

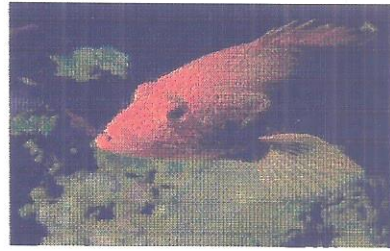
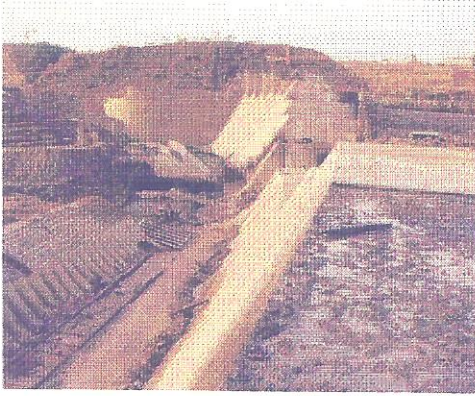


*Narmada River Basin Development*

**Draft**

**ENVIRONMENT RESOURCES REPORT**

**Indira Sagar Project**



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## FOREWORD

Our country gets rain on about 30 days a year, and if this water when it is not restored, it will escape to the sea and only a small percentage of it will go underground or deposit on high mountains. Since Vedic times, the competence of a king was described through his foresight to store rainwater for drinking and irrigation. With the development of science and technology, the construction of dam across the rivers for multi-purpose, i.e., for irrigation and production of power was considered very important and step for modern development. The great multitude of multipurpose and hydel projects emanating for the changed history of planning are envisaged in the Narmada basin, they add up to a gigantic engineering enterprise even on the global scale. This massive river valley project which contemplates the construction of 30 major, 135 medium and over three hundred small dams, is the largest irrigation project that has been ever planned and implemented as a single unit anywhere in the world. The Indira Sagar Project on the river Narmada will submerge 91,348 ha of land including 41,112 ha of forest and displace about 30,739 families & major sons in 249 villages so as to be able to have an installed capacity of 1000 MW of hydel power and to have an irrigation capacity of 1.69 lakhs ha.

A development initiative of this magnitude is bound to significantly impact upon the physical and biological environment and would in turn both directly and indirectly impinge on the social and economic concerns of local people.

Keeping this in view, ISP has been appraised for their comprehensive range of impacts including ecological, socio-cultural and economic aspects.

Submergence of agricultural land, forest stretches and wildlife habitats and relocation of the people are some of the major direct impacts of this project that set off more complex but significant impacts resulting from diversion, decimation and fragmentation of forests, reduction of the quality of upstream terrestrial habitats, transformation of the free river ecosystem to a drastically different reservoir system.

An attempt has been made in the present publication by the authors to highlight important facets of the project and describe the efforts which have gone into evolving the planning and designing of the mitigatory measures of the identified negative consequences. The State Govts. have been guided by the guidelines issued by Ministry of Environment & Forests, Govt. of India regarding programming, implementation and monitoring of environmental issues. The informations and datas are based on the reports of the State Govts. and study reports of various experts, institutions and organisations.

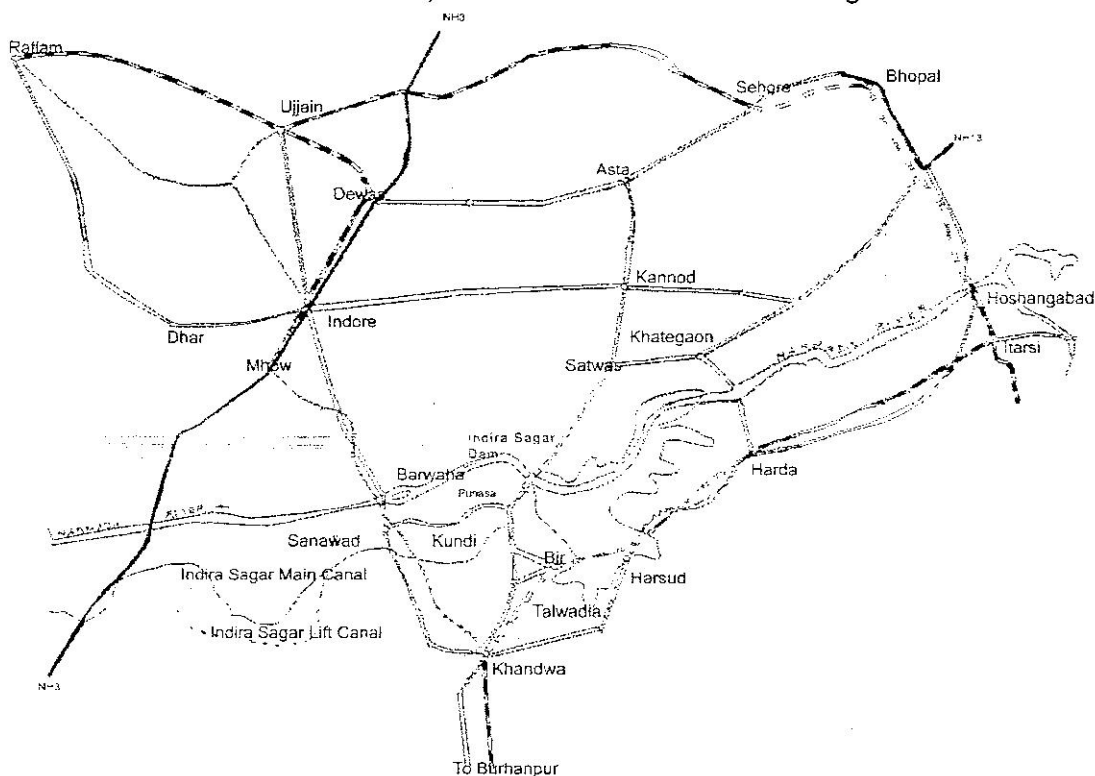
It is hoped that after reading this book, reader will know what Indira Sagar Project is? Endeavour has been made to throw light on specific issues which have been raised by the critics of the project.



## NARMADA RIVER BASIN DEVELOPMENT

**ENVIRONMENT RESOURCES REPORT:INDIRA SAGAR PROJECT****INTRODUCTION**

Mrs. Indira Gandhi, the then Prime Minister of India laid the foundation stone of Indira Sagar Project located about 467 Km from the sea, roughly 320-Km upstream from the Sardar Sarovar dam site, on 24<sup>th</sup> October 1984. Later, the Project was renamed as Indira Sagar Project (ISP). The ISP Dam on completion would create a lake that will inundate about 91,300 ha of valley lands. The area to be inundated constitute lands from five tehsils of three districts in Madhya Pradesh namely Khandwa and Harsud in Khandwa District, Kannod and Khategaon in Dewas Dist. and Harda in Hoshangabad District. Of the total area of 91,300 ha to be submerged about 67,000 ha. is in Harsud Tehsil, 11,500 ha is in Khandwa Tehsil and 12,800 ha area is divided among the other three tehsils.

**LOCATION MAP OF INDIRA SAGAR PROJECT**

Indira Sagar is a multipurpose project with the largest storage capacity in the country. It has an installed capacity of 1000 Mega Watt and an annual irrigation of 2.15 lakh ha. The project provides regulated releases of 8.12 Million Acre Feet to Sardar Sarovar Project (SSP), a terminal project on mainstream of the river in the State of



Gujarat. The water on its way to the SSP would generate power at two intermediate projects in Madhya Pradesh.

## **KEY ISSUES IN INDIRA SAGAR PROJECT**

Ecological transformations following impoundment result in succession of fluvial biocoenoses by lentic environment, the hydrography undergoes a shift by way of, fluctuations in water level, changes in physico-chemical regime and inundation, impacting areas upstream, downstream and in the irrigated command. Inundation results in involuntary resettlement of the people living in the submergence area, submergence of agricultural, forests and other resources like minerals, spawning grounds of fishes, resting/nesting places, buildings, roads etc. Fluctuation in water level brings in the issues of diseases, sedimentation, aesthetics of the area etc. Physico-chemical changes relates to quality of water, formation of hydro-sulphuric sludge, morphology of the river/estuary, salinity ingress etc. The key issues related to environmental control which have been discussed and debated generally being of direct concern to the people at large, are discussed in this report. They include among others the following:

- ◆ Resettlement of oustees
- ◆ Losses of natural forests
- ◆ Loss of wildlife
- ◆ Erosion and sedimentation
- ◆ Public Health issues, especially the water-borne diseases
- ◆ Seismicity and reservoir-induced seismicity.
- ◆ Cultural resources/Heritage
  - ◆ Narmada as sacred river
  - ◆ Loss of religious and historic sites.
- ◆ Command Area and Waterlogging .

## **RESETTLEMENT AND REHABILITATION**

The resettlement of project affected families (PAFs) who are compelled to leave their villages/land due to filling up of the reservoir is the most complex process to be faced by the Project Authorities. The ability of the Governments/Project Authorities about the proper resettlement and rehabilitation of PAFs has been questioned. However, project authorities have aimed the resettlement & rehabilitation in such a way as to provide them an opportunity for participating in the development process initiated by the project i.e. by offering them to resettle in command area of the project and have indicated their determination to safeguard the interests of the displaced population.

The Govt. of India have objective that project affected families shall be no worse off and preferably be better off after resettlement than before and have issued administrative clearances to the project on the condition among others that suitable R&R Plan be drawn





up upto its satisfaction. The State Govt. of Madhya Pradesh has also enunciated a policy of rehabilitation initially in 1989 setting forth the rights of the PAFs. The policy was subsequently revised and updated during 1994 and 1998, each time to the advantage of the PAFs. Accordingly plans for resettlement and rehabilitation are being prepared and implemented by the Govt. of Madhya Pradesh.

## **LOSS OF FOREST & WILDLIFE RESOURCES/EROSION AND SEDIMENTATION**

The loss of forest and wildlife resources and the question of erosion and sedimentation are linked to a greater extent as both of these have synergistic impact and are fuelled by a common causative factor, excessive pressures from human and bovine.

The total forest area getting submerged by the impoundment of Indira Sagar dam has been estimated is 41,589ha. Out of this 72% are reserved forests and the rest is protected forests. The total forest in Khandwa division constitutes about 28% of its geographical area. After losses to submergence, the forest area will be reduced to 26%. In Dewas and Hoshangabad divisions, forest areas of 35.7% and 34.1% will be reduced by 0.6 and 0.01% respectively in terms of geographical areas. The project impact area for purposes of environmental considerations must include not only the area of actual submergence but also the surrounding lands that will be looked upon to absorb displaced people, livestock, and wildlife. Plans for afforestation and treatment/rehabilitation of large areas in the catchment are under implementation.

The process of soil erosion and sedimentation of the Narmada River could shorten the useful life of the project reservoirs as they gets filled with sediments. However the process of erosion and sedimentation of the Narmada River and it's tributaries has been going on for a long time. The rate of erosion stand increased each time the land was disturbed/overexploited. In order to achieve an expected project life of at least 100 years for the Indira Sagar Project, notwithstanding that planners have incorporated into project designs sufficient provisions for the same, plans for afforestation and treatment/rehabilitation of large areas within the Narmada catchment are under implementation

## **PUBLIC HEALTH**

Large water-development projects have often been accompanied by increases in water-related diseases. The Narmada projects involve large reservoirs and canal distribution systems. Their potential to create public health hazards has been recognised and provisions have been included in project planning to budget funds to provide adequate medical facilities, staffing and services. Studies have shown that the project areas are now free of Schistosomiasis. Plans are set to monitor on a continuing basis and to take whatever actions are necessary to keep the project areas free from the schistosomiasis and other diseases.



## **SEISMICITY & RESERVOIR INDUCED SEISMICITY**

Seismicity and the potential for reservoir induced seismicity (RIS) have been studied by the Geological Survey of India, Central Water and Power Research Station of Pune, University of Roorkee, State Govt. of M.P. and several consultants. Investigations have considered the Narmada Sagar Complex the dam sites at Indira Sagar, Omkareshwar and Maheshwar. The conclusions of the studies were that reservoirs might cause earthquakes to occur sooner but that the magnitude or intensity of ground motion associated with the earthquakes would not be affected. This implies that the dam design should be determined by the estimated possible severity of an earthquake that could occur. In case of the Indira Sagar dam, upon the recommendation of the experts, a conservative seismic design that provides an extra measure of safety is already accepted and implemented. A network of seismological stations has been proposed through Indian Meteorological Department covering the area of the projects of Narmada Sagar Complex.

## **CULTURAL RESOURCES/HERITAGE**

The Narmada Projects will have two impacts on cultural resources. The Narmada River is held to be sacred. In keeping with its holy status, the river is the site of a religious pilgrimage known as the Parikarma. Traditionally, the Parikarma is called as the circumambulation of the entire river by foot. There is possibility to discontinue this parikarma as the Parikarma path will be lost because of the change in configuration of the river. From the Sardar Sarovar Dam Site in Gujarat to the eastern extreme of Indira Sagar Reservoir in M.P, the riverine environment of Narmada River will be transformed largely into a lake environment. There are Plans for providing new pilgrimage routes to replace the earlier Parikarma Path so that Parikarma of the Narmada can be continued by traditions.

In addition, a number of religious and historic sites will be inundated by the reservoirs. Central Govt. and State Govt. departments have prepared plans for relocation and protection of the monuments impacted by the submergence. These plans are under implementation by the agencies otherwise responsible for maintaining and safeguarding the archaeological monuments under the provisions of the relevant acts.

## **COMMAND AREA & WATERLOGGING**

Waterlogging occurs when the groundwater table rises too close to the ground surface and the soils are unable to drain properly. Considering that several projects in India, including the Tawa project, located within the Narmada basin, less than 200 km, east of the Narmada Sagar reservoir site in Hoshangabad District have suffered from such conditions of waterlogging in the past, the issue of waterlogging in the Command Area of Narmada project needs attention.

