Km.</u>	<u>Percent</u>
	- in Madhya Pradesh	85859	86.9
	- in Maharashtra	1538	1.6
	- in Gujarat	11399	11.5
	- in Rajasthan	Nil	-
	- Total	<u>98796</u>	<u>100.00</u>
(c)	<u>Culturable area in the basin</u>	<u>Lakh ha.</u>	<u>Percent</u>
	- in Madhya Pradesh	57.5	90.2
	- in Maharashtra	0.4	0.6
	- in Gujarat	6.1	9.2
	- Total	<u>64.0</u>	<u>100.00</u>

(d)	<u>Fall in the river</u>	<u>Metres</u>	
	- in Madhya Pradesh	990	
	- in Maharashtra	31	
	- in Gujarat	35	
	- Total	<u>1056</u>	
(e)	<u>Allocation of water by NWDT</u>	<u>MAF</u>	<u>Percent</u>
	Madhya Pradesh	18.25	65.2
	Maharashtra	0.25	0.9
	Gujarat	9.00	32.1
	Rajasthan	0.50	1.8
	Total	<u>28.00</u>	<u>100.00</u>

1.03 Narmada Basin Master Plan :

To utilise the Narmada Waters, allocated to the State (18.25 MAF) a Master Plan of Narmada Basin has been prepared for the development of Irrigation, Industries and domestic requirements of Madhya Pradesh. It is proposed to construct 29 Major, 135 Medium and 3000 Minor Projects to irrigate 27.55 lakh Ha. of land, generate power with an installed capacity of 3000 MW and to provide water for domestic and Industrial use. The Major projects in the Narmada basin are shown in Map-2.

Out of the above major projects, three projects (Tawa, Barna and Sukta) have been completed and Matiyari (Dhobatoria), Bargi (LBC) and Kolar projects are nearing completion. 16 medium projects and 893 minor projects have been completed. 9 medium and 342 minor projects are in progress. The Indira Sagar, the Omkareshwar, the Maheshwar, the Bargi Diversion, the Man and the Jobat projects are taken up for implementation. The rest of the 18 major projects are proposed to be constructed in the second phase.

Statement showing phasing of major projects in the Narmada Valley

Completed projects	Ongoing projects	Other projects proposed in	
		Phase-I 1979-2000	Phase-II 2000-2015
1. Barna	1. Matiyari (Dhobatoria)	1. Upper Narmada	1. Raghavpur (hydel)

1	2	3	4
2. Tawa	2. Bargi - RABS(LBC) - BDP (RBC)	2. Upper Beda 3. Lower Goi	2. Rosra(Hydel)
3. Sukta	3. Kolar 4. Indira Sagar 5. Omkareshwar 6. Maheshwar(Hydel) 7. Man 8. Jobat	-	3. Upper Burhner 4. Halon 5. Basania(Hydel) 6. Ataria 7. Chinki 8. Sher 9. Shakkar 10. Machharewa 11. Sitarewa(Hydel) 12. Dudhi 13. Morand 14. Ganjal 15. Punasa Lift.

1.04 Narmada Sagar Complex :

the
Indira Sagar Project is the key project on/Narmada River providing excellent storage site. The dam is proposed on the main river near village Punasa in Khandwa District. Omkareshwar and Maheshwar projects are proposed in the downstream to utilise the regulated releases of Indira Sagar Project for irrigation and Power generation. Hence the cascade of Indira Sagar, Omkareshwar and Maheshwar projects, together, is known as "Narmada Sagar Complex". The main features of the three projects are given below :

Features	Indira Sagar Project (Multipurpose)	Omkareshwar Project (Multipurpose)	Maheshwar Project (HYDEL)
Location	Near village Punasa, Distt. Khandwa	Near village Mandhata, Distt.Khandwa	Near village Mandleshwar District Khargone
Height (m)	92.00	73.00	35.00
Length (m)	653.00	949.00	825.00
Gross Storage (BM ³ /MAF)	12.22 (9.9)	0.987 (0.80)	0.483 (0.40)

1	2	3	4
Live Storage(BM ³ /MAF)	9.75 (7.9)	0.299 (0.242)	0.028 (0.023)
Culturable command Area(Lakh Ha)	1.23	1.47	-
<u>Annual Irrigation :</u>			
By surface water (Lakh Ha)	1.69	1.84	-
By ground water (Lakh Ha)	0.96	0.99	-
TOTAL (LAKH HA.)	2.65	2.83	--
<u>Power Generation :</u>			
Installed capacity (MW)	1000	520	400*
<u>Firm Power :</u>			
Initial phase (MW)	223.50	131.20	93.97
Final phase (MW)	118.30	61.60	48.60
Cost of Project (Rs. in crores)	1993.67	788.03	423.36
Cost of command area devp. (Rs. in crores)	50.00**		
Cost of Catchment area Devp. (Rs. in crores)	124.00		
GRAND TOTAL	2167.67	788.03	423.36

* 320 MW with penstocks for installation of 2 units of 40 MW in future.

** Cost of Command Area Devp. included in B.C. ratio.

2.0 INDIRA SAGAR (NARMADA SAGAR) PROJECT :

2.01 Introduction :

Indira Sagar Project is a Multipurpose Project with the largest storage capacity in the country. It has an installed capacity of 1000 MW and an annual irrigation of 2.65 lakh Ha/ on a CCA of 1.23 lakh ha. The project provides regulated releases of 8.12 M.A.F. to Gujarat exMaheshwar project after power generation at downstream projects, viz. Omkareshwar and Maheshwar projects in Madhya Pradesh.

2.02 Brief History :

After independence, the necessity of development of water resources of Narmada Basin was felt and the Government of India set up a committee for submitting recommendations for the development of Narmada Valley.

In 1955, C.W. & P.C. proposed 16 hydroelectric sites on river Narmada (15 in the State of Madhya Pradesh and 1 in Gujarat). Punasa renamed as Narmada Sagar, and thereafter as Indira Sagar was one of them.

C.W. & P.C./ (now CWC) had submitted a preliminary report of Punasa HydroElectric project in 1954 based on the preliminary investigations and surveys. In 1961, Central Water Commission prepared a revised project report considering some irrigation potential also.

The Government of Madhya Pradesh in Irrigation Department carried out further studies, surveys and investigations and submitted a detailed Project Report of Indira Sagar Project in 1969.

In order to settle the dispute relating to the height of the Sardar Sarovar Dam and sharing of water among the concerned states of Gujarat, Madhya Pradesh and Maharashtra, the Government of India constituted the Narmada Water Disputes Tribunal (NWDT) in October 1969. The NWDT gave its final award in 1979. Regarding the construction of the Narmada Sagar (Indira Sagar) dam the NWDT directed that the dam should be completed with FRL 860 ft. concurrently with or earlier than the construction of the Sardar

Sarovar Dam. The detailed project report of Narmada Sagar was modified in conformity with the Narmada Water Disputes Tribunal Award and resubmitted to the Planning Commission in July 1982, estimated cost Was Rs.920.90 crores.

The estimated cost of the project, after due scrutiny in the Central Water Commission, as per 1983 price level was modified as Rs.1,392.85 crores. The administrative approval was accorded by the Government of Madhya Pradesh to the above estimate. The estimate has been further updated to the 1988 price level. The estimated cost as worked out is Rs.1993.67 crores besides the cost of command area development being Rs.50.00 crores and catchment area treatment being Rs.124.00 crores.

The project has been cleared by the Central Water Commission and the Planning Commission the Central Electricity Authority with the updated cost of Rs.2167.67 crores including the cost of Environmental improvement to provide irrigation to 1.23 lakhs Ha. of culturable command area and have an installed capacity of 1000 MW.

2.03 Drainage Area and Hydrology :

The total drainage area at the proposed dam site of Indira Sagar Project is 61,642 sq.Kms., out of which a drainage area of about 7,159 sq.Kms. is intercepted by the existing projects i.e.Barna, Tawa and Sukta. An area of about 16,495 sq.Kms. would also be intercepted by the ongoing projects, viz. Bargi, Kolar and Upper Narmada. This area is partially hilly, steep, full of drainages and forests. Most of the rainfall in the catchment is from June to October. The average annual rainfall is 1,288 mm (the maximum and minimum being 1,879mm and 603mm respectively). Seventy five percent dependable flow at the dam site as indicated in the Project Report is $26,465 \text{ Mm}^3$ (21.47 M.A.F).

The spillway is designed for a standard project flood of 83,534 cumecs (29.59 lakh cusecs). The dam stability against overtopping has been checked for a probable maximum flood of 96,256 cumecs (34.00 lakh cusecs).

2.04 Project Geology :

(i) Dam Seat:

The main dam is located on quartzites of reddish colour and with small interbeddings of silt stone of purple colour belonging to Vindhyan (Super Group). The availability of sound and fairly impervious rock for the foundation of the dam is within reasonable depth.

(ii) Power House Site :

The Power house is located on the stable right bank in deep pit and which is geologically less disturbed. The predominating rock is quartzite with interbedded thin plane of silt stone and is quite suitable for construction of head race channel, foundation of power house and tail race channel.

(iii) The Command Area :

The command area is mostly composed of basaltic lava flows. These flows are designated as deccan traps. The thickness of lava flow ranges from 6.5m to 30m with presence of vesicular and amygdaloidal basaltic flow with appreciable weathering on top. At lower depths, the basalt flows are massive and compact. Contacts of basalt flows are often represented by the presence of red bole layer or clayey layers. The predominant soil in the command area is black cotton soil and the soils in the vicinity of Narmada River are alluvial soils.