This concern has been carefully tackled in planning stage to avoid the problems. The conjunctive use of surface and groundwater resources, the provision of drainage





systems to prevent the accumulation of excessive water in the soils, water management planning and monitoring to control the proportions of surface water and groundwater used in irrigation and water levels in the groundwater aquifers are some of the measures planned for prevention of any such eventuality.

### ***Planning and Chapterisation***

Chapter one deals with ISP at a glance. It will describe the brief history of development/management of water resources of Narmada, NWDT. Organisations like NCA and its subgroup Narmada Sagar Complex and organisation like NVDA of M.P. to plan and implement. Chapter two discusses about the Salient Features of ISP. In Chapter, three we will describe about the environment and resettlement impact assessment and clearance of ISP by Govt. of India. Chapter four deals in detail about the planning and implementation of environmental mitigation steps and R&R issues of the Project.

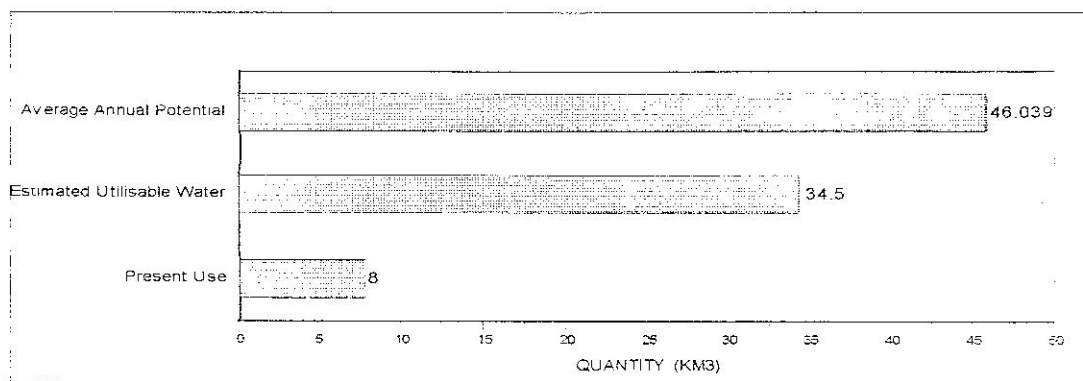
Chapter five deals with Context and Compliance about Environmental and Forestry Clearances and summarises the project activity.



# Chapter-I

## BASIN PLANNING : INDIRA SAGAR PROJECT

Narmada is the fifth largest river of India. It originates from Amarkantak in district Shahdol of Madhya Pradesh at an altitude of 1065 meters and runs through a deep valley between Vindhya and Satpuda ranges for a distance of 1312 Km and joins the Arabian Sea. It runs about 1,100 km in the State of Madhya Pradesh through the districts of Shahdol, Mandla, Jabalpur, Khandwa, Khargone, Dhar and Jhabua and about 170 Km through the State of Maharashtra and 82 Km in the State of Gujarat. Potential and current utilisation of the Narmada Water is given below :



### Brief History

Investigations into harnessing the waters of the Narmada Valley commenced around the time of Independence. There were differences amongst riparian States with regard to sharing of Narmada Water. Therefore, on the application of Government of Gujarat, in order to settle the dispute relating to sharing of water and power among the concerned States of Gujarat, Madhya Pradesh and Maharashtra, the Govt. of India constituted the Narmada Water Dispute Tribunal in October 1969 under Section-4 of the Inter State Water Disputes Act, 1956. The Tribunal investigated the matters referred to it and forwarded to the Central Government a report in August 1978. Award of the Tribunal was gazetted by the Central Govt. on 12<sup>th</sup> December 1979.

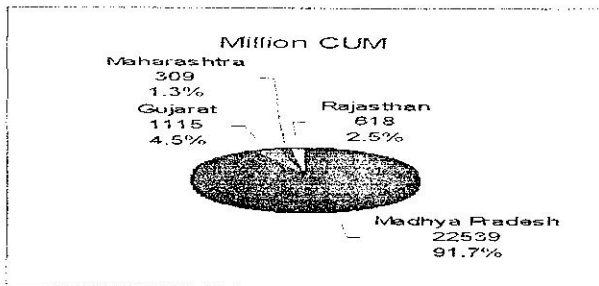
### NARMADA WATER DISPUTE TRIBUNAL AWARD

The total water availability of the river at 75% dependability was estimated by the Tribunal as 34580 mm<sup>3</sup> (28 MAF) and the Tribunal awarded the share of Narmada waters to the different States as follows:





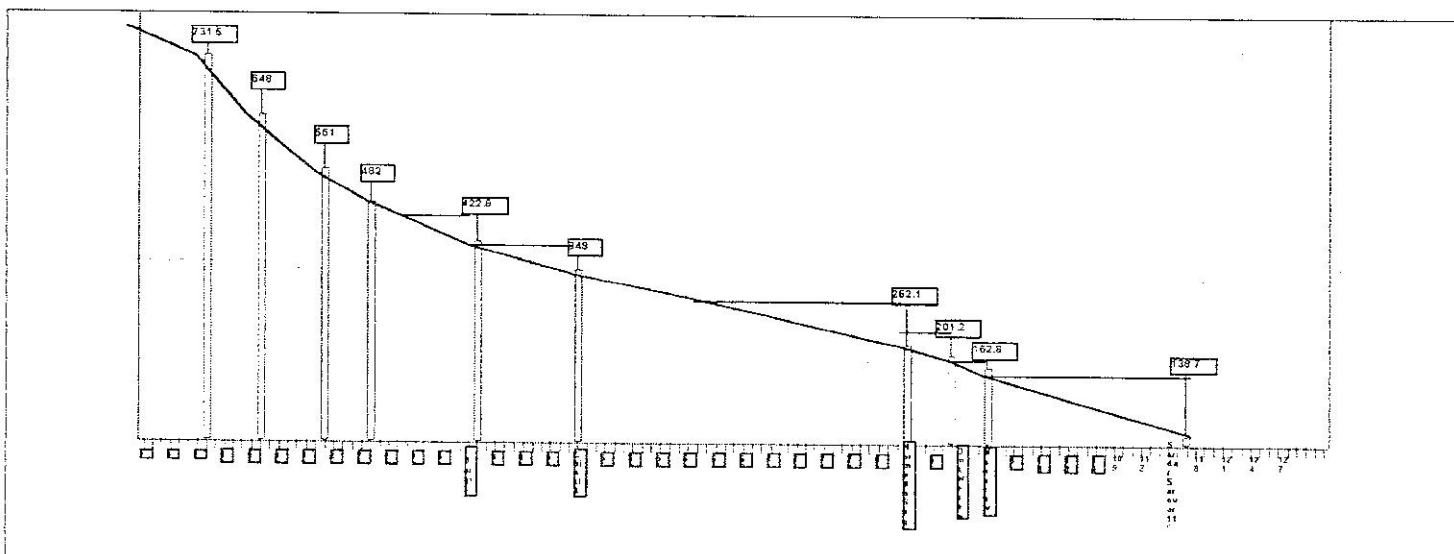
Madhya Pradesh	18.25 MAF (22539 mm <sup>3</sup> )
Gujarat	9.00 MAF (11115 mm <sup>3</sup> )
Maharashtra	0.25 MAF (309 mm <sup>3</sup> )
Rajasthan	0.50 MAF (618 mm <sup>3</sup> )



The Award inter-alia stipulated the FRL of the Sardar Sarovar Project in Gujarat and Indira Sagar Project in M.P. The regulated releases to be made by Narmada Sagar for utilisation at Sardar Sarovar, sharing of cost by Sardar Sarovar in Narmada Sagar and has also stipulated that the construction of Narmada Sagar be taken up by M.P. concurrently with or earlier than the construction of Sardar Sarovar dam.

**NARMADA BASIN PLAN**

After the Tribunal fixed the share of Narmada Water the Master Plan of Narmada Water was prepared for the development of irrigation, industries land domestics requirements. It has been proposed to construct 130 major dams of which 11 would be on the main river and 19 on the tributaries, 135 medium and 3,000 minor projects. All these proposed schemes are in Madhya Pradesh except the Sardar Sarovar Project (SSP). SSP a terminal project on the main stem of the river, is under construction in the State of Gujarat.

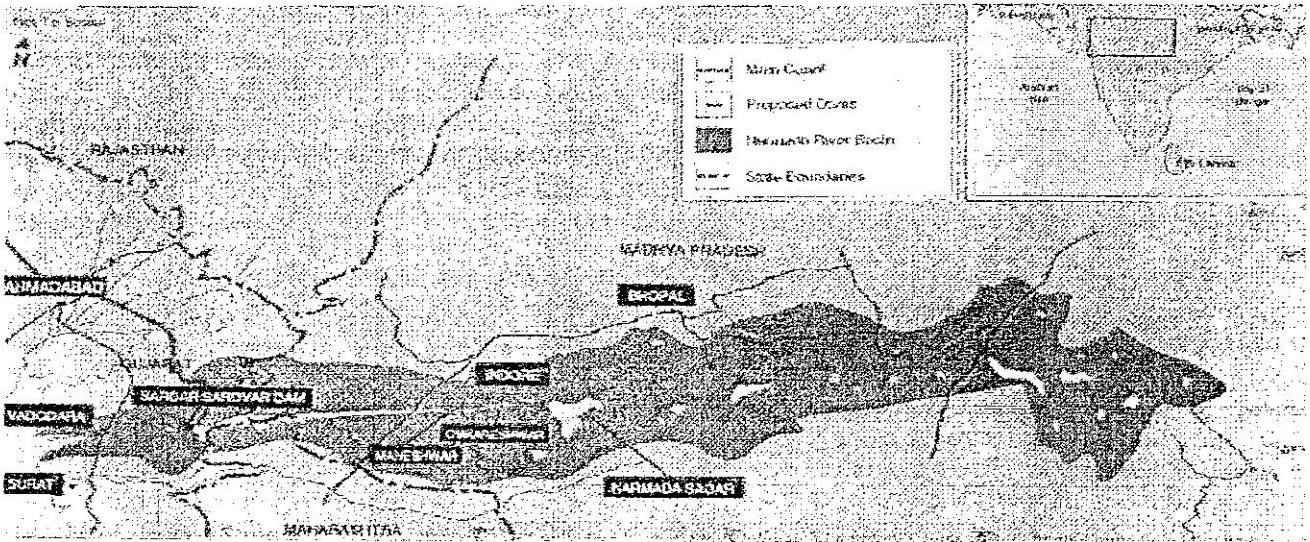


**PROPOSED DEVELOPMENT IN MADHYA PRADESH**

Out of the major projects in Madhya Pradesh, Tawa, Barna and Sukta projects have been completed: and Mateyari, Bargi and Kolar projects are nearing completion. The balance projects, which are in the initial phase of construction, are proposed to be



completed in two phases. In the first phase, Indira Sagar, Omkareshwar, Maheshwar, Bargi Diversion, Man and Jobat Projects are proposed to be completed. The rest of the 17 major projects are proposed to be constructed in the second phase.



Map of Narmada River Basin showing the plan of major projects under implementation

**NARMADA SAGAR COMPLEX, INDIRA SAGAR AND SARDAR SAROVAR PROJECT**

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 of Madhya Pradesh. Omkareshwar, Maheshwar and Sardar Sarovar projects are proposed in the downstream to utilise the regulated releases of Indira Sagar Project for irrigation and power generation. The cascade of Indira Sagar, Omkareshwar and Maheshwar projects together, are known as "Narmada Sagar Complex".

**NARMADA CONTROL AUTHORITY**

The Award also stipulated the setting up of an inter-state administrative authority called Narmada Control Authority (NCA ) for the purpose of securing compliance with the implementation of the decision and directions of the Tribunal. The Award envisaged a coordination and direction role for the Authority. Narmada Control Authority was charged with the power and under key duty to do, any or all, things necessary, sufficient and expedient for the implementation of the Award. The Narmada Water scheme was notified by the Central Govt. in September 1980 setting up the NCA with the duties and functions envisaged by the NWDTA.



The Central Govt. in June 1987 modified the powers. Functions and duties of the Narmada Control Authority. Accordingly, the role of the Authority mainly comprises of overall coordination and direction of the implementation of all the projects, including the engineering works, the environmental protection measures and the rehabilitation programme besides ensuring the faithful compliance of the terms and conditions stipulated by the Central Government at the time of clearance of the aforesaid projects. The Authority was given the mandate to constitute one or more sub-Committees and to assign them such of its function and delegate such of its powers as deemed fit.

To ensure proper planning and implementation of the plan with regard to Environmental safeguards and Resettlement & Rehabilitation, the Authority constituted among others two sub-groups, one each on Environment , under the Chairmanship of Secretary, Govt. of India, Ministry of Environment & Forests (MOE&F), and on Resettlement and Rehabilitation under the Chairmanship of Secretary, Govt. of India, Ministry of Social Justice and Empowerment (MOSJ&E) respectively.

### ENVIRONMENT SUB-GROUP

Environment Sub-Group is headed by Secretary MOEF and has as members one representative each from the four participating States. Representative of ICAR, MOWR, technical experts in the field of forestry, wild life , hydrology, flora, health, archaeology, anthropology, agriculture, and environment. The terms of reference to the sub-group is as follows:

- To work out the environmental safeguard measures to be planned and implemented for the entire Narmada Basin so that the environmental safeguard measures are executed and remain fully in consonance with the clearance accorded to the Narmada Sagar and Sardar Sarovar Projects
- To determine the terms of reference of required surveys necessary for the implementation of environmental safeguard measures inclusive of data-base required, the method by which the data base is to be prepared and also to identify the institutions/individuals to undertake the preparation of such documents.
- To get prepared for clearance by Ministries and NCA the action plans with regard to all environmental safeguard measures and the assessment criteria thereof.
- To devise a suitable monitoring and evaluation mechanism so that the action plans are effectively implemented in consonance with stipulations at the time of clearance of the projects.