2.05 Seismological Studies :

Detailed ^{Seismological} studies got done from the University of Roorkee, by consultancy with Dr. Guha and expert opinion obtained from Dr. Ray, W.Clough, were placed before the Dam Review Panel. Based on the recommendations of the Dam Review Panel, detailed designs for the dam have been prepared by the Central Water Commission.

A network for ^{the} ten seismological stations is proposed to be established through/Indian Meteorological Department covering the area of the projects of Narmada Sagar Complex. At present, three experimental seismological stations have been established with the guidance of Central Water and Power Research Station, Pune at Narmada Sagar, Omkareshwar and Maheshwar dam sites. The experimental station at Narmada Sagar dam site consists of a RV320 Micro Earth Quake Recorder, a Wood Anderson Seismograph and a Digital Recorder 100 strong motion accelerograph. The results are analysed by the Central Water and Research Station, Pune.

2.06 Project proposals :

The Indira Sagar Project envisages construction of the following main engineering works :

(i) A Concrete Gravity Dam :

The dam is proposed to be 92m (302 Ft.) high and 653m (2142 Ft.) in length with a slightly curved alignment of 880m radius across river Narmada near Village Punasa, about 845 Kms. from the source of origin in District Khandwa with a gross storage of 12,220 Mm³ (9.9 M.A.F) and a live storage of 9,750 Mm³ (7.9 M.A.F) corresponding to FRL of 262.13m (860 Ft) There will also be a small saddle dam on the right side of the reservoir.

(ii) A Central Spillway :

A Central Spillway of 495m (1,624 Ft.) long with crest R.L. of 245.13m is provided to pass a design flood (SPF) of 83,534 cumecs (29.50 lakh cusecs) through 20 numbers of radial crest gates of size 20m x 17m.

(iii) A SubSurface Power -House :

A subsurface power house on the right bank is proposed to house 8 units of 125 MW each with conventional Francis Turbines.

(iv) A main Gravity Flow Canal :

A lined gravity flow canal takes off from the reservoir with FSL of 239.15m through a 3.4 Kms. long tunnel named Punasa Tunnel. The total length of the left bank main canal is 248.65 Kms. The main flow canal alignment further passes through 3 tunnels named Amba, Ahirkheda and Gulania tunnels. It is proposed to irrigate about 98,475 Ha. of land in Khandwa and Khargone districts of Madhya Pradesh. The distribution system is proposed to be lined. Selective lining to water courses is also proposed.

(v) The Khargone Lift Canal :

The lift canal is proposed to offtake from 92.10 Kms. of the main flow canal. It is 83 Kms. long and involves 38m lift. It is proposed to irrigate about 24,282 Ha. of land in higher elevated areas of Khargone district in Bhikangaon and Kasrawad tehsils.

(vi) Punasa Lift Scheme :

A provision for future expansion to irrigate about 26,000 Ha. of land by lift is also considered in the design of intake components of Indra Sagar Project Canal. It will serve the areas around Punasa and Mundi villages in the command of the earlier proposed Chota Tawa Project.

(vii) Relocation of a Railway Line passing through the reservoir area:

the
The diversion of / Central Railway trunk line of 57 Kms. between Khirkiya and Talvadia Railway stations on Bombay New Delhi section is proposed.

2.07 Project clearance and Administrative Approval :

The techno-economic clearance by the Central Water Commission was given in 1984. The Government of India, Ministry of Environment and Forest accorded approval from environmental angle vide its memo No.3 87/80 1 A dtd.24th June 1987. The approval for diversion of forest land has also been accorded by the Government of India vide letter No.8/646/84 FC dated 7th October 1987. The Technical Advisory Committee to the Planning Commission have recommended the project with the estimated cost of Rs.2167.67 crores (including environmental cost etc) for approval in its meeting dtd.11th January 1989. The Planning Commission accorded investment clearance on 6.9.1989.

The State Government have accorded Administrative Approval to the updated estimated cost, at December 1988 price level, amounting to Rs.2,167.67 crores (including environmental cost etc) on 5.11.1990.

3.0 MILE STONES FOR COMPLETION OF WORK :-

The Narmada Control Board (NCB) in its 5th meeting held on 26.7.1990 decided to invite tenders for the construction of dam and Power House Complex of Indira Sagar Project in 4 packages. Following targets for important activities were fixed by Government of M.P. vide their letter No.55/27/807/NCB/93 dtd.28.8.1992 (on approval by the NCB).

1. Raising of ISP Dam to the crest level June 1998
2. Raising of ISP Dam to full height with commissioning of gates. June 2000
3. Commissioning of first 2 units of Power House. June 2000
4. Commissioning of remaining 6 units of Power House. June 2005
5. Completion of canal to irrigate 36000 Ha. June 2000
6. Completion of entire canal system June 2010

Accordingly, the tenders for the construction of dam under package-I and power house complex under package-II, III and IV were invited and approved by the NCB/Government as below :-

S.No.	Name of work	Tendered cost (in Rs.crore)	Completion period provided in the contract	Date of award of contract	Due date of completion per contract
1.	Constn.of Main Dam of ISP Under Pack-I	192.31	97 months	5.5.92	4.6.2000
2.	Constn.of HRC Package-II	24.58	60 months	3.3.92	12.3.1997
3.	Constn.of Intake pressure shaft & Power House Pkg-III	165.31	108 months	5.5.92	4.5.2001
4.	Construction of TRC - Package-IV.	20.14	48 months	7.3.92	6.3.1996

4.0 STATUS OF WORKS - ENDING DECEMBER 1995 :-

4.1 Preliminary works :-

All necessary approach roads to the dam site and colony internal roads have almost been completed. About 80% residential and non-residential buildings at dam site and Khandwa have been completed. About 10% buildings are under construction and remaining 10% are to be under taken in near future. The work of laying 33 KVA line upto the dam site, commissioning of 2 Nos. of 3.3 KVA transformers for the power supply to work site, arrangement for external and internal electrifications, water supply arrangements to colony, other pre-construction works have been almost completed.

4.2 River Diversion works :-

For taking up construction of dam in the river bed, the river diversion arrangement comprises of construction of upstream and downstream coffer dams and a 465m long diversion tunnel on the left bank.

4.2.1 U/s and D/s Cofferdams :-

U/s coffer dam is 245m long and 22.5m high and D/s coffer dam is 95m long and 11m high. The above work costing about Rs.5.40 crores awarded during 8/90 was executed with modern techniques of laying concrete blocks under flowing water. Both U/s and D/s coffer dams have been raised to full height and work had almost been completed by 6/93 except the plugging of sluices. Plugging of sluices has since been completed in January 1995.

4.2.2 Diversion Tunnel :-

This work costing about Rs.8 crores comprises of 390m long river bed tunnel and 75m long Goose Neck Tunnel with necessary approach and exit. Diversion tunnel was

commissioned on 25.5.1993 by completing work on approach, exit and river bed tunnel and raising of gate shaft. Remaining work of shaft and goose neck tunnel is programmed to be completed by 6/96.

4.2.3 The contract for commissioning of diversion tunnel gates have also been awarded and all essential embedments required for commissioning river bed tunnels have been fixed before 6/93. Balance work for commissioning of gates is proposed to be completed by 6/96.

4.3 Main Dam :-

To gain time till fixing of agency for main dam, the work of part foundation excavation of main dam blocks 1 to 9 and 15 to 27 was awarded in the year 1987 to M/s Aqua Tunnel Company of India. The contractor under this contract has completed 4.07 lakh cum excavation. Agency for balance excavation and construction of main dam was awarded under package-I to M/s Jaiprakash Associates, New Delhi on ICB contract at a tender cost of Rs.192.31 crores. The work order for this package was awarded on 5.5.1992. The contractor has mobilised the required resources and has completed upto 12/95 about 2.05 lakh cum (57%) excavation against the total estimated balance quantity of 3.62 lakh cum. The concreting for the main dam has been started in 12/93 and about 2.32 lakh cum (13%) has been completed upto 12/95 against the total estimated quantity of 14.70 lakh cum.

The construction of Tail Race Channel beyond RD 690m to Tail was also included under this contract. The work of excavation of TRC is almost completed and 6.86 lakhs cum of excavation has been completed upto 12/95. The slope protection work in an area of 7153 sqm has also been completed upto 12/95 against the total quantity of 11712 sqm.

The work of construction of main dam is proposed to be completed in 8 years.

4.4 Saddle Dam :-

Agency for this work costing about Rs.1.00 crore has been fixed. Stripping, cut-off trench excavation etc. has been started and work is likely to be completed by 6/96.

4.5 Agencies for execution of power house complex :-

Following agencies for the construction of power house complex have already been fixed :-

1. Package-II The construction of Head Race Ghannel was awarded to M/s N.P.C.C. New Delhi on ICB contract at a tender cost of Rs.24.58 crores during 3/92 with stipulated period of 5 years for completion. About 92% (17.3 lakh cum) excavation of the total quantity involved (18.80 lakhs cum) has been completed upto 12/95. Slope protection work is in progress and about 19100 (about 53%) sqm area has been protected against total quantity of 35757 sqm.
2. Package-III Construction of Intake Structure, Power House, Pressure shaft was awarded to M/s Jaiprakash Associates, New Delhi on ICB contract at a tender cost of Rs.165.32 crores during 5/92 with

stipulated time period of 9 years for completion. By 12/95 about 21.00 lakhs cum i.e. 97% excavation of the total quantity involved (21.57 lakhs cum) has been completed and balance is likely to be completed by 6/96. Concreting on intake structure has been started and about 0.27 lakh cum has been completed against the 3.79 lakhs cum of total quantity involved. The work of concrete in power house is likely to be started by 10/96. The work is held up due to non-finalisation of required electrical equipments. The excavation of access tunnel to power house has also been started and out of 200m length, about 158m length of tunnel excavation except benching has been completed upto 12/95. About 45786 sqm (about 47%) slope protection work has been completed upto 12/95 against the total quantity of 97,000 sqm.

3. Package-IV

Construction of Tail Race Channel was awarded to M/s Continental Construction Company, New Delhi on ICB contract at a tender cost of Rs.20.14 crores during 3/92. Excavation of 9.20 lakhs cum i.e. 85% excavation of the total quantity involved (10.79 lakhs cum) has been completed upto 12/95. About 20700 sqm (28%) slope protection work has been completed against the total quantity of 64,600 sqm upto 12/95.

All the main contractors have mobilised their Men, Machinery and resources in a short period and are executing work of foundation excavation ahead of schedule in full swing and are geared-up to complete the works within the contract period.

4.6 Railway Diversion :-

About 23.17 Kms. of Bomaby-Howrah Railway line is coming under the submergence necessitating construction of 57 Kms. long diverted railway line at revised estimated cost of about Rs.202 crores (1992-93 price level against Rs.102 crores at 1986-87 price level). So far about Rs.52.10 crores have been paid to the Central Railway for the construction of the diverted railway line with a view to complete the same by 1996. The earth work and structures for 38.93 Kms. between Khirkiya and Chhota Tawa has been taken up by the Central Railway.

4.7 Submergence, Rehabilitation & Resettlement.:

4.7.1 Submergence : The submergence of Indira Sagar Project is 91,348 Ha. including forest and revenue land extending to 249 villages of East Nimar (Khandwa), Hoshangabad and Dewas districts. These villages have been divided into the following five categories according to severity of rehabilitation problem :

S.No.	Category	Description	No.of villages
1.	Villages in which neither abadi nor private land is submerged.		38
2.	Villages in which private land upto 20 Ha is submerged but abadi is not submerged.		25
3.	Villages in which private land upto 20 Ha is submerged and abadi is also submerged.		2
4.	Villages in which more than 20 Ha of land is submerged but abadi is not submerged.		40
5.	Villages in which more than 20 Ha of land is submerged and abadi is also submerged.		144
TOTAL :			249

The District-wise number of villages affected is as under :

S.No.	Districts	Tehsil	No. of villages		Total
			Fully sub-merged	Partially submerged	
1.	East Nimar (Khandwa)	Khandwa	6	14	20
		Harsud	60	82	142
2.	Hoshangabad	Khirkiya	-	9	9
		Harda	1	38	39
3.	Dewas	Khategaon	-	19	19
		Kannod	2	18	20
		TOTAL	69	180	249

Out of 249 villages going under submergence, 12 are forest villages and the remaining 237 are revenue villages.

The break-up of area under submergence is as under :

1.	Area under forest	41,420 Ha.
2.	Cultivated Area	44,363 Ha.
3.	Other Area	5,565 Ha.
TOTAL		<u>91,348 Ha.</u>

4.7.2 Resettlement and Rehabilitation of Affected Population :

The State Government have enunciated a very liberal rehabilitation policy for Narmada Sagar Complex Projects in November 1987, which has been further reviewed and liberalised in June 1991 and September 1992. The main objects of this policy are to improve, or at least, retain the standard of living of the affected population that they were enjoying prior to their relocation.

The broad principles for rehabilitation of displaced families are as below :-

- a. Displaced families, whether land holders or landless would improve, or at least regain within reasonable time of transition their previous standard of living.
- b. It would be ensured that no hardship is caused to the displaced families in moving out of their familiar habitat into a new place and way of living.
- c. It would be ensured that no adverse social, economic and environmental effects of displacement would take place on the communities as far as possible.

- d. Special care would be taken of families of the scheduled castes, schedule tribes, marginal farmers and small farmers.
- e. Families having legal titles to land and the encroachers would be treated on the same footing for the purpose of entitlement for compensation and for their rehabilitation.
- f. No distinction would be made for rehabilitation between the families displaced from revenue villages and those from forest villages.
- g. Fair compensation would be arrived at for the land, building and other immovable assets. Similarly, fair price would be charged for the land that would be allotted at the new sites.
- h. Displaced families would be rehabilitated as villages, village sections or communities or groups in the command area or near the periphery of the affected areas in accordance with their preferences as far as possible.
- i. Adequate physical and social infrastructure and community services would be provided at the new sites.
- j. Families depending on agriculture, land holders or encroachers to be displaced would be resettled at the new site by allotting viable units of land.
- k. To ensure full integration of new and host families, the displaced families would be encouraged and assisted to purchase land from the voluntary sellers of land.
- l. The rehabilitation policy would be so framed that middlemen and profiteers would get eliminated.
- m. Landless agricultural labourers and non-agricultural families would be assisted in rehabilitation at the new place by giving grant-in-aid in the initial period and self and wage employment opportunities.
- n. Displaced families would be given priority in employment on the project construction.

4.7.3 Progress of R&R under Indira Sagar Project :

Action to rehabilitate the Project Affected Families (PAFs) of Dharikotla village affected by the construction of the coffer dam has been taken. 37 PAFs have been resettled by giving house plots in village Sarlya.

20 villages are likely to be affected in 1997. So far land acquisition awards have been declared for 9 villages and compensation has been paid. 24 resettlement sites have been identified covering an area of 366 Ha. and development works are in progress. District land purchase committees are assisting in purchasing agricultural lands for the PAFs.

4.8 Environmental Aspects :

The Narmada Valley Development Authority is aware of the importance of monitoring and surveillance of the environmental parameters for maximising project benefits. This Authority fully appreciates the need for preserving and protecting the environmental and ecological equilibrium for studying the various environmental and ecological aspects. Accordingly various studies/surveys have been initiated through various organisations of the Central and State Government. The present status of environments aspects is as under :

4.8.1 Phased Catchment Area Treatment :-

The freely draining area of Narmada Sagar Project down stream of Bargi Dam is about 39,25,422 Ha. As per the guidelines of MOWR, directly draining watersheds of very high priority categories only are to be treated Pari passu with the construction of the dam and at the project cost. Prioritisation survey of the watershed was entrusted earlier to SGSIT&S Indore. Later on as per Govt's instructions the prioritisation survey was entrusted to the all India Soil and Land Use Survey Organisation, New Delhi. The surveys have been completed by AIS & LUSO, New Delhi and the survey reports have been received in the NVDA.

On the basis of the reports submitted by the AIS&LUSO, 30 Sub-watersheds belonging to the very high and high priority categories and directly draining into the reservoir have been identified for treatment. These 30 sub-watersheds cover an area of about 73,456 Ha.

1. Directly Draining Sub-Watershed of High & very High Priority Categories :

Critically degraded Sub-watersheds below Bargi Dam:

(Figure in Ha)

	Forest		Non-Forest		Total	
	Gross	Net	Gross	Net	Gross	Net
Critically Degraded Sub-watersheds	15759	11048	57697	51927*	73456	62975

* in addition an area of 1636 Ha. was treated under pilot project earlier.

PROGRAMME AND PROGRESS OF WORKS

Cummulative progress 1995-96			
	Upto 94-95	Target	96-97
Non-Forest Area/ha (51927 ha)	28924	19651	3352
Forest area (11048 ha)	2623	4777	3648
TOTAL AREA (62,975 ha) :	31547	23824	7000

11. Freely Draining Area (Excluding Direct Draining Sub-watersheds) :

Number of watersheds	-	478
Gross Area	-	10,12,650 Ha
Net Area	-	9,15,150 Ha

4.8.2 Catchment Area Treatment :

Catchment Area Treatment (CAT) has been completed over an area of 33,138 Ha. CAT on the balance directly draining area of 29,837 Ha. will be completed in the next two years. It is proposed to develop a national park in the Dewas and Khandwa Districts.

4.8.3 Compensatory Afforestation :

The District wise break up/ is given as under :

S.No.	District	Degraded Forest (in ha)	Area other than forest (in ha)
1.	East Nimar(Khandwa)	30,572	2,314
2.	Hoshangabad	22,739	2,842
3.	Dewas	17,491	802
4.	Sehore	-	1,247
5.	Dhar	-	1,001
6.	West Nimar (Khargone)	-	1,937
TOTAL :		70,802	10,143

Nine Forest Divisions have been created to take up and complete afforestation work in 80,945 Ha. Afforestation work in 63,556 Ha. have been completed upto August 1995.

A total of 40,332 Ha. forest land would come under submergence and an additional 779.9 Ha. of forest land has been diverted for the residential colony, power house complex, dam, saddle dam and approach roads, subsequently, another 308.4 Ha. of forest land was permitted to be diverted for power house. Thus a total of 41,420 Ha. of forest land has been permitted to be utilised for construction of Indira Sagar Project. To compensate for this loss of forest, 10,143 Ha. of non-forest and 70,802 Ha. of degraded forest land has been identified for compensatory afforestation.

4.8.4 Progress on Compensatory Afforestation :

Compensatory afforestation has been completed so far on an area of 63,666 Ha. Compensatory afforestation on the balance area of 17,279 Ha. will be completed in the next two years.

4.9 Flora, Fauna, Wildlife and Carrying Capacity :

Studies of these aspects were entrusted to the Wildlife Institute of India, Dehradun in December, 1989 and were scheduled to be completed by March 1993. The studies have been completed. The final study report is submitted to MOEF & NCA.

Besides this, the friends of Nature's Society, Bhopal, was entrusted with the preparation of Wildlife Retrieval and Conservation plan. They have submitted the final report. Action plan is under formulation.