### R&R SUB GROUP

The Sub group is headed by Secretary to the Govt. of India, Ministry of Social Justice and Empowerment and have as members one representative from the Madhya Pradesh, Gujarat and Maharashtra and independent members from each State who have contributed in the work of resettlement and rehabilitation. The key functions of the sub-group are delineated below .



- To monitor the progress of land acquisition in respect of submergence of land of Sardar Sarovar Project.
- To monitor progress of implementation of the plan of rehabilitation of affected villages at the selected sites in Gujarat in phases.
- To review the initial or first phase plan from time to time in the light of results of the implementation
- To finalise details of the subsequent phases of resettlement and rehabilitation of the villages.
- To review the reports of the agencies entrusted by each of the State in respect of monitoring and evaluation of the progress in the matter of rehabilitation and resettlement
- To monitor the progress of land acquisition and rehabilitation of the subsequent phases.
- To monitor and review implementation of rehabilitation and resettlement of the subsequent phases.
- To undertake any or all activities to achieve co-ordination amongst States/Agencies in the matter of rehabilitation and resettlement of Sardar Sarovar Project oustees .

The Secretary, Ministry of Environment & Forests have expressed the opinion that R&R aspects of Indira Sagar Project should be monitored by the R&R sub-group of NCA.

#### **NCA REVIEW COMMITTEE**

The Government vide notification No. S.O. 856 (E) dated 22.11.82 has constituted Review Committee of Narmada Control Authority (RCNCA) chaired by Union Minister, Water Resources and the Chief Ministers of four States as Members. The Secretary to the Govt. of India, Ministry of Water Resources has been the convenor of the Review Committee. Later Union Minister of Environment. & Forests was included as Member of the Review Committee vide notification No. 554(E) dated 3.6.87 giving him an opportunity to take up the issues related in Environmental Safeguard.

Review Committee Suo moto or on the application of any party State or Secretary to the Government of India, Ministry of Environment and Forests/ review any decision of the authority. In urgent cases the Chairman of the Review Committee may on the application of the Government of any part State,/ or Secretary to the Government of India, Ministry of Environment and Forests grant stay of any order of the Authority pending final decision on review.





# Chapter-III

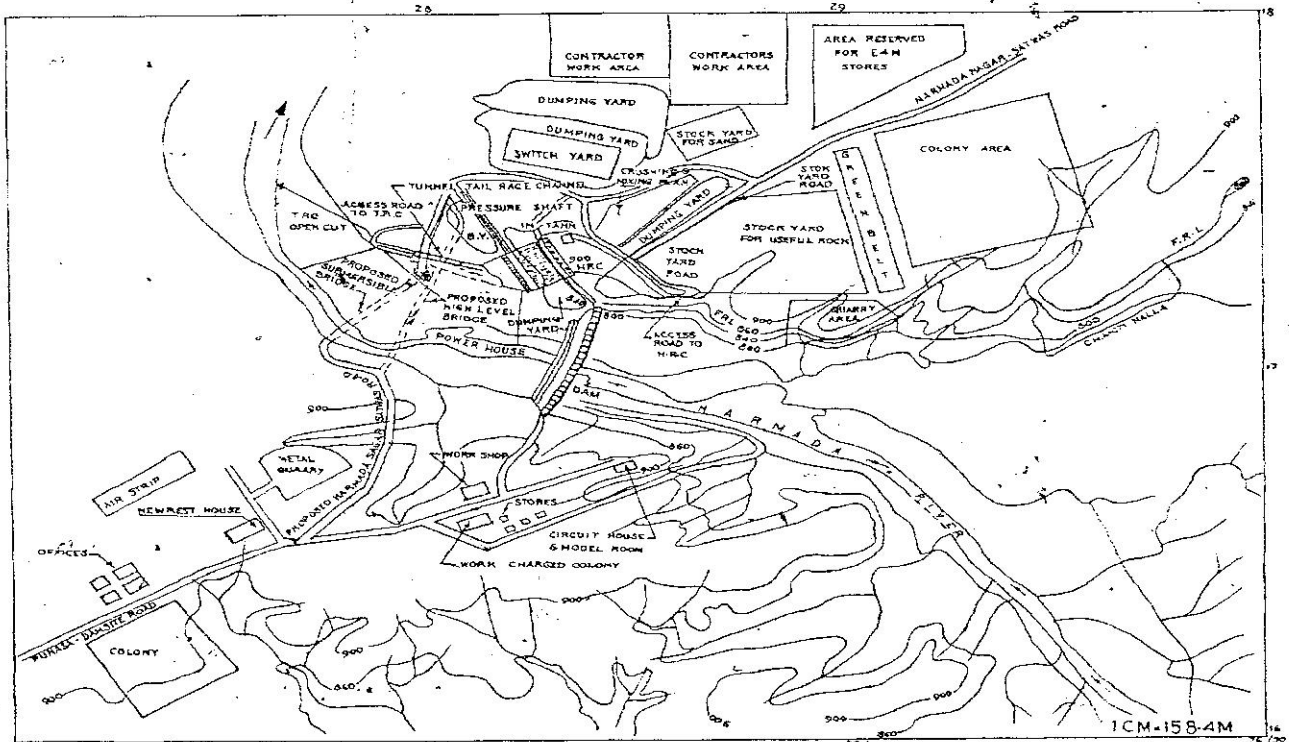
## INDIRA SAGAR PROJECT: ENGINEERING PROPOSALS

The Indira Sagar Project envisages the following main engineering works:

### 1. A concrete gravity dam

The dam is proposed to be 92 m (302 Ft.) high and 653 m (2142 Ft.) in length with a slightly curved alignment of 880 m radius across river Narmada near village Punasa, about 845 km from the origin in District Khandwa with a gross storage of 12,220 Mm<sup>3</sup> (9.9 MAF) and a live storage of 9,750 Mm<sup>3</sup> (7.9 MAF) corresponding to FRL of 262.13 m (860 Ft.). It comprises of 27 blocks, of which 4 to 16 form the main spillway and 17 to 24, the auxiliary spillway. Blocks 1 to 3 and 25 to 27 form the non-overflow section of the dam. The hillock on the right of the dam is also proposed to be raised to the TBL of 267.00 m. For this, Block No.28 to 35 are proposed. There will also be a small saddle dam on the right side of the reservoir.

Project area layout plan showing ISP dam site & Power house



## SADDLE DAM

An Earth dam on a Saddle on the right flank is under construction about 5 km N-NE of Main Dam. The Saddle Dam forms a portion of the road connecting Narmada Nagar and Bhopal via Kannod. The length of Saddle Dam is 688 m, maximum height is 9 m. Seepage drains and extended filter are provided.

## A CENTRAL SPILLWAY

A central spillway of 495 m (1,624 Ft.) long with crest RL of 245.13 m 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 20 m X 17 m.

### ii) A Sub-surface Power House

A sub-surface powerhouse on the right bank is proposed to house 8 units of 125 MW each with conventional Francis Turbines. The design of powerhouse downstream wall was reviewed in the light of comments of Project Review Panel (PRP). CWC had suggested a composite load bearing structure transferring part of load on Power House structure. This modified design has been accepted by PRP and is under implementation.

### iii) A Main Gravity Flow Canal

A lined gravity flow canal takes off from the reservoir with FSL of 239.15 m 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. The project envisages irrigation to a CCA of 1.23 Lakh ha in 564 villages of Khandwa and Khargone districts as per following details.

S.No.	District	Irrigation in Lakh ha (CCA)	No. of villages
1.	Khandwa	0.19	76
2.	Khargone	1.04	488
	<b>Total</b>	<b>1.23</b>	<b>564</b>

The outlet works of Main Canal of Indira Sagar Project to facilitate withdrawal of irrigation requirements are termed as "Punasa Facilities". This system extends upto 9380 m from the reservoir and consists of following components of works.



- i. Open approach channel, 3045 m long (RD 0 to 3045 m) and a 26 m high control structure (at RD 3045 m) for regulating the flows into canal with 188 m long stilling basin (RD 3045 to 3232.75 m)
- ii. A tunnel of 7.75 m diameter and 3677.25 m long (RD 3232.75 to 6910 m) designed to carry a discharge of 185 cumec inclusive of 25 cumec for Punasa Lift irrigation Scheme.
- iii. Open exit channel, 2470 m long (RD 6910 to 9380 m).

### **i) Khargone Lift Canal**

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

## **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 Indira Sagar Project canal. It will serve the areas around Punasa and Mundi villages in the command of the earlier proposed Chhota Tawa Project.

## **Relocation of a Railway Line**

The diversion of a central railway trunk line of 57 kms. between Khirkiya and Talvadia railway stations on Mumbai-New Delhi section is proposed.

## **Plan of Implementation**

The Project was proposed to be completed in different stages as follows :

### **i.) Dam and Power House**

#### **Stage-I**

- Completion of concrete dam and saddle dam upto an elevation of 213 m (700 Ft.).
- Diversion of Railway track between Talvadia and Khirkiya railway stations.
- Rehabilitation of oustees in Harsud town.

#### **Stage-II**

- Completion of concrete dam upto crest level without radial gates, power house and installation of one unit of 125 MW and commissioning of 1st unit by September, 1997.



**Stage-III**

- Installation of radial gates and appurtenant works including remaining 7 units of 125 MW each.

**REGULATED RELEASE TO SSP**

In accordance with Clause-IX of Narmada Water Dispute Tribunal (NWDT) "Final Orders and Decisions", regulated flows corresponding to 10.01 B Cum (8.12 MAF) shall be released from Indira Sagar Project to Sardar Sarovar Project (SSP, ex-Maheshwar).

**ii.) Canals**

The canal system was proposed for completion in three phases as below :

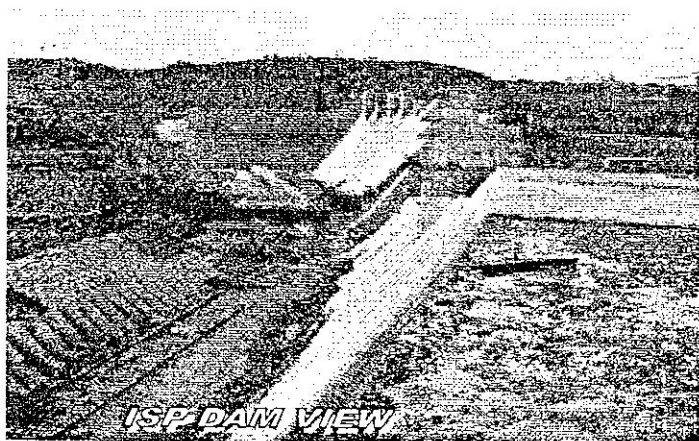
Sl. No.	Phase	Description of canal reach	Proposed Irrigation (ha.) (CCA)
1.	I	Main canal from Km 0 to Km 81.59	36,100
2.	II	Main canal to Km 206.28	82,900
3.	III	Main Canal to km 248.65, including canal from Khargone Lift Scheme	1,23,000

*Note:-\* As per Revised Implementation Schedule of the Project-1992.*

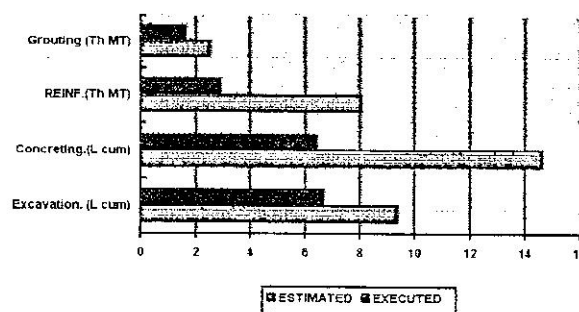
**Progress of works**

**Dam**

Above plan is behind schedule due to various reasons including delayed start and lack of resources. Current Status of works is as follows

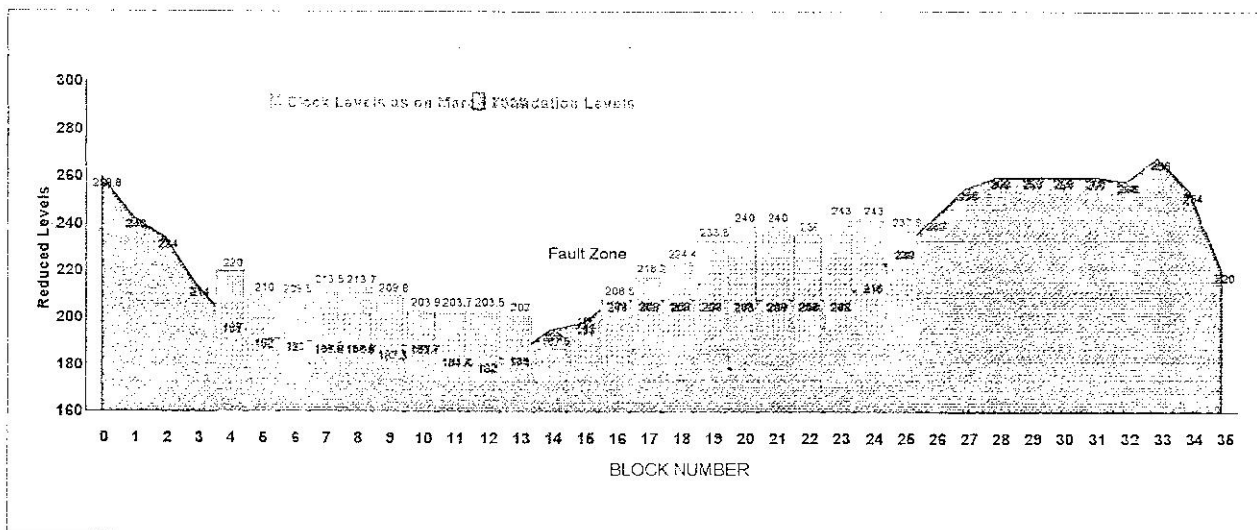


**PROGRESS OF MAIN ACTIVITIES ON DAM**





Diagrammatic view of the Dam profile



Canals: RD 0 - 20.00 KM

In accordance with the revised implementation schedule of January, 1992, first phase of irrigation requires completion of main canal and distributories from Km 0 to 81 Km by June, 1999 for an annual irrigation of 36100 ha. However alignment has been approved for a length of 58.5 Km of main canal. In order to streamline the construction programme, the length of 58.5 km has been distributed to 13 groups. Status of progress of excavation from RD 0 to 20.00 km is as given in Table-

Group	Estd. Quantity Th cum	Contractor	Contract Amount Rs in Crore	Physical Progress		
				Upto Mar 98	Upto Sep 98	%
ME-1 (RD 0 to 1.0 km)	353	M/S Ketil Constr. Indore	3.12	353.0	Completed	Completed
ME-2 (RD 1.24 to 4.56 km)	347 544	M/S Bharat Const. Co. Indore	2.38	411.21	411.21	75.6**
ME-3 (RD 4.75 to 10.0 km)	724	M/S S V Engg Const Co. Nellore	3.79	695.0	Completed	Completed
ME-4 (RD 10.2 to 13.0 km)	594 635	---do---	3.72	595.0	--do--	--do--
ME-5 (RD 13.2 to 20.0 km)	714 760	---do---	4.09	760.0	--do--	--do--

Revised. \*\* Case in arbitration.

Note:-The quantities reported for completed sections may slightly vary on closure of contract after final payments are made.



## COST OF THE INDIRA SAGAR PROJECT

The Detailed Project Report was modified in conformity with the Narmada Water Dispute Tribunal Award and resubmitted in July, 1982 and its 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.1,993.67 crores, besides the cost of command area development being Rs.50.00 crores and catchment area treatment being Rs.124.00 crores. The estimated cost of the project is Rs.2167.67 crores as under at 1988 price level

	Rs. in Crores
Unit -I Dam	832.32
Unit-II Canals	541.98
Unit-III Power	619.37
Catchment Area Treatment	124.00
Command Area Development	50.00
<b>Total</b>	<b>2167.67</b>

The Project has been cleared by the Central Water Commission and Central Electricity Authority with the updated cost of Rs.2,167.67 crores including the cost of environmental improvement to provide irrigation to 1.23 lakh ha. of culturable command area and have an installed capacity of 1000 MW.

## EXPENDITURE

Against the above provision, actual expenditure incurred during the financial year 1998-99 (upto the end of Sept. 98) is Rs. 72.34 crore. Unitwise expenditure upto September 1998 is given in the table below and shown in the adjoining chart.

S. No	Major Head	Total Expenditure Upto 3/98		Expenditure during the year upto 9/98	Cumulative expenditure upto 9/98
		As reported in Apr. 98	As revised by NVDA		
1	Unit-I Dam	620.34	624.71	45.88	670.59
2	Unit-II Canal	104.13	101.43	8.11	109.54
3	Unit-III Power	185.48	196.41	18.35	214.76
TOTAL		909.95	922.55	72.34	994.89



## Chapter-III

### INDIRA SAGAR PROJECT: ENVIRONMENTAL IMPACTS

NWDT laid down the concurrent construction of NSP & SSP for the optimisation of the Water Resources. Similarly, administrative clearance by the Ministry of Environment & Forest from environmental angle also envisioned concurrent development of these twin projects. The two projects namely Sardar Sarovar and Indira Sagar lay down the foundation for the integrated development of the basin generating impacts in the process.

Key environmental impacts generated from alterations in hydrological regime to be effected by construction of Indira Sagar Project are discussed hereunder.

#### SOURCE OF IMPACTS :

##### • ALTERATIONS IN HYDROLOGICAL REGIME

Impounding of a river moderate its natural flow besides regulation of flow due to varied uses of water results in containment of fresh water availability both upstream and downstream. The major changes brought are

- Inundation of lands (forests and agricultural) and village settlements in upstream areas,
- Changes in physico-chemical properties of the lake and
- Synergistic impacts on downstream projects culminating in alterations in the behaviour of the estuary.

#### UPSTREAM : RELOCATION OF VILLAGES

The submergence by the Indira Sagar Project is 91,348 ha of land extending to 249 villages of Khandwa, Hoshangabad and Dewas districts. Depending upon the extent of submergence in the villages, the villages impacted have been categorised as follows :

Phase	Description	No. of villages
I	Villages in which neither abadi nor private land is submerged	38
II	Villages in which neither private land upto 20 ha is submerged nor abadi is submerged	25
III	Villages in which private land upto 20 ha is submerged but abadi is also submerged	2
IV	Villages in which more than 20 ha land is submerged but abadi is not submerged	40
V	Villages in which more than 20 ha is submerged but abadi is also submerged	114
<b>Total</b>		<b>249</b>



The district-wise number of villages affected are as under

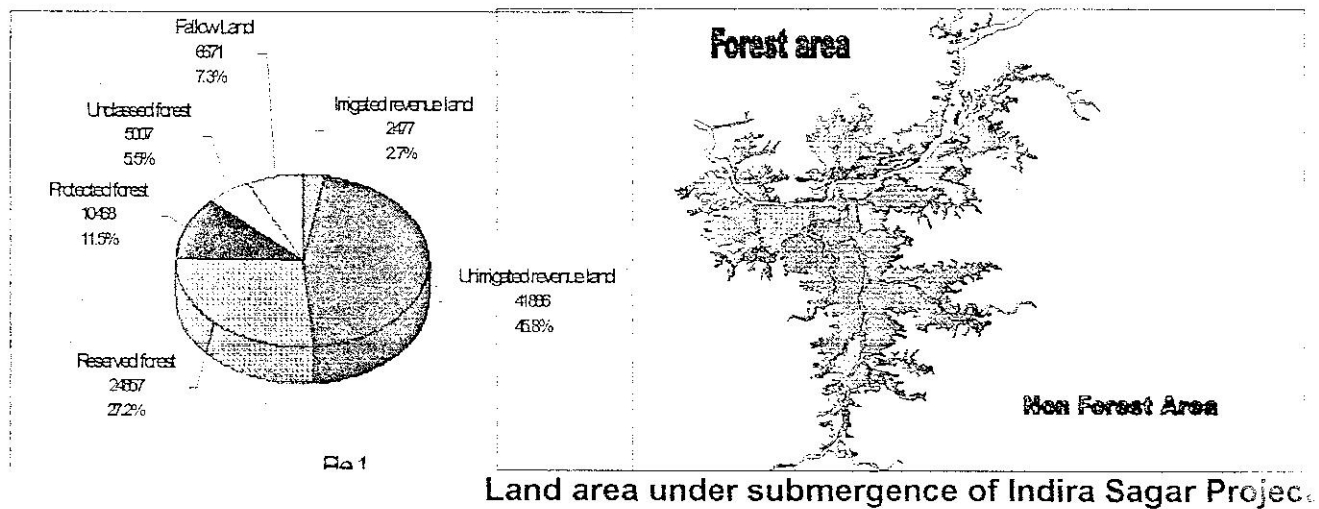
District	Tehsil	No. of villages submerged		Total
		Fully	Partially	
Khandwa	Khandwa	6	14	20
	Harsud	60	82	142
Hoshangabad	Khirkiya	-	9	9
	Harda	1	38	39
Dewas	Khategaon	-	19	19
	Kannod	2	18	20
<b>Total</b>		<b>69</b>	<b>180</b>	<b>249</b>

- Out of 249 villages under submergence, 12 are forest villages.

## UPSTREAM : EDAPHIC ENVIRONMENT

### SUBMERGENCE OF LAND

The break-up of 91000 ha areas proposed to be submerged by the ISP is as under :



## LOTIC ENVIRONMENT : AQUATIC ECO-SYSTEM

Fluvitile biocoenoses are succeeded by lentic ones. The hydrography undergoes a change mainly through changes in act in physico-chemical regime & fluctuations in water level. However, during the period of high inflow and outflow, the reservoir partially resembles lotic environment while during rest of the year, it become lentic. This change in the eco-system from lotic to lentic is to be guarded against negative consequences.





## DOWNSTREAM ENVIRONMENT

Indira Sagar Project is a key project providing water storage which enables the downstream projects in the cascade, i.e., Omkareshwar, Maheshwar and Sardar Sarovar to cater the needs of irrigation and power generation as given in the following table :

Sl. No.	Name of Project	Gross Submergence (Lakh Ha.)	Proposed annual irrigation (Lakh Ha.)	Power Generation (MW)
1.	Indira Sagar	0.91348	1.69	1,000
2.	Omkareshwar	0.9393	2.83	520
3.	Maheshwar	0.04866	-	320
4.	Sardar Sarovar	0.34867	17.92	1,450
<b>Total</b>		<b>1.40474</b>	<b>21.44</b>	<b>3,290</b>

Impacts, downstream of Indira Sagar Project would get synergised by the projects Omkareshwar, Maheshwar and Sardar Sarovar. The cumulative impact on number of parameters like tidal wedge, drift in circulation, water exchange pattern, reduction in silt load, influx in terrigenous nutrients etc. would be rather large. This may cause erosion and aberration in delta configuration downstream of the terminal project.

## ENVIRONMENTAL IMPACT ASSESSMENT

- Proposals regarding diversion of forestland for non-forestry purposes, require statutory clearance of the Ministry of Environment & Forests under the Forest (Conservation) Act, 1980. An Advisory Committee has been setup in the Ministry, for advising the Authorities on merit of the proposal, as envisaged in the above Act. The Forest Conservation Division in the Ministry of Environment & Forest examine the projects which involves diversion of forestland for non-forestry purposes.
- Prior to notification of 1994, which made EIA mandatory for various categories of the projects. Ministry of Environment and Forests was assigned with the responsibility of appraising the projects for administrative clearances from environmental angle. The Ministry has an Environmental Impact Assessment wing comprising the several divisions vested with responsibilities for specific areas. A multi disciplinary staff in the divisions is responsible for scrutiny of the project. To elicit multi-disciplinary inputs for appraisal of projects, the Ministry has constituted Environmental Appraisal Committee. The appraisal committee consists of experts from varied disciplines like water resources management, pollution control, forestry, ecology, landscape planning etc. The membership of these Committees also includes specialists from concerned organisations and individuals who are knowledgeable about the projects under consideration. In addition to the above mentioned Committees, specific groups committees and task forces are constituted from time to time for appraisal of other major projects referred to the Ministry. River Valley Projects, major irrigation projects, and hydel-power projects are appraised by Impact Assessment Division. Based on environmental impact assessment and issues arising thereto, decisions are taken by the concerned Authorities.



## ENVIRONMENTAL AND FOREST CLEARANCE

On the reference received from the Planning Commission for assessing the environmental viability of the Sardar Sarovar and Indira Sagar projects by the Ministry of Environment & Forests, on the basis of the proposals contained in the following documents, the concerned Divisions of the Impact Assessment Wing scrutinised the proposals.

1. Detailed Project Report (DPR).
2. Filled-in Questionnaire on environmental aspects developed by Ministry of Environment & Forests. This questionnaire was meant for providing information on specific queries for determining the likely environmental impacts the project.
3. Environmental Impact Statement (self-assessment), along with Environmental Work Plans, to prevent or mitigate the adverse environmental impacts, were submitted in various stages of completion through a series of meetings between project authorities and the officials of MOEF. This included plans for rehabilitation of project oustees besides, safeguards and control measures towards catchment area treatment, compensatory afforestation, flora & fauna, health, archaeology, seismicity etc. Plans provided monitoring and feed-back mechanism on implementation of necessary safeguards

After preliminary scrutiny, the project authorities were invited for discussions with the experts of the Committees and this was followed up by necessary site visits for on-the-spot assessment of environmental aspects. On the basis of these exercises, the Appraisal Committees made recommendations for consideration of an approval of the proposal with certain safeguards. The recommendations made were considered and administrative clearance from environmental angle, with certain conditions was accorded to the Indira Sagar project, along with Sardar Sarovar project vide MOEF Memo No.3-87/80-I-A, dated 24<sup>th</sup> June 1987.

Proposal for diversion of forestland was considered by the Advisory Committee which looked into the essentiality of the requirement, ecology of the forests and made recommendation for acceptance with suitable safeguards. The conditional approval for diversion of forestland of 4111.97 ha was accorded by the Government of India vide letter No.8/646/84-FC, dated 7<sup>th</sup> October 1987. Subsequent order of the State Govt. of Madhya Pradesh referred to the clearance given by the Govt. of India vide it's letter dated 7<sup>th</sup> October, 1987 and also the Memorandum No.168, dated 13<sup>th</sup> October, 1987 of the Forest Department of Govt. of Madhya Pradesh and the Govt. of Madhya Pradesh's Memorandum of even No. dated 7<sup>th</sup> November, 1987. This order stipulated that having furnished the information with regard to the conditions No. 3 and 5 contained in the clearance order issued by the Ministry of Environment & Forest, Govt. of India, vide Govt. of Madhya Pradesh's letter of even no. dated 18<sup>th</sup> November, 1987, State Govt. of Madhya Pradesh conveyed the approval for diversion of the forestland to the Forest Department vide it's order No.F-5/111/84/10/3, dated November 24, 1987

## CONDITIONS OF ENVIRONMENTAL CLEARANCE

The clearance from environmental angle given to Indira Sagar project along with Sardar Sarovar Project by MOEF was subject to the following conditions :

1. The NCA will ensure that environmental safeguard measures are planned and implemented pari-passu with progress of works on projects.



2. The detailed surveys/ studies assured will be carried out as per the schedule proposed and details made available to the Department for assessment.
3. The catchment area treatment plan and the rehabilitation plan be so drawn as to be completed ahead of reservoir filling.
4. The department should be kept informed of progress of various works periodically.