Actions have been taken up by NVDA to implement the recommendation of the WLI regarding construction of National Park and Protected areas.

4.10 Soil Survey and Land Irrigability Classification :

The high intensity reconnaissance soil survey has been conducted by the Agriculture Department of the State in the command area of 2.10 Lakh Ha. with the help of the National Bureau of Surveys and Land Use Planning, Nagpur, and Jawaharlal Nehru Krishi Vishwa Vidhyalaya, Jabalpur. The broad features are as under :

S.No.	Land Irrigability class	Slope percent	Depth of Soil (In cms)	Percentage of gross command area
1.	2	0-3%	Morethan 90	29.5
2.	3	1-5%	22.5 to 90	21.5
3.	4	3.10%	7.5 to 45	25.7
4.	6	5-15%	0 to 22.5	23.3

4.10.1 Command Area -Development -Programme :

The command area has immense potential for development. The objectives of the Command area development are :

Optimum utilization of created potential of irrigation.

Introduction of multiple cropping patterns and increasing the levels of productivity and strengthening of agriculture research activities.

Creation of adequate communication and storage facilities.

Conservation management for integrated fisheries development and intensification of dairy development.

The main components of the command area development programme are on farm development, conjunctive use, agro industries, regulated market warehousing facilities and roads etc.

The Government of Madhya Pradesh has submitted command area development plan. The project on completion will provide annual irrigation to 1.69 lakh Ha.

The implementation of the plan would be taken up in three phases for completion in 6/2007. Monthly observation of water levels started in November 1991 for subsequent supply of this data to the consultants already short listed, are likely to be continued for 2 seasons to draw inference for preparation of master plan for drainage. The study on Impact of Agro Chemicals, runoff from fields on surface and ground water quality in the command area has been assigned to J.N. Agricultural University, Jabalpur.

To Achieve the above objectives, an expenditure of Rs. 50.00 crores would be incurred. The works of on farm development will be started 2 years in advance of the start of irrigation from canal system in a phased manner in the entire command area. To provide safeguards against water logging conjunctive use of ground water to the extent of 30% is proposed.

4.10.2 Ground-water and Conjunctive Use :-

The Indian Institute of Sciences, Bangalore, have done the study to identify the scope for development of ground water in the composite command of Indira Sagar and Omkareshwar projects. This is with a view to provide additional irrigation facilities and also to avoid the hazards of water logging.

The Institute, in its study has proposed an average conjunctive use of 70% from surface water and 30% from ground water.

Tube-wells are not feasible in the area due to rocky bed. The ground water utilisation will be done through dug wells, which will benefit an additional area of 18,000 Ha. of class-4 land proposed to be irrigated by buried pipes and sprinkler system. Use of ground water will increase the overall irrigation intensity from 138% to 188%.

The Institute has proposed one dug well per 6.2 Ha. The total requirement of the dug wells will be about 34,000 in the entire command of Indira Sagar Project. The number of dug wells existing in 1978-79 were 10,700 and in 1987-88 16,000. Considering the present growth rate, the expected number of wells in the year 1997-98 will be about 27,000 and at the completion of the project, it would be about 44,000, which is more than the required number of dug wells. As a further incentive to the cultivator for digging wells a provision of Rs.1,000/- per Ha. for the whole command area has been proposed in the estimates of catchment area treatment to be utilized in critical areas.

4.10.3 Surface and Sub-surface Drainage :-

The command area consists of a good network of natural drainage. After the development of intensive irrigation, in order to protect the fertility of soil, surface drains are provided. It is proposed to develop the drainage simultaneously with irrigation delivery system in the entire command.

Based on the cost estimates of the sample areas, the average cost of surface drainage works out to Rs.300/- per Ha. and a provision of Rs.3.68 crores has been made in the project estimate.

The dug wells used for ground water will also serve as vertical drainage.

4.11 Seismicity and Rim Stability :

The reservoir competency survey has been done by GSI and report is submitted. In the report, GSI has suggested further studies for some patches of narrow water divide. As such they were requested to carry out the study in the required area. GSI is further reviewing the need to survey the area identified earlier.

Establishment of 10 Nos. of Seismic Observatories in the Narmada Sagar Complex area is taken up by NVDA. 12 Nos. of Wood Anderson Seismometers and 6 Nos. of photographic recorders are being procured from IMD. Procurement of Micro Earth Quake recorders is also in progress. In the mean time on the initiatives taken by NVDA, CWPRS has already installed the instruments to record preimpounding data and for undertaking seismic studies at NSP, Omkareshwar and Maheshwar Projects through Analogic micro earth quake recorder and strong motion Accelerograph as an interim measure. Work on establishment of remaining seven observatories is in progress.

4.12 Health Aspect :

A note on health aspects of ISP prepared by NVDA was examined in the ministry of E&F and comments were sent for modifying the report. NVDA has submitted the revised plan costing Rs.748.73 lacs for the preventive and curative aspects of health. Regarding preventive aspects, a MOU has been signed with the Department of Preventive and Social Medicine. Gandhi Medical College, Bhopal. Three six monthly reports ^{are} /received. For studies on health aspect in project impact areas of SSP and ISP. Work is proposed through a cell of monitoring and evaluation under the Directorate of health services Bhopal. The approved plan is being implemented.

Pre-impoundment and post-impoundment. Limnological studies carried out by three Universities will take care of water quality aspect. These studies have been completed and the final report is submitted. Action plan is under formulation.

4.13 Fisheries Development :-

The studies of certain aspects of fisheries have been included in the Limnological studies being conducted by the three universities of the State; studies in the upper Narmada (Bargi reservoir) by Rani Durgawati University, Jabalpur, studies in the middle Narmada (Tawa, Barna and Kolar reservoirs) by Barkatullah University, Bhopal, studies in the Lower Narmada by Vikram University Ujjain. All the three Universities have completed the studies in their respective areas as per MOU and final report is available. Aquatic fauna has also been covered under the studies completed by Friends of Nature Society, Bhopal. The draft report of FONS is also available. Action plan submitted earlier is being updated.

4.14 Archaeological and Anthropological Survey :-

A survey of the 254 villages is received for identification of the archaeological monuments falling within the submergence area. The State department of Archaeology and Museum, Bhopal was entrusted with the survey of 87 villages which has been completed. Archaeological survey of India has also completed the survey for 167 villages assigned for identification of the monuments of significance.

Action plan is available. Action will be taken to preserve material of archaeological importance in consultation with experts.

As only lower basin in north of the Joga fort is likely to be affected by scour action of water, this is being studied and the Siddheshwar Temple is well above FRL of 860 ft. these two structures are not considered as affected by the Project. The State Department of Archaeology and Museum has already submitted an action plan for relocation^{of} the monuments of Archaeological significance. This plan is being implemented.

Excavation of the early historic mound in village Khedinima

in Hoshangabad District is completed and report is available in NCA. Actual tools and artifacts have been found.

Anthropological Studies :

Efforts are being made for retrieval of bio-cultural material from the Narmada Basin. A lot of information is gathered from the field which generates immense data of socio-Anthropological significance.

Rashtriya Manav Sangrahalaya has constituted a working group for the retrieval of bio-cultural material in Narmada basin. Survey of tribal art and handicraft entrusted to M.P. Adivasi Kala Parishad is completed and report is available. Besides Anthropological survey of India has covered these studies under its own project called "People of India". The report is in 61 volumes out of which seven volumes are under final editing. A Narmada Salvage plan is also launched by Anthropological Survey of India, recently and the entire area is scanned and some ancient tools have been found.

4.15 SPECIAL STUDIES FOR NARMADA SAGAR COMPLEX

Expert opinions have been obtained from different agencies working on the project investigation task in the country for finalisation of different issues, which are as under :

S.No.	Name of Study	Agency
A.	Studies connected with Engineering and Socio-Economic aspects:	
1.	Studies for Planning : <u>Dam and Power House</u>	
1.	Design of Dam, Power House & irrigation outlet works, etc.	Central Water Commission, New Delhi.
2.	All types of geological investigations for dam, Power House and Canal.	Geological Survey of India Nagpur.
3.	Geotechnical Investigations	Central Soil & Material Research Station, New Delhi

- | | | |
|---|--|--|
| 4. | Design of storm Analysis | Indian Institute of Tropical Meteorology, Pune. |
| 5. | Flood Estimation for Indira Sagar Project using frequency analysis | 1. National Institute of Hydrology, Roorkee.
2. Central Water & Power Research Station, Pune. |
| 6. | Micro Earth quake reconnaissance survey around proposed Indira Sagar Dam. | Indian Meteorological Deptt. New Delhi |
| 7. | Evaluation of Earthquake parameters of N.S. Dam site | Deptt. of Earthquake Engg. University of Roorkee. |
| 8. | System studies for planning of Narmada Sagar Complex. | Indian Institute of Management, Bangalore. |
| 9. | Hydraulic Model Studies : | |
| | a. Dam | |
| | i) Diversion tunnel model study (3-D Model) | Maharashtra Engg. Research Institute, Nasik. |
| | ii) Spillway model studies with different bucket invert levels (both 2-D & 3-D models) | i) Maharashtra Engg. Research Institute, Nasik.
ii) Directorate of Irrigation Research, BODHI, Bhopal |
| | iii) Spillway aeration model study | Maharashtra Engineering Research Institute, Nasik. |
| | b. Power House | |
| | i) Tail Race Channel model | Maharashtra Engineering Research Institute, Nasik. |
| | ii) Hydraulic performance of water conductor system | Central Water & Power Research Station, Pune. |
| | <u>Canal and Command Area</u> | |
| 10. | Ground water modelling for composite command site of Narmada Sagar Complex. | Indian Institute of Sciences, Bangalore. |
| 11. | Surface and sub-surface drainage studies in command area. | Consulting Engineering service New Delhi. |
| II. Studies for construction facilities : | | |
| 12. | i) Mass concrete mix design | Central Water & Power Research station, Pune. |
| | ii) Thermal properties of mass concrete. | -do- |
| | iii) Lift height & placement temperature for mass concrete. | -do- |