## **CONDITIONS OF FOREST CLEARANCE**

The key conditions attached with the order of Ministry of Environment & Forests, Govt. of India permitting diversion of forestland were as follows :

- The State Govt. of Madhya Pradesh will intimate by 31<sup>st</sup> December 1987, the complete details of equivalent non-forestland identified for compensatory afforestation, preferably in project impact area.
- The work of compensatory afforestation will be completed in five years' time. Depending upon the availability and selection of suitable area in the non-forest/forestland, a detailed scheme will be prepared by the State Govt. showing yearwise targets and expenditure, keeping in view the cost escalation on account of inflation. The project will release the amount for these annual plantation programmes as per the scheme in the beginning of each financial year in the non-voted fund to the Forest Department of the State Govt., the State Govt. would ensure that these amounts would be in addition to the normal forestry budget.
- Since the project involves violation of Forest (Conservation) Act, 1980, compensatory afforestation will be carried out over suitable degraded forestland double the diverted forest area in extent and in addition to the equivalent area in non-forestland. For this purpose, the area offered by the State Govt. vide their letter No.5/III/84-10-3. dated 14.10.1986 will be accepted and compensatory afforestation raised at the cost of the project in this area.
- The areas will be surveyed, demarcated and declared protected forests and placed under the control of the Forest Department for compensatory afforestation at the cost of the project. Areas not found suitable will be substituted by suitable areas.
- The State Govt. will also intimate details of the non-forestland identified for rehabilitation of the oustees and draw up by 15<sup>th</sup> December 1987 a rehabilitation plan to the satisfaction of the Govt. of India.
- No work on the project in forest area will commence unless conditions (1) & (5) above are fulfilled.
- Under item (2) of paragraph 2 above only 50 hectares should be utilised for construction of the powerhouse only. The proposed colony in the Powerhouse area



should be accommodated in the area of 621.98 hectares already utilised under item (5).

- Sand quarry should be located in the submergence area. Therefore, the area of 72.50 hectares for sand quarries and 41.15 hectares for approach road for sand quarries is not being permitted for non-forest use.
- For conservation and management of wildlife, a committee will be constituted by the State Govt. by 15<sup>th</sup> December 1987 which will include a representative from the Govt. of India. The Committee will suggest the necessary steps to be taken and draw up a plan which will be implemented at the cost of the project.
- Forest clearance will be done only upto 4 M below FRL.
- A plan for the treatment of the catchment area will be prepared by 15<sup>th</sup> December 1987 and implemented at the cost of the project.
- Tree planting will also be done on either side of canal, road and foreshore of the reservoir lands under the control of the Irrigation Department in the command area.
- It was informed by Govt. of M.P. that this point shall be integrated into the command area development plan which is on the anvil.
- Water should be supplied free of cost to the Forest Department for raising nursery and irrigated forest plantations in the command area.
- In order that the construction labour and staff while working on the project in the forest area may not cause destruction of forests for meeting their fuelwood free of cost to the labourers.
- Satisfactory fulfilment of the above conditions will be a deciding factor for the future proposals of the State Govt. for diversion of forestland under Forest (Conservation) Act, 1980.
- Legal status of the forestland will remain unchanged.
- No forestland will be utilised for the rehabilitation of oustees.





The key conditions attached with the order of Department of Forest, Govt. of Madhya Pradesh reconveying diversion of forestland for the ISP were as follows:

1. वन भूमि का वैधानिक स्वरूप परिवर्तित नहीं होगा । भूमि पर स्वात्वाधिकार वन विभाग का ही रहेगा । परियोजना अधिकारियों को केवल वन भूमि के उपयोग की अनुमति रहेगी ।
2. वृक्षारोपण योजना में बताये अनुसार 5 वर्षों में वृक्षारोपण का कार्य गैर वन भूमि / वन भूमि पर पूर्ण किया जाये । वृक्षारोपण के कार्य के लिये प्रति वित्तीय वर्ष में नर्मदा घाटी विकास विभाग 'नान व्हेटेड फण्ड' से वन विभाग को राशि उपलब्ध करायेगा और यह राशि सामान्य वृक्षारोपण हेतु व्यय की जाने वाली राशि से पृथक होगी ।
3. जितने वन क्षेत्र पर वन विभाग की अनुमति के बिना कार्य कर वन ; संरक्षण & अधिनियम का उल्लंघन किया है उसके दुगने बिगड़े वन क्षेत्र पर वृक्षारोपण किया जाये तथा समतुल्य अन्य क्षेत्र पर तो वृक्षारोपण किया ही जायेगा । शासन के समसंख्या पत्र दिनांक 14-10-1986 से भारत सरकार को प्रेषित वृक्षारोपण योजना के अन्तर्गत प्रस्तावित क्षेत्र इस कार्य हेतु मान्य होगा । वृक्षारोपण पर होने वाला पूर्ण व्यय परियोजना के लिये उपलब्ध राशि में से किया जायेगा ।
4. वृक्षारोपण के लिये उपलब्ध कराई गई गैर वन भूमि को ठीक से सर्वेक्षण कर सीमांकित किया जाये और उसे आरक्षित वन घोषित किया जाये और उसे आरक्षित वन घोषित करने की अधिसूचना शासन को शीघ्र प्रेषित करें । गैर वन भूमि में जो क्षेत्र वृक्षारोपण के लिये अनुपयुक्त पाया जाये उसके बदले दूसरी भूमि ली जाये ।
5. भूमि संबंधी दी गई उपरोक्त जानकारी में क्रमांक 2 में उपलब्ध कराई गई केवल 50 हेक्टर वन भूमि पर ही पावर हाउस का निर्माण किया जाये । पावर हाउस क्षेत्र में कालोनी का निर्माण क्रमांक 5 में दर्शित 621.98 हेक्टर वन भूमि पर किया ही जा चुका है ।
6. रेत खादान हेतु 72.50 हेक्टर तथा खादान तक पहुँच मार्ग के लिये 41.15 हेक्टर आवेदित वन भूमि उपयोग पर नहीं दी जायेगी । रेत खादान डूब क्षेत्र में तलाशी जाये ।
7. परियोजना के पूर्ण जलाशय स्तर से 4 मीटर नीचे के बीच से वृक्षों की कटाई नहीं की जाये



8. नहरों के दोनों किनारे, बाँध के उपरी सिरे, उपयोग किये जाने वाले मार्गों के दोनों ओर तथा परियोजना के नियंत्रण की पट्ट पर एवं रिक्त भूमि पर परियोजना के व्यय से वृक्षरोपण के व्यय से वृक्षारोपण किया जाये ।
9. वन विभाग द्वारा कमांड क्षेत्र में तैयार की जाने वाली नर्सरी एवं सिंचित वृक्षारोपण हेतु परियोजना से निः शुल्क जल प्रदाय किया जायेगा ।
10. परियोजना की निर्माणाधीन अवधि में कार्यरत श्रमिकों द्वारा निकटस्थ वन को जलाऊ लकड़ी के डिपो खोले जायें और श्रमिकों को निः शुल्क लकड़ी प्रदाय की जाये ।
11. परियोजना के जलग्रहण क्षेत्र के उपचार हेतु विस्तृत योजना बनाकर परियोजना के व्यय पर क्रियान्वित की जायेगी ।
12. वन्य प्राणियों के संरक्षण व प्रबन्ध हेतु गठित समिति की अनुशंसायें व उनके द्वारा बनाई गई परियोजना के व्यय पर क्रियान्वित की जायेगी ।
13. परियोजना प्राधिकारियों से यह लिखित वचन पत्र लिया जाये कि इस संबंध में भविष्य में कोई शर्तें निर्धारित की जाती हैं तो वे उसे मानने के लिये बाध्य होंगे ।
14. प्रभावित वन क्षेत्र से काटे जाने वाले वृक्षों पर जो भी व्यय हो वह परियोजना प्राधिकारियों से लिया जाये । इसके अतिरिक्त वन भूमि उपयोग पर देने के पूर्व जो भी मुआवजे या राशि हो वह परियोजना प्राधिकारियों से वसूल कर ली जायें ।

## **INVESTMENT CLEARANCE AND ADMINISTRATIVE APPROVALS**

### **Planning Commission**

On 6.9.87, the Planning Commission issued the investment clearance of ISP at a cost of Rs.1993.67 crores. The State Govt. was required to comply with the conditions laid down by MOEF while according environment and forest clearances and also establish adequate network for ground water monitoring in the command within 2 years.

### **CLEARANCES BY CWC AND THE GOVT. OF MADHYA PRADESH**

The techno-economic clearance by the Central Water Commission was given in 1984. Accordingly, the State Government of Madhya Pradesh have earlier accorded administrative approval to the estimate amounting to Rs.1,392.85 crores in September, 1984. The administrative approval for the updated estimated cost at December, 1988 price level amounting to Rs.2,167.67 crores (including environmental cost etc.) was accorded by the State Government of Madhya Pradesh.



## Chapter-IV

# ENVIRONMENT RESOURCE: PLANNING AND IMPLEMENTATION

## K<sub>EY</sub> ISSUES

The action plans and status of studies and implementation of Environmental Safeguard Measures are being ensured through regular monitoring by the Environment Wing of the NCA and periodically reviewed by the Environment Sub-group of NCA. Status of works on the identified key issues, wherever referred refers to the period ending March 1999.

### 1.

## RESETTLEMENT & REHABILITATION

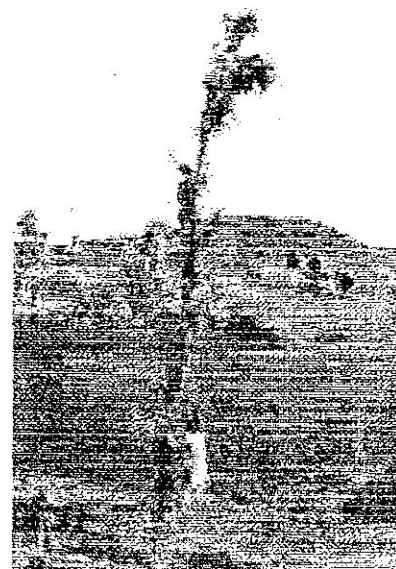
The MOEF clearance granted in 1987 stipulated that the rehabilitation plan be drawn as to be completed ahead of reservoir filling

### REHABILITATION POLICY

During November 1987, the State Government of Madhya Pradesh enunciated a very liberal rehabilitation policy for Narmada Sagar Complex projects. The main objects of this policy were to improve, or at least, regain the standard of living of the affected population that they were enjoying prior to their relocation. This policy was updated and revised during 1994 and again during 1998 to the further advantage of the PAFs. Salient features of the 1994 policy are summarised below.

#### POLICY OF 1994

- The aim of the State Govt. is that all displaced families as defined hereinafter, would, after their relocation and resettlement improve, or at least regain, their previous standard of living within a reasonable time.



- It would be ensured that no hardship is caused to the displaced families in moving out from the present habitat into a new place and way of living.
- It would be ensured that no adverse social, economic and environmental effects of displacement would take place on the host communities.
- Special care would be taken of the families of Scheduled Castes, Scheduled Tribes, marginal farmers and small farmers.
- Families having legal titles to land and the encroachers would be treated on the same footing for the purpose of entitlement for compensation or for payment of an amount equivalent to compensation as the case may be and for their rehabilitation.
- No distinction would be made between the families displaced from revenue villages and the families displaced from the forest villages and the families displaced from the forest villages in respect of their rehabilitation.
- Reasonable compensation would be determined for the lands, buildings and other immovable assets acquired. Similarly, a reasonable cost would be charged for the lands that would be allotted at the new sites.
- Displaced families would be rehabilitated, maintaining the existing structure of social groups as far as possible, in the command area or near the periphery of the affected areas in accordance with their preferences.
- Adequate physical and social infrastructure and community services would be provided at the new sites.
- While resettling families entitled for allotment of land, it will be ensured that viable units of land are given.
- In order that in the process of resettlement, the new and host families get fully integrated, the displaced families would be encouraged and assisted in purchase of lands from voluntary sellers of the host villages.
- The rehabilitation policy be so implemented that middlemen and profiteers would get eliminated.
- Landless agricultural labourers and non-agriculturist families would be assisted in rehabilitation at the new places by giving grant-in-aid in the initial period and self and wage employment opportunities.
- Displaced families would be given priority in employment on the project construction.

## REHABILITATION PLANNING

### • REHABILITATION PLAN OF 1987

Plan prepared Initially, by the Govt of Madhya Pradesh during 1987 was for implementation of R&R in five phases. Each phase corresponded to the submergence levels to be effected by the construction activity as given below:

Phase	RL of water in meter	No. of villages	Land acquisition year	Rehabilitation
I	225.75	12	1989	1990
II	237.75	40	1990	1991
III	250.00	39	1991	1992
IV	256.00	48	1992	1993



V	262.13	115	1993	1994
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The key features of this plan were as follows:

- The total requirement of the land was estimated at 40,000 ha.
- M.P. Consultancy Organisation, Bhopal provided detail baseline data for each household in the affected villages. Agricultural land and house sites were identified. Civic amenities to be made available at the relocation sites were listed.
- Choice of relocation site was provided.

The district-wise number of villages affected were as under

District	Tehsil	No. of villages	Total Population	SC Population	ST Population
Khandwa	Khandwa	21	12864	1175	6185
	Harsud	146	87137	12473	15026
Hoshangabad	Harda	48	15446	2774	4910
Dewas	Khategaon	20	5814	816	1624
	Kannod	19	8135	1041	1092
<b>Total</b>		<b>254</b>	<b>129396</b>	<b>18279</b>	<b>28847</b>

- Out of 249 villages under submergence, 12 are forest villages and 237 villages were the revenue villages.

#### • REHABILITATION PLAN OF 1994

The plan laid the requirement of land at 2044 ha for rehabilitation and 42728 ha for agricultural land as delineated below:

S.N.	I.	II.	III.	IV.	V.	VI.	
1.	Phase	Phase-I	Phase-II	Phase-III	Phase-IV	Total	
2.	Total land (ha)	9199.303	3713.001	13385.460	59228.632	85526.396	
3.	Affected land (ha)	9199.303	3713.001	12008.030	19578.555	44498.889	
4.	Affected families	General	4277	415	2516	4024	11232
5.		SC	358	130	534	996	2018
6.		ST	594	377	607	1596	3174
7.		<b>Total</b>	<b>5229</b>	<b>922</b>	<b>3657</b>	<b>6616</b>	<b>16424</b>
8.	Affected Major Sons	General	2795	362	2339	4113	9609
9.		SC	239	92	476	821	1628
10.		ST	357	340	488	1893	3078
11.	<b>Total</b>	<b>3391</b>	<b>794</b>	<b>3303</b>	<b>6827</b>	<b>14315</b>	
12.	Total (VII+XI)	8620	1716	6960	13443	30739	
13.	Land required	Rehabilitation sites (ha)	535.14	420.00	579.10	509.16	2043.58
		Agricultural land (ha)	13327.66	11384.00	5798.00	12218.00	42727.61

- Household socio-economic survey was completed through 64 columns/ Proforma.
- Total affected families and major sons are estimated to be 30,739.
- Out of the 85,526 ha, the total land affected is 44,498.889 ha.

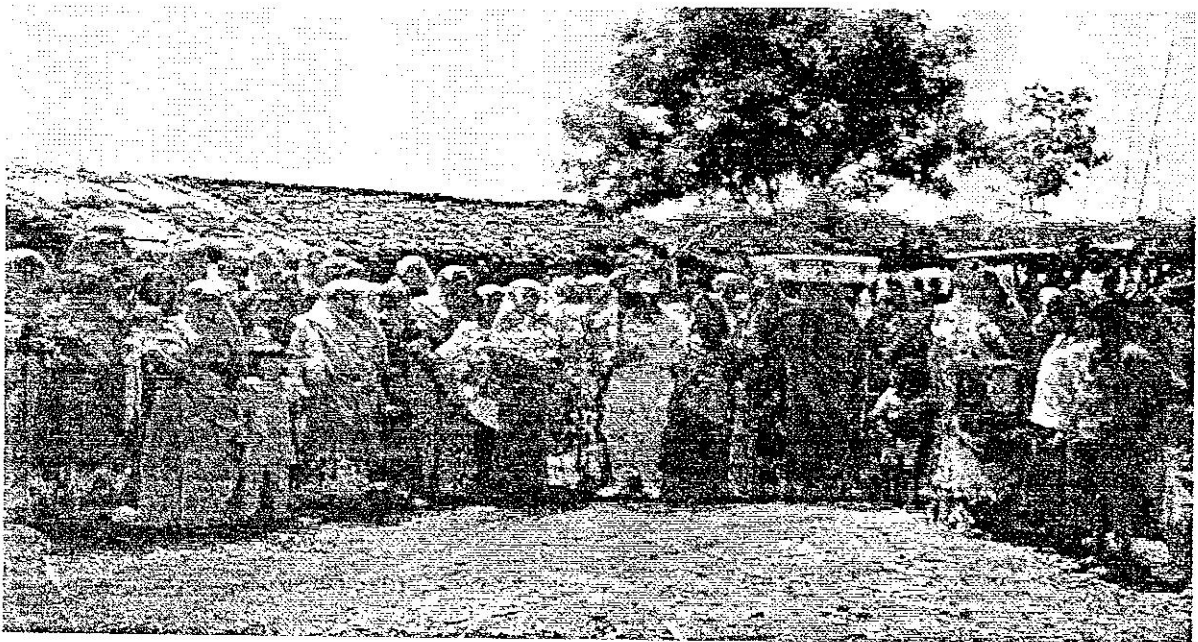




- Plan estimates, the requirement of 47,728 ha of agricultural land besides 2044 ha of rehabilitation sites for resettling the PAFs.
- Plan indicates availability of the Government land of 4600 ha for resettlement and indicates that land of 40172 ha was likely to be available from private sources. However, these sources were not identified and were left for the PAFs to locate himself.
- The plan outlines establishment of dissemination of information system and seeks to ensure people's participation in the rehabilitation process and cooperation of non-governmental organisation and the people besides consultation with oustees.
- Plan envisages right of appeal to the District Collector to be disposed-off within three months.
- Existing Harsud Town was to be submerged by 1998 and its inhabitants were to be resettled at village Chhanera village which was only 17 Km away from existing township.

## **IMPLEMENTATION OF THE EXISTING PLAN**

The reservoir of ISP would cause partial or full submergence of 249 villages (Partial 69 villages and full 180 villages), in the districts of Khandwa, Dewas and Hoshangabad affecting 44363 ha of private land and 80572 people or 30,739 families. The land acquisition will be carried out only in 211 villages because Government land is coming under submergence in the remaining 38 villages.



By the monsoon of 1999, 13 villages having a population of about 2200 families are likely to be submerged. These families are planned to be resettled in 7 R&R sites namely : Sarliya, Satwas, Bedhani, Anjhia Khurd, Khalwa, Kala Patha and Chainpur. Out of these 13 villages, PAFs of Dhari Kotla village (which was submerged due to construction of coffer dam) have been resettled at Sarliya rehabilitation. Budget provision



of Rs. 30 million was made. Out of this budget about Rs. 14.5 million were made available to the rehabilitation officer during 1998-99. The progress achieved is summarised below

1. No. of villages for which award is passed	24
2. No. of villages under progress of land acquisition	13
3. Total habitation land to be acquired	700.15 ha
4. Total habitation land acquired so far	167.94 ha
5. Total agricultural land to be acquired	41706.09 ha
6. Total agricultural land acquired so far	8018.41 ha
7. Total forestland acquired so far	1979.28 ha
8. Compensation paid up to 31.03.1998	Rs 45.55 crores
9. Land purchased by PAFs through Sauda-Chitthi	
Land purchased	1302.05 ha
No. of PAFs	558
10. Resettlement Completed	
No. of village (Dharikotla)	1
No. of PAFs	37

## **LINKAGE OF DAM CONSTRUCTION WITH RESETTLEMENT ACTIVITIES**

According to the implementation schedule of the dam the effect of submergence will be as follows :

The rehabilitation and resettlement and land acquisition plans takes care of shifting and compensating losses due to the flood effects. Similarly, effects due to pondage in subsequent years, i.e., 1995, 1996, 1997 and 1998 has been considered while planning the land acquisition and rehabilitation & resettlement activities. It was unanimously decided in 33<sup>rd</sup> meeting of Narmada Control Authority held on 30<sup>th</sup> January 1990 that one in hundred years frequency flood (24.5 Lakh Cusecs) shall be used for back water computations for giving flood working to the villages likely to be affected at the intermediate stages of construction and back water.

In order to provide a needed linkage between implementation of rehabilitation and resettlement activities and the schedule of Indira Sagar Project dam construction, it has been planned to ensure that all the entitlements have been given to the PAPs before proceeding with the further construction of the dam.

A computerised database in a dBASE III<sup>+</sup> medium incorporating only those data elements that are considered absolutely essential to provide the necessary information on the progress of rehabilitation & resettlement and to track the progress of works at relocation sites has been developed. The information for each PAP will be collected from the Rehabilitation Officer in the input and will be fed into the computer and the results will be linked to the dam construction schedule.



The certification proformance have been devised in order to certify that the PAP has been given all the entitlements and development of sites work is in progress. The necessary certificates will be given after proper check by senior officers. It is contemplated that the Rehabilitation Officer will be check 100% of the entries, Additional Director (Rehabilitation & Resettlement) will check 10% and test checks will be done by the Secretary (Rehabilitation & Resettlement) and Narmada Valley Development Authority.



## 2.

### **CATCHMENT AREA TREATMENT**

The Narmada River drains a total catchment area of 9.879 million ha. upto it's mouth at the Arabian sea. Out of this, about 6.164 million ha forms the catchment area of Indira Sagar Project. The freely draining area of Indira Sagar Project down stream of Bargi Dam is about 3.925 million ha. The prioritisation at watershed level using LANDSAT TM data of 1:2,50,000 scale was completed much before 1986

The master plan for treatment of the Indira Sagar catchment area was submitted by the state Govt. of M.P. during December 1986 about 7,920 km<sup>2</sup> was classified as critical *catchment area to be treated*. *Establishment of priority in areas to be treated was followed* by a detailed soil survey to determine what treatment measures would be most effective. This surveys was carried-out by the All India Soil and Land Use Survey Organisation of the Govt of India during 1989 to 1991, which was subsequently revised and updated during 1993.

### **THE POLICY FRAME-WORK**

GOI issued a directive in July 1992 that, for the ISP, the project would bear the costs of the treatment of all critically degraded sub-watersheds draining directly into the reservoir. These watersheds were identified amongst those classified as either very high or high-priority categories by the All India Soil and Land Use Survey Organisation (AISLUSO). The project would also be responsible for the treatment of those areas of the catchment which are directly damaged by the project activities. In addition, plans are required to be prepared for the treatment of the balance of the critically degraded sub-watersheds but the cost of this was to be met from other ongoing schemes and in a timeframe to be determined. The MOEF clearance granted in 1987 contained two conditions pertaining to CAT, as follows:

- More detailed surveys for prioritisation of the sub-catchments in the ISP area should be undertaken;
- A phased CAT programme should be prepared and implemented ahead of reservoir filling.

In order to determine appropriate soil and water conservation measures, surveys of topography and vegetative cover was also carried-out by the M.P. Agriculture Department. The vegetative cover survey was completed by the M.P. Forest Department. Both surveys were completed by 1992-93, Expert agencies and consultants involved in the preparation of the master plan agreed that treatment of the catchment area would require both engineering and biological measures. The type of treatment would depend on the nature of the topography, the soil characteristics, the climate, and the forestry or farming use to

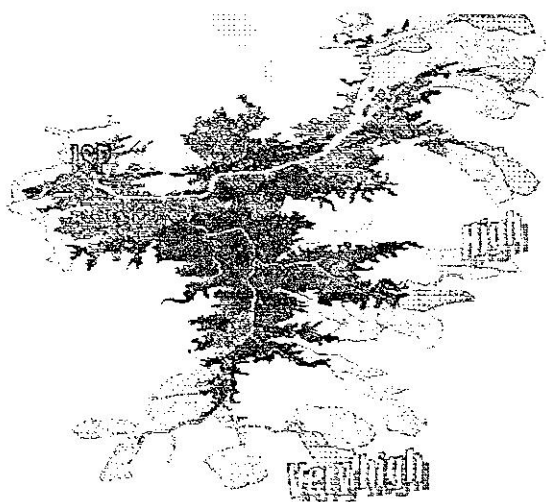


be made of the land. Recommended treatments included contour bunding, bench terracing, gully plugging, training and diversion of streams, levee construction, and planting of timber and fuelwood or fodder and pasture. The Action Plan also laid down the construction of farm ponds and silt detention tanks. This led to the submission of Macro-watershed plans, delineating extent, land use, measures of treatment and a phased programme. To ensure quality of works staffing to carry out the treatment works in the agriculture and forest areas is provided by the M.P. Agriculture and Forest Departments respectively. Funds are being provided by the NVDA project budget. The work is spread over a period of ten years so that its completion will correspond with the completion of the Indira Sagar reservoir

**PHASED PROGRAMME**

AIS&LUSO in their final report have identified 508 no of critically degraded sub-watersheds (having Silt Yield Index of 1200 and above), covering an area of about 1.084 million ha. On the basis of their proximity to the reservoir these watersheds have been planned for treatment in two phases namely phase-I and phase-II. Phase-I programme covers those sub-watershed which drain directly into the reservoir. Whereas Phase-II programme covers all those critically degraded sub-watersheds not covered by the phase-I programme.

**1. Directly draining sub-watersheds:**



On the basis of the report of 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 gross area of about 73,456 ha. The net area available for treatment however, was 62975 ha. Schemes have been drawn to treat this area pari-passu with construction works on the project.

Programme and Progress of works: Target = 62,975 ha.\* Progress = 40,818 ha.

	Upto 93-94	94-95	95-96	96-97	97-98	98-99	Cumulative
Non-forest area/ha (51,927 ha)	21,700.00	7,224.00	3,878.00	2,757.00	1,561.00	835.00	36,790.00
Forest area (11,048ha)	-	2,623.00	240.00	NIL	NIL	NIL	2,863.00
Total Area: (62,975 ha)	21,700.00	9,847.00	4,118.00	2,757.00	1,561.00	835.00	40,818.00

\* In addition an area of 1636 ha. was treated up under pilot project earlier.





2. Freely draining area (Excluding Directly Draining Sub-watersheds)

Number of Sub-watershed 478, Gross Area 10,12,650 ha. Net Area 9,15,150 ha.

Schedule of Implementation: (Area in 000 ha.)

Year	Target			Plans covering area				Progress over area			
	FA	NFA	TOTAL	Submitted		Approved		FA	NFA	TOTAL	
1995-96	0.00	18.00	18.00	0.73	0.196	N.R	0.196	N.R	N.R	N.R	
1996-97	0.00	18.00	18.00								
1997-98	10.00	27.00	37.00	Not Reported							
1998-99	10.00	28.80	38.80								
99-2000	10.00	28.80	38.80								
2000-01	10.00	28.80	38.80								
2001-02	10.00	28.80	38.80								
2002-03	10.00	28.80	38.80								
2003-04	10.00	28.80	38.80								
2004-05	10.00	28.80	38.80								
2005-06	10.00	28.80	38.80								
2006-07	10.00	28.80	38.80								
2007-08	8.43	28.80	37.23								
2008-09	0.00	28.80	28.80								
2009-10	0.00	28.80	28.80								
2010-11	0.00	28.80	28.80								
2011-12	0.00	28.80	28.80								
2012-13	0.00	28.80	28.80								
2013-14	0.00	28.80	28.80								
2014-15	0.00	28.80	28.80								
2015-16	0.00	28.80	28.80								
2016-17	0.00	28.80	28.80								
2017-18	0.00	28.80	28.80								
2018-19	0.00	28.80	28.80								
2019-20	0.00	28.80	28.80								
2020-21	0.00	28.80	28.80								
2021-22	0.00	28.80	28.80								
2022-23	0.00	26.40	26.40								
2023-24	0.00	26.12	26.12								
<b>Total</b>	<b>108.43</b>	<b>806.72</b>	<b>915.15</b>								

N.R = Not Reported

- 5 projects for seeking funds for 40 sub-watersheds covering an area of 53,709 ha. of forest were submitted by NVDA to National Afforestation & Eco-Development Board.