- | | | |
|------|--|---|
| 13. | Concrete mix design with various percentages of site stone aggregate. | Directorate of Irrigation Research, BODHI, Bhopal |
| 14. | To study blasting pattern and slop stability | Central Mining Research Institute, Dhanbad. |
| 15. | Alkali aggregate reactivity test | National Council of Cement & Building Research, New Delhi. |
| 16. | Quality Control Manual | Water & Power Consultancy services(WAPCOS), Directorate of Irrigation Research, BODHI. |
| 17. | Stage construction model | Directorate of Irrigation Research, BODHI, Bhopal. |
| III. | Personnel Training : | |
| 18. | Training programme | National Institute of Constn. Management & Research, Bombay and Indian Institute of Public Administration, Delhi. |
| 19. | Socio-economic studies | Tata Economic consultancy Services, Bomaby. |
| 20. | Agriculture marketing in the composite command of Narmada Sagar Complex. | Society for study of Economic Disparities, New Delhi. |
| 21. | Command area studies, high intensity reconnaissance soil survey and detailed soil survey | Govt. of Madhya Pradesh Bhopal Deptt.of Agriculture. |
| B. | Studies connected with Environmental Aspects. | |
| 22. | Effects of dam construction on fish life | Central Inland Fisheries Research Institute, Barrackpore |
| 23. | Flora and Fauna study | Botanical Survey of India and Zoological Survey of India. |
| 24. | Wild life study | Friends of Nature Society, Bhopal |
| 25. | Draw down cultivation studies | Centre for Environmental studies, Bhopal. |
| 26. | Archaeological study | Department of Archaeology Government of India |
| 27. | Watershed Prioritisation for catchment area treatment | i) Space Application Centre, Ahmedabad.
ii) All India Soil & Land Use Survey, Government of India, New Delhi. |

C. **Studies connected with Rehabilitation & Resettlement :**

28. Town Planning for New Harsud Town Consulting Engineering Services New Delhi.

Notes :

1. All Technical issues connected with design and layout of dam and power house are recommended on the basis of the studies by the Dam Review Panel in their meetings.
2. All the studies have been carried out as per the suggestion of the World Bank during their meetings.

5.0 Expenditure and Budget Provisions :

An expenditure of Rs.564.87 crore has been incurred on the Indira Sagar Project by the end of March 1995. During the current year the expenditure till end of November 1995 is Rs.50.71 crore.

6.0 PROGRAMME OF CONSTRUCTION FOR THE WORKING-SEASON 95-96

6.1 An allocation of Rs.69.51 crore has been made available for the Indira Sagar Project for the year 1995-96 is as under :

	<u>Rs. crore</u>
Dam	23.51
Power House	15.50
Canal	10.50
R & R	10.00
Environment	10.00
	<hr/>
	69.51

6.2 All the major contracts for the construction of the Main Dam and the Power House Civil works (four packages costing Rs.402.36 crores at 1990 price level) have been fixed and with the contractors having mobilised their resources the works are going on in full swing. In order to achieve the mile-stone targets fixed by NCB an allocation of Rs.9275 lakhs has been demanded for the financial year 1995-96.

The Index map showing the location of projects under Narmada Sagar Complex, the General layout plan of Indira Sagar Project, the typical cross section of Indira Sagar Project, L-section of the dam indicating the levels proposed to be achieved during the working season, the bar chart of construction of power house are enclosed at Map No.3,4,5,6 & 7 respectively.

SALIENT FEATURES OF INDIRA SAGAR PROJECT

S.No.	Description	Particulars
A. GENERAL		
1.	District	East Nimar (Khandwa)
2.	Latitude	22° 17' 00"
3.	Longitude	76° 28' 00"
B. HYDROLOGY		
4.	Catchment Area (Sq.Km)	61,642
5.	Rainfall :	
	a. Maximum (mm)	1,879
	b. Minimum (mm)	603
	c. Average (mm)	1,288
6.	Dependable yield [$Bm^3/(M.A.F)$]	
	a. 75%	26.465 (21.47)
	b. 90%	18.184 (14.74)
7.	Standard project flood outflow (cumecs)	65,670
8.	Probable maximum flood outflow (cumecs)	83,534
C. RESERVOIR LEVELS		
9.	T.B.L (m)	267.00
10.	M.W.L. (m)	263.35
11.	F.R.L. (m)	262.13
12.	M.D.D.L. (m)	243.23
13.	Crest level (spillway) (m)	245.13
14.	Water spread area at FRL (sq.kms.)	913.48

D. STORAGE CAPACITY		
15.	Gross [$Bm^3/(MAF)$]	12.220 (9.900)
16.	Live [$Bm^3/(MAF)$]	9.750 (7.900)
17.	Dead [$Bm^3/(MAF)$]	2.470 (2.000)
E. CONCRETE GRAVITY DAM		
18.	Total Length (m)	653
	i. Non-overflow (m)	158
	ii. Overflow portion (spillway) (m)	495
	iii. Power dam (m)	-
19.	Maximum height (m)	92
F. RIVER DIVERSION WORK		
20.	Length of diversion tunnel (m)	465
21.	Diameter of diversion tunnel (m)	8
22.	Design discharge (cumecs)	368
G. EARTH DAM		<u>Saddle</u>
23.	Length (m)	815
24.	Height (m)	10.7
H. RADIAL CREST GATES		
25.	Number	20
26.	Length (m)	20
27.	Height (m)	17
I. POWER HOUSE		
28.	Type of power house	Sub-surface
29.	Installed capacity (MW)	1000 (8x125)
WATER CONDUCTOR SYSTEM		
30.	Penstock (No.)	8
31.	Diameter of penstock (m)	8
32.	Type of Turbine	Francis

HEAD RACE CHANNEL		
33.	Length (m)	530
34.	Width(m) (average)	75
35.	Bed level (m)	222.43
INTAKE STRUCTURE		
36.	Length (m)	208
MACHINE HALL		
37.	Length (m)	200
38.	Width (m)	23.0
TAIL RACE CHANNEL		
39.	Length (m)	1000
40.	Width (m) (average)	30
41.	Bed level (m)	172
J. SUBMERGENCE		
42.	i. Villages affected due to submergence at F.R.L.	249
43.	ii. Population affected (1981 Census)	80,572
III.LAND :		
44.	a. Cultivated area (ha)	44,363
45.	b. Other area (ha)	5,565
46.	c. Forest area (ha)	41,420
TOTAL :		91,348
47.	iv. Diversion of railway line(Kms)	57
K. CANALS		
48.	Length (Kms.)	248.65
49.	Head discharge(cumecs)	160
50.	Full supply level at head(m)	239.15
51.	Bed width (m)	16.4(Normal reach) 9.0(Deep reach)
52.	Full supply depth (m)	5.0

Lift Canal (Khargone lift canal (Left Bank):

53.	Length (Kms.)	83
54.	Head discharge (cumecs)	31.0

COMMAND AREA DETAILS

55.	Gross command area (lakh Ha)	2.10
56.	Culturable command area(Lakh Ha)	1.75
57.	Irrigated area (lakh Ha)	1.23

(ii) a. Main flow canal(left)
(area in Ha/irrigation intensity %)

58.	East Nimar (Khandwa)	18,979/138
59.	West Nimar (Khargone)	79,496/138

TOTAL : **98,475**

b. Main flow canal (right) (area
in Ha/irrigation intensity %)

60.	West Nimar (Khargone)	-
61.	Dhar	-

c. Khargone lift canal(left)
(area in Ha/irrigation intensity %)

62.	West Nimar (Khargone)	24,282/132
63.	Dhar	-

TOTAL : **24,282**

d. Right bank lift canal (area
in Ha/irrigation intensity %)