## 3.

**COMPENSATORY AFFORESTATION**

The preceding section presented information on the areas of forest that would be inundated by the Indira Sagar reservoir. Many of the project impacts will be in the form of direct losses associated with submergence. In the case of forests, the areas to be submerged are known and the resources have been inventoried for the most part. The plan identified forest losses in M.P. associated with the project as follows: State Govt. plans to mitigate forest and wildlife losses include compensatory afforestation and wildlife protection measures.

Approval for the diversion of forest land for the ISP was granted by the MOEF in 1987 & 1990. A total of 40,332 ha. forest land would come under submergence and an additional 779.90 ha. of forestland has been diverted for the residential colony, powerhouse complex, dam, saddle dam and approach roads. Subsequently, another 308.40 ha. of forestland was permitted to be diverted for power house.

Thus a total of 41,420 ha. of forestland has been permitted to be utilised for the construction of ISP but several conditions, relating to the planning and implementation of CAF as summarised in earlier sections, were attached in the clearance order issued.

District	Loss in hectares
Khandwa	33,383
Dewas	4,528
Hoshangabad	3,678
	<b>41,589</b>

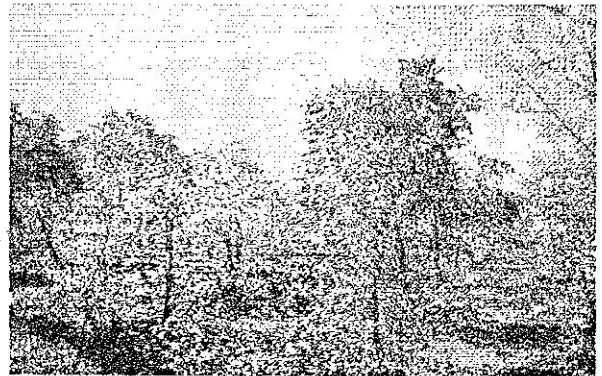
**PLAN OF AFFORESTATION AND REFORESTATION**

To compensate for this loss of forest the M.P. Forest Department submitted a Revised Action Plan for Compensatory Afforestation for the Indira Sagar Project in December, 1986. Accordingly, 10,143 ha. of non-forest and 70,802 ha. of degraded forest land has been identified for compensatory afforestation, in the districts of Khandwa, Hoshangabad, Dewas, Sehore, Dhar and Khargone as follows. It was envisaged to implement this plan within a ten years period commencing 1989-90

District	Degraded Forest (In Ha.)	Area other than forest (In Ha.)
Khandwa	30,572	2,314
Hoshangabad	22,739	2,842
Dewas	17,491	802
Sehore	-	1,247
Dhar	-	1,001
Khargone	-	1,937
Total	70,802	10,143



Considering that with the dedication of vast areas to the proposed National Parks, some adverse impacts on the local population's nistar needs may develop and that the wood from the submergence zone was expected to meet local fuel needs for about 8 to 10 years, more emphasis was placed on fodder production in plantation areas in Khandwa and Dewas divisions. The plantations were to provide shelter and habitat to wildlife also.



Programme of Compensatory Afforestation:

Targets = 80,945 ha. Progress = 67,133 ha. Balance targets = 9,812 ha.

	Prog. upto 91-92	92-93	93-94	94-95	95-96	96-97	97-98	98-99	Cumulative
Degraded forest area(70,802 ha)	23,048	11,919	12,987	4,056	2,902	162	3,204		58,278
Non-forest area (10,143 ha)	5,239	1,390	1,327	667	131	NIL	101		8,855
Total (80,945 ha)	28,287	13,309	14,314	4,723	3,033	162	3,305	4000	67,133



# 4.

## COMMAND AREA DEVELOPMENT

The Command area proposed to be irrigated by the ISP spreads on the left bank of the Narmada River. It comprises territory falling in the Khandwa tehsil of Khandwa District and six tehsils of Khargone District. The Satpura Ranges flank the command on the south. The northern boundary is formed by the Narmada River itself. The land of the command comprises Forest:10,055ha; Grasses and pastures:10,498ha; Cultivated land: 142,406ha; Culturable fallow : 8,116ha ; Barren:18,385 ha.

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

- Optimum utilisation 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 of integrated fisheries development.
- 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,
- roads etc.

### Geology

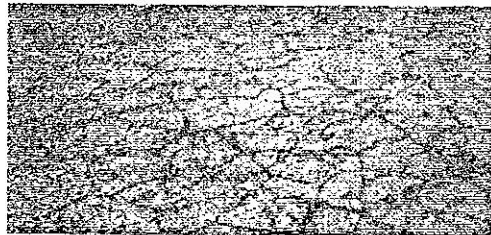
The project command area encompasses the Narmada Sone lineament. The command area is mostly composed of basaltic lava flows. These flows are designated as deccan traps. The thickness of lava flow ranges from 6.5 m to 30 m with presence of vesicular and amygdaloidal basaltic flow with appreciable weathering on top. At lower depths, the 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.



**SOILS**

In 1975, at the request of the Narmada Water Dispute Tribunal (NWDT), the Gwalior Campus of J.N.K.V.V. University undertook a reconnaissance survey of the Indira Sagar Command, using a 2-mile grid. Nearly 265 soil profiles were examined.

During 1982-83, to appraise land irrigability, an area of about 2,80,000 ha. falling within parts of Khandwa and Khargone districts was surveyed by the Department of Agriculture, M.P.. Surveys were carried out on 1:50,000 – scale toposheets. Aerial photo-interpretation was carried out wherever possible. About 366 profiles and about 2787 auger bores were examined. The rate of profile examination was about 1 per 1000 ha. A total of 30 soil series were mapped. Areas falling under different classes of depth, erosion, slope, texture, and land irrigability subclasses were identified. This report indicated that typical vertisols are not extensive in the surveyed area.



A detailed reconnaissance soil survey of the Indira Sagar Command Area was also carried out in January 1984 by the Directorate of Agriculture in co-ordination with the Govt. of India, National Bureau of Soil Survey and Land Use Planning Wing and the Agricultural University, Jabalpur in the command area of 2.10 lakh ha. The soils of the areas have been classified into 26 soil series taking into account the morphological features, topography, and physical and chemical characteristics. As per soil taxonomy (1970), altogether three orders, three suborders, three great groups, eight subgroups and ten families have been identified. Soils have been classified into various recognised classes in terms of their suitability for irrigation.

Sl. No.	Land Irrigability Class	Slope Percent	Depth of Soil (in cms.)	Percentage of gross command area
1.	2	0-3%	More than 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

**ANTI-WATERLOGGING : STUDING AND PLANNING**

In order to study whether full irrigation would lead to waterlogging and salinity problems, state govt of Madhya Pradesh commissioned special studies on subsurface drainage and groundwater behavior to the Indian Institute of Science at Bangalore. For study purposes, the entire Narmada Sagar Complex Area was divided into 34 hydro-geological zones. The studies considered the following :

- Rainfall data from stations around the composite command.





- Runoff as measured in nearby gauging stations.
- Evaporation rate data.
- Climatological data.
- Groundwater-level data from all types of wells.
- Pump test data.
- Hydro-geological information on wells and aquifers.
- Soil and soil moisture data.
- Agricultural land use data, including information on crops and the seasonal nature and extent of surface water and groundwater irrigation
- Proposed crop-water requirements.

The Bangalore institute's study concluded that conjunctive use of surface water and groundwater on a significant scale would be required to avoid waterlogging and salinity problems in the Composite Command Area. Study data indicated that a water balance of 70% surface water and 30% groundwater would be suitable in most project areas to avoid waterlogged conditions. Two conjunctive use of pumping patterns were studied: uniform pumping throughout the year and non-uniform pumping, with no groundwater use from May through August. It was found that the maximum area over which water levels rose to within two meters of ground level was somewhat greater for the non-uniform pumping pattern, but after the monsoon the water level receded much more rapidly for the non-uniform pumping pattern than for the uniform pattern. Studies in the 34 zones indicated the need for a density of one well for every 6.5 ha. on average over the gross Command Area. This result was compared with the existing situation in the Satark Command where there is a well for every 7.3 ha over the gross area. The conclusion was that groundwater development to the proposed density is feasible. There were about 10,700 dug wells in the Indira Sagar Command Area in 1980. Accordingly, this required an additional 33,300 wells.

Natural drainage conditions in the Narmada Sagar Complex Command Areas are quite favourable as Indira Sagar area has a well-developed natural drainage system. The command complex lies on both flanks of the Narmada River, with a number of tributaries draining the area towards the Narmada River. The slope of the cultivable land generally ranges from 1 to 3% and it has good natural drainage. The groundwater aquifers are deeply incised, and major problems of surface drainage do not appear to exist. Surface drainage will, however, be required after irrigation is implemented through the provision of a proper network of field drains so that excess water will be removed from the cultivated fields.

Irrigation water from the Narmada River will be of good quality, and normal irrigation applications are considered sufficient to leach out the salts from saline/sodic soils. No additional leaching requirements will generally be necessary. Project planners do not expect any salinity problems if proper surface and subsurface drainage systems are installed.

In keeping with the study conclusions, planning for the Indira Sagar Project includes maintaining a water balance of 70% surface water and 30% groundwater use, lining of the canal distribution system from the Main Canal upto the eight ha. service area, and installing and maintaining surface and field drainage systems. Because of the deeply incised aquifers,



plans for surface and field drains, and plans for conjunctive use of surface water and groundwater, the planned groundwater monitoring programme would be sufficient to indicate the needed remedial measures. Essentially all of the groundwater development will be undertaken by the farmers, however the State Govt. plan to take appropriate action to encourage planned groundwater development on schedule and to ensure that the required 30% of the total irrigation demand was met from the groundwater. If groundwater development does not occur on schedule because of the lack of farmer initiative or because of problems with water quality or adverse aquifer conditions, state govt plan to step in and install appropriate drainage systems whenever wherever needed

The plan adopted by NVDA to ensure the removal of excess water is simple and straightforward. Surface waters will normally flow uncontrolled to disposal areas, except where low-lying lands require pumping. Surface water pumps will be designed to operate automatically. NVDA groundwater pumps will be operated as needed to control groundwater levels, with usable water being introduced into the canal system. Excess flows will enter the main drainage system by gravity from the local collector systems. Project reservoirs will reduce the frequency of flooding in the Command Areas but the drainage facilities will not reduce or control flood flows.

Reports on the quality of groundwater in the Indira Sagar Project area are limited, but the general assumption is that the quality is suitable for use in irrigation. Limited water quality testing was done in several blocks in the Indira Sagar Project area. These tests were apparently conducted in 1966 and 1967. In Barwaha block, five samples out of seven tested were of excellent quality. These samples were collected at different villages within the block, including Sanawad and Dakalgaon. Water from one village in this block was deemed to be good only for salt-tolerant crops while the sample from another village could be used only with gypsum applications. Alternatively, the poor quality waters from the last two village groundwater sources could be used for irrigation after appropriate mixing with surface water. Most of the groundwater samples from Punasa and Bhikangaon blocks were excellent. Two samples exhibited salinity levels that limited their use to crops that are semi-tolerant to salinity. In Kasrawad and Thikri blocks, 23 well water samples were tested and 15 of these were found to be of excellent quality. Of the remaining eight samples, five had excessive residual sodium carbonate and could be used only after the addition of gypsum and then only in mixture with surface water.

### **Impact of agro-chemicals in run-off**

Jawahar Lal Nehru Krishi Vishwavidhyalaya, Jabalpur through their research centre are carrying out studies on impact of agro-chemicals run-off from fields on underground and surface water in command area with an objective of assessing the residues of toxic agricultural chemicals from fields in the ground water and surface water of command areas and ecological effects of the residues in irrigation water and their physiological effects on aquatic and terrestrial vegetation, crops, animal life and agro-ecosystem as a whole for devising measures to mitigate the same under the fallow and cropped yield conditions. Studies are commenced and are making progress.



## Ground Water and Conjunctive Use

Tubewells 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 end of 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 well, a provision of Rs.1,000/- per ha for the whole command area has been proposed in the estimate of catchment area development to be utilised in critical areas.

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

## **INTEGRATED COMMAND AREA DEVELOPMENT PLAN**

The Government of Madhya Pradesh have submitted command area development plan, delineating the soil classifications and land irrigability in the Indira Sagar Command Area showing the first three phases of irrigation development by area, the land irrigability map of the Indira Sagar Command Area showing lands of classes 2 through 6 by location in the first three phases of irrigation development during 1986. The project on completion will provide annual irrigation to 1.69 lakh ha. Waterlogging occurs when the groundwater table rises too close to the ground surface and the soils are unable to drain properly. This concern has been carefully planned to avoid the problems. The conjunctive use of surface and groundwater resources to the extent of 30% is proposed. The provision of drainage systems to prevent the accumulation of excessive water in the soils, and water management planning and monitoring to control the proportions of surface water and groundwater used in irrigation and the water levels in the groundwater aquifers are some of the measures being planned for prevention of any such eventuality.

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.

The implementation of the plan would be taken up in three phases for completion in September-2007. The study on impact of Agro chemicals, runoff from fields on surface & ground water quality in the command area has been assigned to J.L. Agricultural University, Jabalpur. An MOU for this work was finalised. An allocation of Rs.24.5 lakhs was made. Studies have commenced and are making progress.