64.	West Nimar (Khargone)	-
65.	Dhar	-

GRAND TOTAL : **1,22,757**

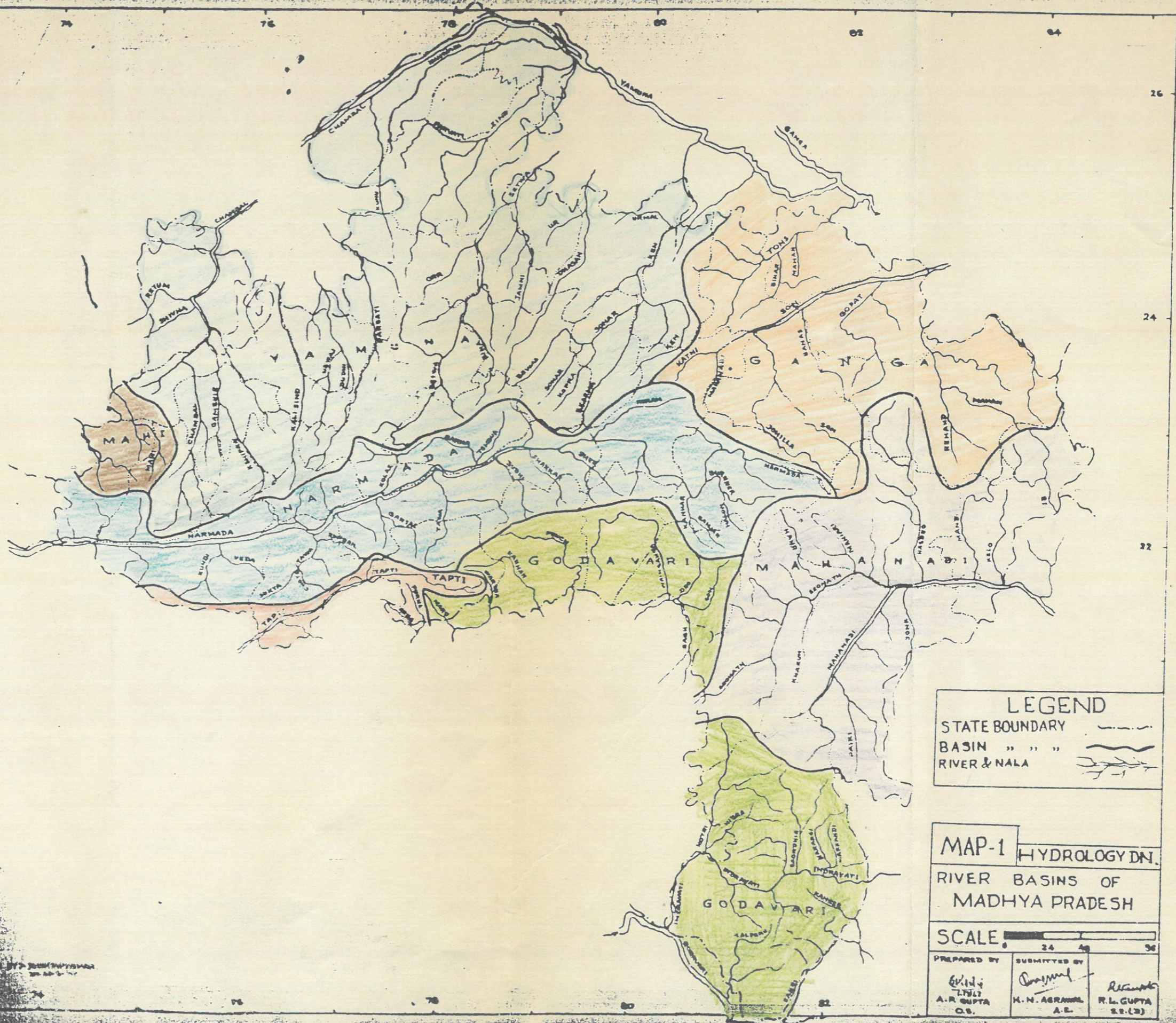
SAY : **1.23 lakh Ha.**

(iii) Tunnel [Diameter (M)/total length (Kms.)]

66.	Punasa	8.0/4.40
67.	Amba	7.9/2.16
68.	Ahirkheda	6.5/2.16
69.	Gulania	4.8/1.73

	iv. C.D. works (Nos.) :	
70.	Main flow canal (left)	311
71.	Main flow canal (right)	-
72.	Khargone lift canal (left)	126
73.	Right bank (lift) canal	-
L.	COST ESTIMATES (in crores)	
74.	Unit-I head works	832.32
75.	Unit-II canals	541.98
76.	Unit-III power	619.37
77.	Command area development	50.00
78.	Catchment area treatment	124.00
	GRAND TOTAL :	2167.67
M.	COST ALLOCATION	
79.	Irrigation	652.13
80.	Power	1275.15
81.	Omkareshwar project (in cost of Indira Sagar Project)	71.79
82.	Sardar Sarovar Project (in cost of Indira Sagar Project)	168.60
	TOTAL	2167.67
N.	BENEFITS	
83.	Installed power (MW)	1000
84.	Firm power generation :	
85.	Initial phase (MW)	223.50
86.	Final phase (MW)	118.30
87.	Energy generation (GWH)	2015
88.	Cost of energy generation (paise/KWH)	73
89.	Cost per KW of installed capacity (Rs.)	11,630/-

90.	Irrigation proposed(lakh Ha)	1.23 (only left bank)
91.	B.C. ratio (for irrigation component)	1.85
92.	No. of villages benefited in the command (nos)	564
93.	Production of food grains (lakh Tons)	4.00
94.	Production of other grains (lakh Tons)	10.55
95.	Municipal and Industrial water supply average (MAF)	0.06



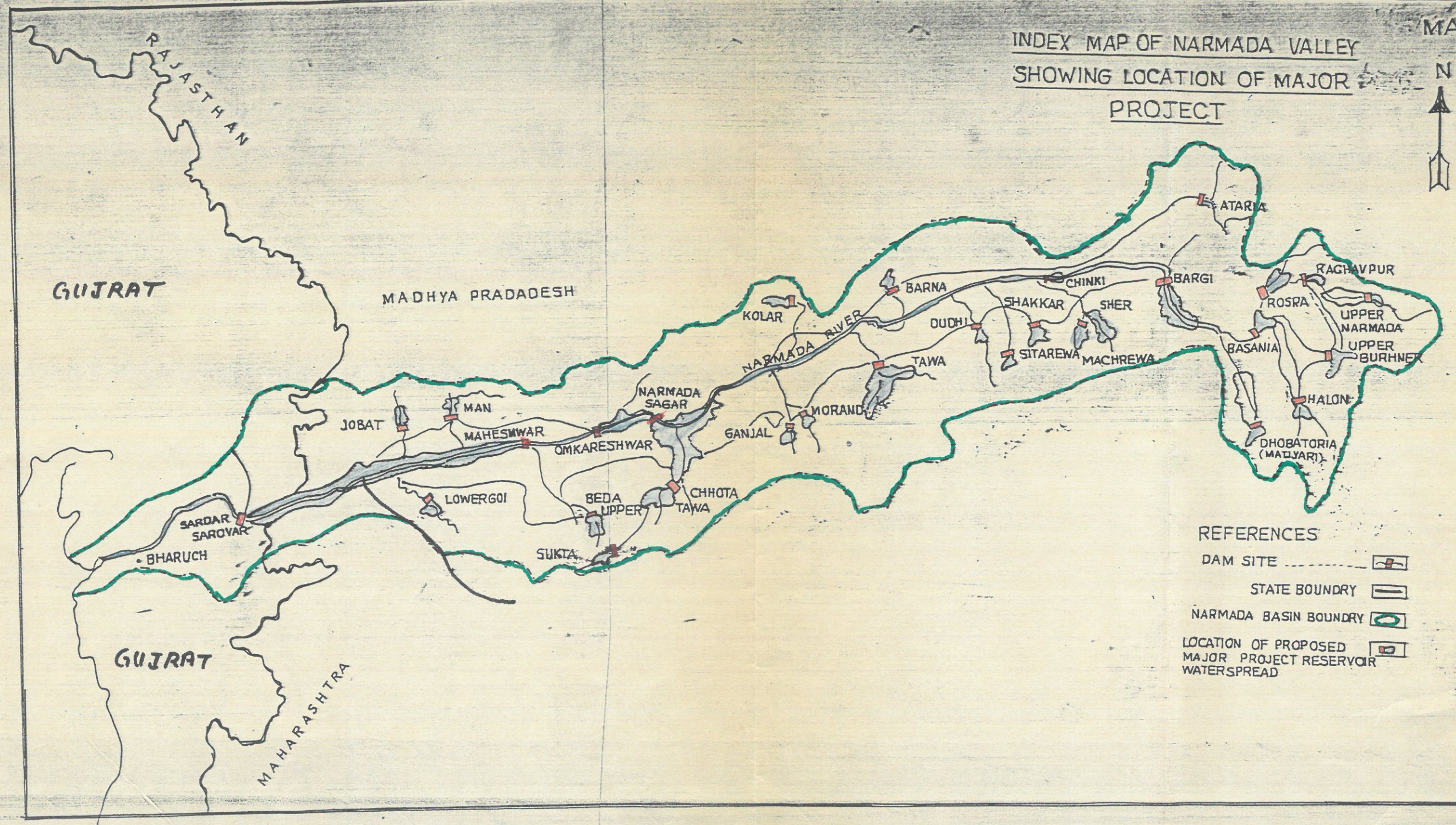
LEGEND
 STATE BOUNDARY ———
 BASIN " " " ———
 RIVER & NALA ———





MAP-1 HYDROLOGY DN.
 RIVER BASINS OF
 MADHYA PRADESH

SCALE 0 24 48 96

PREPARED BY A. R. GUPTA C.S.	SUBMITTED BY H. N. AGRAWAL A.E.	REVISIONS R. L. GUPTA S.S.(D)
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INDEX MAP OF NARMADA VALLEY
SHOWING LOCATION OF MAJOR
PROJECT

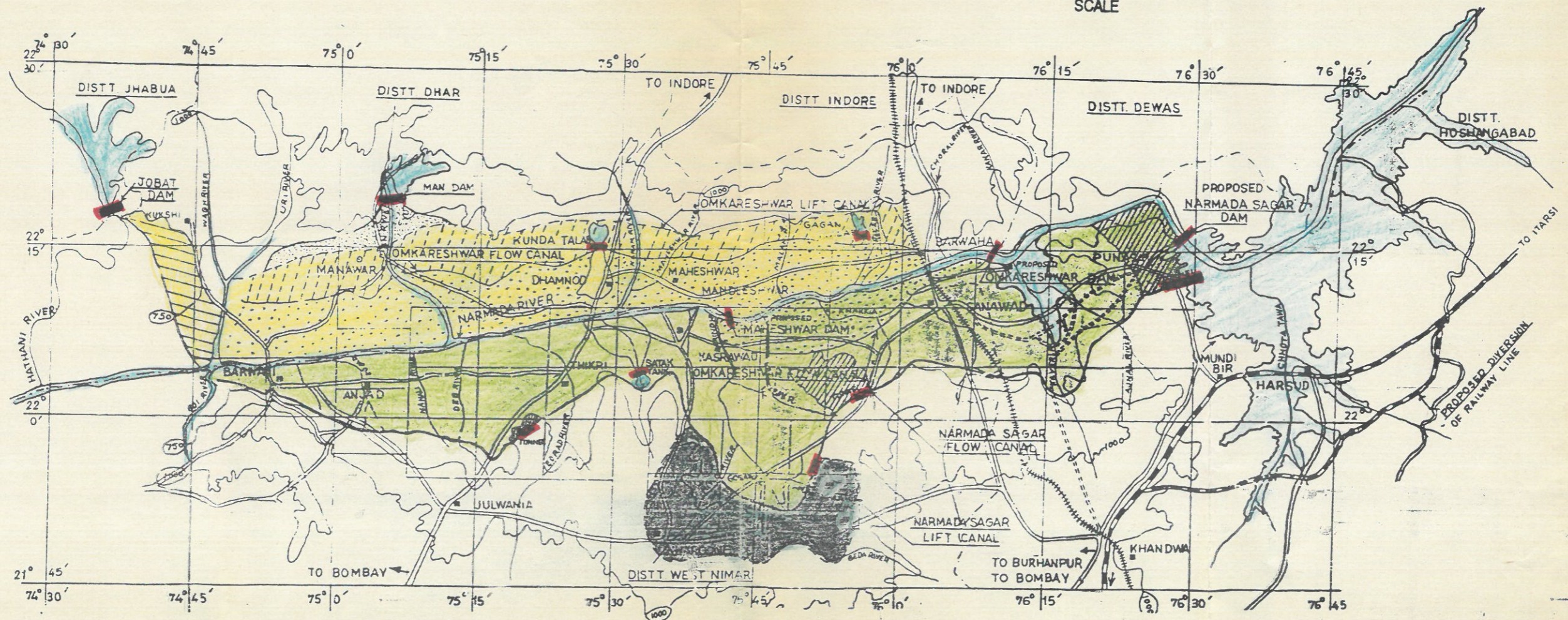
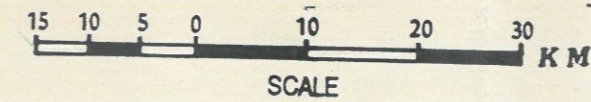


- REFERENCES
- DAM SITE 
 - STATE BOUNDARY 
 - NARMADA BASIN BOUNDARY 
 - LOCATION OF PROPOSED MAJOR PROJECT RESERVOIR WATERSPREAD 

INDEX MAP OF NARMADA SAGAR COMPLEX

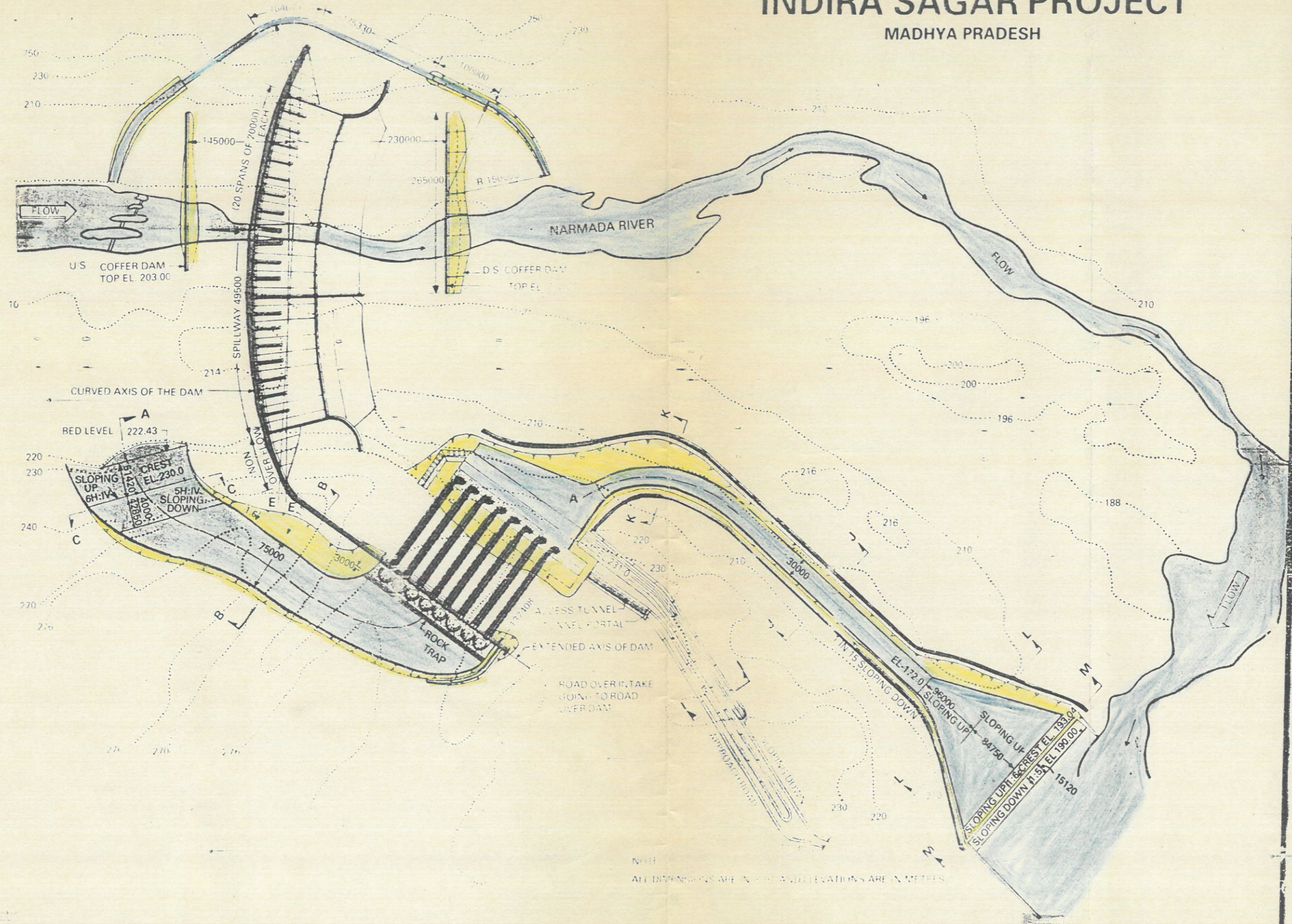
MAP-3

LEGEND	
DISTT. BOUNDARY	
ROADS	
RAILWAYS	METRE GAUGE BROAD GAUGE
CANALS	
NARMADA SAGAR FLOW	
NARMADA SAGAR LIFT	
OMKARESHWAR FLOW	
OMKARESHWAR LIFT	
COMMANDED AREA	FLOW
NARMADA SAGAR	LIFT
OMKARESHWAR	FLOW
	LIFT
TUNNEL	
EXISTING MEDIUM WORK	
RESERVIOR	
AREA OUT OF COMMAND	

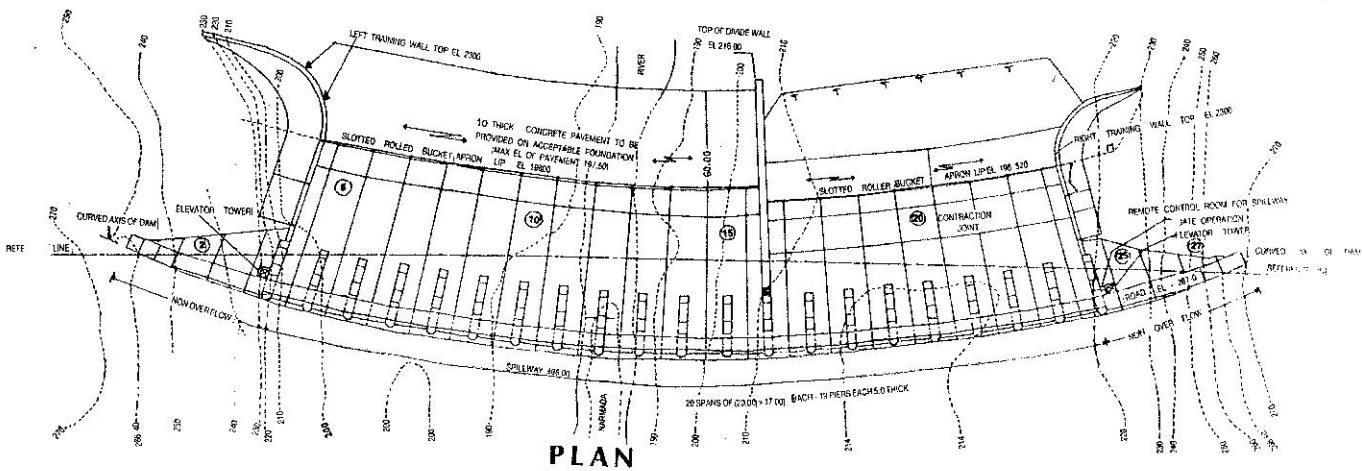
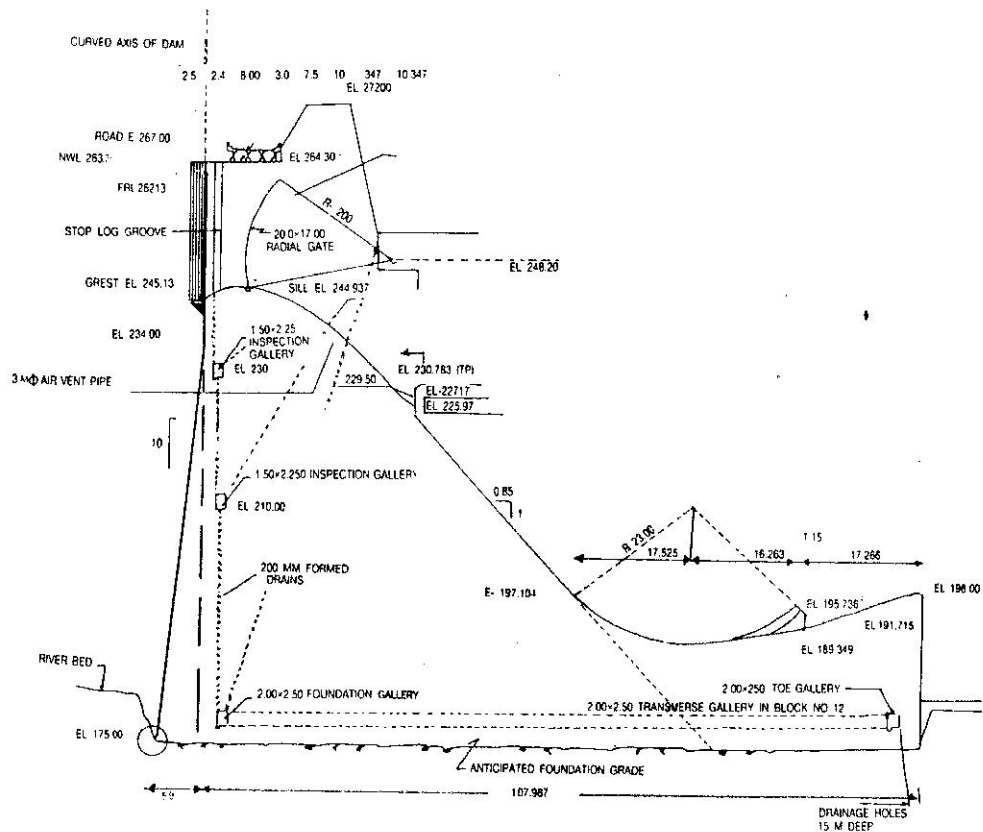


INDIRA SAGAR PROJECT

MADHYA PRADESH

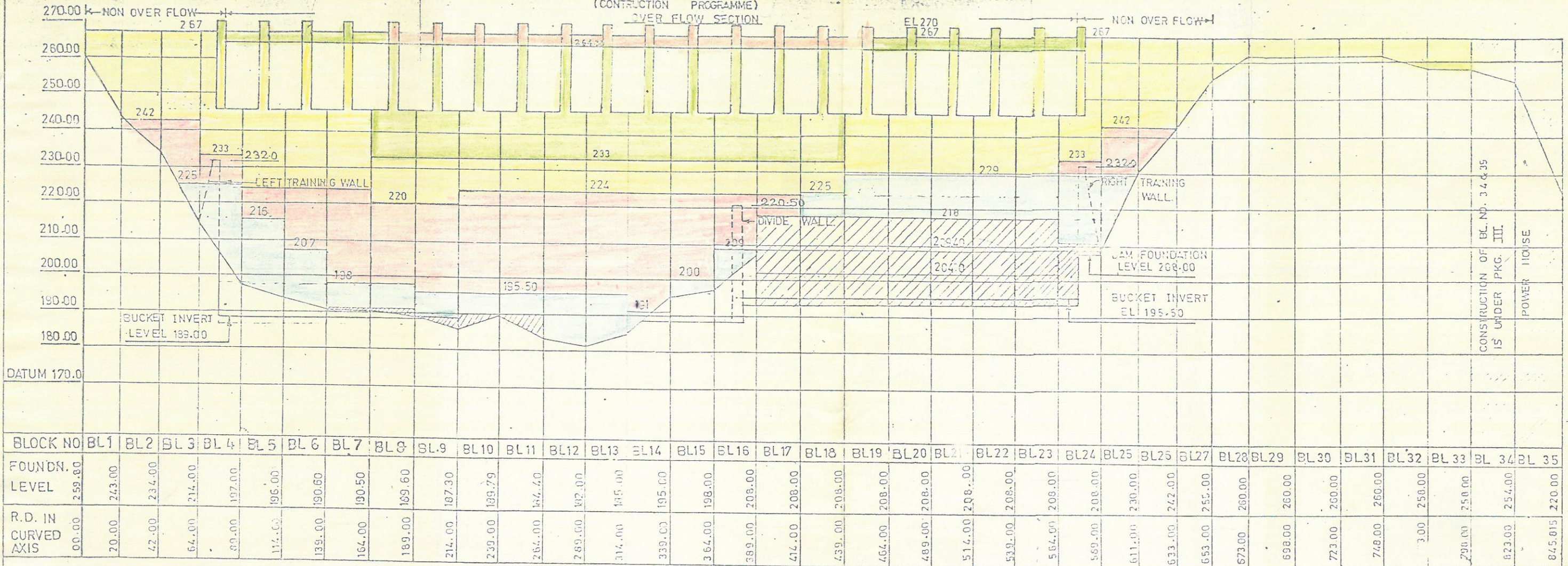


GENERAL LAY OUT PLAN



PLAN AND TYPICAL SECTION OF INDIRA SAGAR DAM

INDIRA SAGAR PROJECT
CONSTRUCTION OF CONCRETE DAM (PACKAGE-I)
 (CONSTRUCTION PROGRAMME)
 OVER FLOW SECTION



BLOCK NO	BL1	BL2	BL3	BL4	BL5	BL6	BL7	BL8	BL9	BL10	BL11	BL12	BL13	BL14	BL15	BL16	BL17	BL18	BL19	BL20	BL21	BL22	BL23	BL24	BL25	BL26	BL27	BL28	BL29	BL30	BL31	BL32	BL33	BL34	BL35
FOUNDN. LEVEL	259.00	243.00	234.00	214.00	197.00	196.00	190.60	190.50	189.60	187.30	189.79	184.00	185.00	195.00	198.00	208.00	208.00	208.00	208.00	208.00	208.00	208.00	208.00	208.00	208.00	230.00	242.00	255.00	260.00	260.00	260.00	260.00	258.00	250.00	220.00
R.D. IN CURVED AXIS	00.00	20.00	42.00	64.00	89.00	114.00	139.00	164.00	189.00	214.00	239.00	264.00	289.00	314.00	339.00	364.00	389.00	414.00	439.00	464.00	489.00	514.00	539.00	564.00	589.00	611.00	633.00	653.00	673.00	698.00	723.00	748.00	796.00	823.00	845.015

YEAR	AFELUX LEVEL
JUNE -94	225.00
JUNE -95	225.00
JUNE -96	225.00
JUNE -97	233.00
JUNE -98	251.00
JUNE -99	257.00
JUNE -2000	263.35

- NOTE:-
- I. WORKING SEASON FROM JULY TO JUNE.
 - II. LEVEL OF HARSUD TOWN IS EL.260.00 M.
 - III. AFFLUX CALCULATED FOR OBSERVED FLOOD OF 414.00 CUMECs.
 - IV. ALL DIMENSIONS ARE IN METERS.

YEARLY PROGRAMME OF CONCRETE		
YEAR	QUANTITY	SYMBOL
1993-94	0.25	COMPLETED
1994-95	1.40	
1995-96	3.40	
1996-97	3.50	
1997-98	3.10	
1998-99	1.25	
1999-2000	0.10	
TOTAL	13.50 L.CUM.	

NARMADA VALLEY DEVELOPMENT DEPTT.
INDIRA SAGAR PROJECT
CONSTRUCTION PROGRAMME OF DAM

BAR CHART OF CONSTRUCTION PROGRAMME OF POWER HOUSE

MAP-7

INDIRA SAGAR PROJECT

SLNO	ACTIVITIES	QTY.	UNIT	VIII PLAN					IX PLAN			
				1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000	2000-2001
1.	CONSTRUCTION OF H.R.C.	18.80	L.CUM	3.96	9.18	3.86	1.50	0.30				
2.	EXCAVATION OF INTAKE AND POWER HOUSE.	21.57	L.CUM	11.13	8.16	1.67	0.61					
3.	EXCAVATION IN PRESSURE SHAFT TUNNEL.	0.96	LAKH CUM		0.15	0.43	0.38					
4.	STAGE I CONCRETE IN P.H.	0.82	LAKH CUM				0.31	0.29	0.22			
5.	CONCRETE IN DOWN STREAM COUNTER FORT RETAINING WALL.	0.83	LAKH CUM				0.19	0.21	0.30	0.13		
6.	SUPPLY FABRICATION AND INSTALLATION OF P.S. LINER.	5800	MT				2000	2000	1800			
7.	INTAKE STRUCTURE.	1.33	LAKH CUM			0.16	0.32	0.32	0.35	0.18		
8.	STAGE II AND III CONCRETE FOR P.H.	0.48	L.CUM					0.08	0.10	0.10	0.10	0.10
9.	INSTALLATION OF UNITS	8	NOS						2	2	2	2
10.	COMPLETE ALL THE WORK UNDER THE CONTRACT PACKAGE III	JOB	100%	8	8	12	18	18	19	13	02	02
11.	CONSTRUCTION OF T.R.C.	10.79	L.CUM	3.12	3.06	2.35	2.26					