## 5.

**FLORA, FAUNA AND CARRYING CAPACITY**

Forest cover maps on file and data from field investigations show the forest areas to be poorly stocked (about 25 m<sup>3</sup> /ha of timber), mostly devoid of understory vegetation, and widely subject to severe sheet erosion and moisture stress. The main cause appears to be excess population pressure, reflected in the needs of the growing population for firewood, building poles, and grazing and browsing areas for cattle. Even before submergence, the density of livestock in the project area was quite high, with an average of four to six animals per family or 0.7 animal per ha. of the total geographical area

Traditionally, the area has been managed for timber production, with teak being the predominant species. Of the 41,589 ha of forest getting submerged the crop composition by dominant tree type was as follows Teak- 78%, Salai ;19%, Mixed - 3%. Thus, the local forest was not well suited to meet the nistar needs of an expanding population of humans and their livestock. Short supplies of fuelwood and fodder have caused prices to rise manifold over the last decade. The chronic sheet erosion, the poorly stocked forest areas, the growing human and livestock population, the lack of desirable vegetative cover on the forest floor, and the poor moisture retention capacity of the area besides virtual disappearance of traditional grazing lands compelled that livestock must be fed primarily on agricultural by-products and edible forest..



The guidelines of the environmental clearance for should be conducted so fauna present can be endangered)species can be appropriate conservation survey work undertaken for the purpose had included the following

MOEF require that while seeking the hydropower projects, surveys that the status of the flora and assessed, listed (rare and detected, if present, and measures devised. Important

- Preliminary Report on First Botanical Exploration and Plant Collection from Narmada Valley by the Botanical Survey of India in 1986.
- Report on the Survey of the Indira Sagar Area by Zoological Survey of India, 1988.
- Narmada Basin Water Development Plan: Development of Fisheries, 1987, was prepared by the Narmada Planning Agency, GOMP.
- Rapid Reconnaissance Survey of Limnological Aspects Part I, II and III, 1987, were undertaken by the Bhopal, Vikram and Rani Durgavati, Universities for GOMP.
- Water quality data has been collected by the Central Pollution Control Board, Central Water Commission, the State Pollution Control Boards and the National Institute of Oceanography





On the basis of relevant details supplied by the various states, MOEF issued clearance in 1987. A condition of this clearance, as far as it related specifically to the Flora & Fauna, was that the Narmada Control Authority would ensure in-depth studies on flora & fauna needed for implementation of Environmental Safeguard measures

Considering the existing pressures on the forestlands in the project area from human and livestock populations. Also considering that these populations will also be moving from the submergence areas to the surrounding areas. In the process, additional pressures will be put on an area that consists of a fragile ecosystem that is already beyond its sustainable carrying capacity, the chronic sheet erosion, the poorly stocked forest areas, the growing human and livestock population, the lack of desirable vegetative cover on the forest floor, and the poor moisture retention capacity of the area coupled with the virtual disappearance of traditional grazing lands are putting heavy demands on the resource base. Even before submergence, the density of livestock in the project area was already high, with an average of four to six animals per family or 0.7 animal per ha. of the total geographical area.

NCA acting through its Environment Subgroup, identified the key issues required to be addressed on among others the concerns on protection of flora and fauna and stressed the need to determine habitat requirements in addition to wildlife species populations and also the carrying capacity of the surrounding area where wildlife from the submergence area would have to disperse and be accommodated in the absence of newly created wildlife sanctuaries or national parks. Considering that the successful migrations of this type are problematic because of the distances involved and the lack of continuous forest corridors in some cases possibilities for establishing migration routes to a nearby national park area or to wildlife sanctuaries or bird sanctuaries, like Satpura National Park, Kheoni and Bori Wildlife Sanctuaries, and Sardarpur and Sailana Bird Sanctuaries in the vicinity of the Indira Sagar reservoir further in-depth studies with focus on the following prime concerns were suggested.

- Relocating and protecting wildlife through setting up and maintenance of the permanent protection areas.
- Detailed surveys of both flora and fauna to determine the number of individuals of the various species, their habitat types and other needs, their status in terms of being endangered, threatened or protected under Indian Legislation, and recommendations for minimising project impacts and maximising opportunities for protecting and enhancing plant and animal life.
- Studies to ascertain the capacity of the surrounding areas to accommodate additional wildlife

The objective of the suggested studies was to assess the environmental impacts as a result of the Narmada Sagar Complex, consisting of the three dams: the Indira Sagar, Maheshwar and Omkareshwar, to ensure minimal adverse effects on wildlife as a result of the project development works. Studies were entrusted to Wildlife Institute of India and Friends of Nature Society. Institutes carried out exhaustive studies with a view to address the above concerns. Studies focused on the following

The reports submitted by the identified premier organisation during the period 1996 and 1997 included the following



- Sociological Survey of the Fishing Families of the Narmada River by CICFRI, 1991.
- Aquatic Fauna (Fish) Studies in Indira Sagar Submergence Area, prepared by the Friends of Nature Society in 1991 on behalf on the NVDA reported on the fish fauna of the Narmada.
- Pre-and Post-Impoundment Limnological Studies of Narmada Basin, by three universities coordinated by Barkatullah University for the NVDA. (1989-92) Study report was available in 1994
- Studies on Fish Conservation in Indira Sagar, Sardar Sarovar and its Downstream, is a desk review sponsored by the NCA and undertaken by CICFRI, 1993.
- Wetland and aquatic flora of Narmada Valley in Madhya Pradesh was also published in 1991 in Vol 15 No.3 in J.Econ. Toxicology Bot.
- Studies on EIA of Flora & Fauna of ISP were entrusted to the Wildlife Institute of India, Dehradun in December 1989 and were completed by March, 1994.

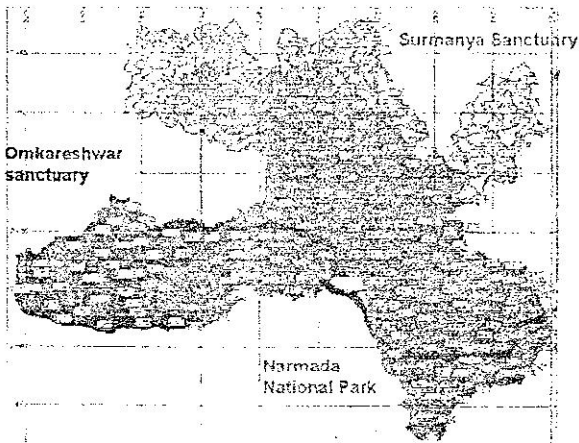
Key concerns addressed on the terrestrial ecosystem were as follows:

- A wildlife inventory giving reliable estimates of the numbers of various species of wildlife in the project impact area.
- A catalogue of habitat types found in the project area.
- A status report on individual species indicating ones that are endangered, threatened, or protected under prevailing Indian wildlife Laws. The report on these special status species was also included the recommendations for actions to be taken to safeguard threatened species
- Recommendations for the creation of new protected areas for wildlife in the areas neighbouring the submergence area.
- An assessment of the impact of the project gene pool reserves of wildlife in the project area.
- A list of vertebrate species characterising the wetland aquatic habitat in the project area. Information was also collected on the distribution and abundance of the species.

## **SUGGESTED STRATEGIES AND MANAGEMENT**

Establishments of protected areas in many parts of the country in the last three decades has largely been and outcome of the Govt. concern for mitigation of the environmental degradation specially for preservation of species diversity and the genetic valuation within them. Besides, maintaining productive capacities of eco-system and safeguarding habitat critically for the local range of species. Three new protected areas were proposed to mitigate the losses. This includes Narmada National Park, Suryamanya Sanctuary and Omkareshwar Sanctuary.





**Proposed protected areas of Narmada Sagar Complex (Showing Forest compartments)**

Name of the Sanctuary/Park	Area in ha.
Narmada National Park	47522
Suryamanyu Sanctuary	16370
Omkareshwar Sanctuary	11996
<b>Total Area</b>	<b>75888</b>

In order to reduce the much high pressure on forests at the reservoir fringes, a package of measures for eco-development was suggested.

The package includes enhancing sustainable economic productivity of private property resources and augment incomes from on farm and off farm activities. enhancing productivity of the buffer zones specially to meet the resources needs of people and providing technology to improve efficacy of use of conventional resources and to promote use of substitutes were necessary and feasible. A very important aspect of eco-development improved is to reduce the number of scrub cattle and their substitute by smaller number of cattle breeds and alternatives for domestic energy. It may be seen that the proposed projected areas have variety plant associations in different bio-morphological formations and are supported by good teak and haldu forests area is also sufficient large and would help in conserving the bio-diversity.

It is suggested that the severity of the impact resulting from direct and indirect losses could be minimised through restoration of some of the aquatic vertebrates and delineation of a substantial area of the contiguity forest which has similar conservation values that are being lost in submergence and to elevate its status to a protected area – a combination of a national park and sanctuary. Key aquatic vertebrates species like otter is proposed to be restored and translocated. It was suggested to explore the possibility of capturing and translocation of impacted otters of Indira Sagar into identified localities of the vacant niches in central Indian rivers. Besides, a species restoration plan for aquatic reptile (turtle) was also suggested within the submergence zone and also in other stretches of the river with rocky structure and sandy banks. The restoration programme for muggar crocodile as being practices in other districts of M.P. was also suggested.

Actions have been taken by NVDA to implement the recommendation of the WLI regarding declaration of National Park & protected areas. Matter is under consideration of the State Govt.



Aquatic fauna has also been covered under the studies completed by Friends of Nature Society, Bhopal. FONS have prepared a Wildlife Retrieval and Conservation Plan. Implementation of the plan awaits submergence. The plan envisages the following.

- Enrichment planting in receiving habitats in Category I areas and provision of water sources by small nala bundings;
- Development of three shallow water swamps for bird sanctuary and aquatic fauna and flora;
- Plantations in islands of ten ha and more in area emerging in revenue land;
- Provision of woven mesh fencing on islands at entry points, formed during drawdown period to prohibit entry of cattle in islands, approximate length 5 kms;
- Fencing and special protection of isolated forest patches over FRL, difficult to be managed and protected for use as fodder production areas;
- Construction of three stop dams on Chain ALA, Match River and Riparian ALA;
- Fencing and creation of corridor for movement of wildlife across Punasa-Narmadanagar road, approximate length 2 Kms;
- Fencing and creation of corridor over Punasa tunnel for movement of wildlife between unit No.18 Bhogani and 9 Channel, approximate length 2 Kms; and
- Creation of aquatic reptile hatchery and rearing facilities and creation of aquatic mammal breeding centre for otter.

The continuous organic loading coupled with the autochthonous inputs into the system results in oxygen depletion and anoxic conditions give rise to eutrophication & hydrosulphuric sludge formation which degrades the environment. However, this phenomena is more under halocline formation than thermocline. The studies of certain aspects of fisheries and reservoir sciences 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. Accordingly Action Plan has also been drawn up

## **ISLANDS IN THE RESERVOIR AFTER SUBMERGENCE**

Since the topography in the reservoir area consists of rolling hills, NVDA expected the higher peaks to remain above the water surface level and constitute islands in the reservoir. These islands would contain remnant flora and fauna that would remain isolated and would be subjected to changes in microclimate by virtue of being surrounded by a large body of water. NVDA scientists have expressed an interest in the possible effects these special circumstances could induce.

In addition to these small islands, two large islands will be formed to the north and south of the Narmada River just upstream of the Indira Sagar dam. Present plans are to reserve the northern island of 17 km<sup>2</sup>, for people and to link it to the mainland and the highways leading to Indore and Bhopal. The southern island of about 23 km<sup>2</sup>, however, is earmarked for conversion into a wildlife sanctuary. This prospective island would be considered large enough to preserve existing flora and fauna.



## TREE FELLING PLAN

Before the reservoir lands are submerged, the forest cover will have to be removed. Timing in the clearance of various reservoir sectors provides an additional opportunity for wildlife management in the project area. Wildlife is attracted to areas where the forest is clear. Dense forest growth occurs because climbers grow faster once the top canopy of trees is removed. The undergrowth with rhizomes and bulbs grows fast and very thick forest is formed. Tall grasses fill in barren and partially vegetated areas. The emerging vegetation provides plenty of food for herbivores, which are soon followed by predators.

Preliminary plans formed earlier, for clear felling of the forests on the northern bank of the river first to attract wildlife from the south bank where the forest sources are more meagre to the north bank where the forest resources are more abundant have been revised by the FONS. The measures necessary for the protection of the flora & fauna, plan for clearing of the forests and the planned migration of wild life besides the measures for improving the studies of receiving areas to relieve the pressure on the relict patches of forests and other forests have also been suggested. Plans have been drawn up for retrieval and conservation of terrestrial wild life.





# 6.

## SEISMICITY AND RIM STABILITY

The Indira Sagar reservoir has a gross capacity of 12,200 million cubic meters, or about 9.9 million acre-feet, by far the largest-capacity reservoir planned in the Narmada River basin. Therefore the issues of seismicity, the potential for reservoir-induced seismicity (RIS) and the rim stability have been carefully studied and addressed

### SOURCE OF IMPACTS

#### Geology

- i. **Dam Seat :** The main dam is located on quartzites of reddish colour and with small inter-beddings 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 inter-bedded thin plane of silt, stone and is quite suitable for construction of head race channel, foundation of power house and tail race channel

#### Studies

Investigations have considered the Narmada Sagar Complex dam sites at Indira Sagar, Omkareshwar and Maheshwar together for the studies. Geological Survey of India, the Central Water and Power Research Station of Pune, the University of Roorkee, GOG, GOMP and World Bank Consultants Pinkerton, Markwell and others have been closely associated with the studies and the mitigation planning. Several reports on seismological factors affecting design of the dam, including the following are available

1. Technical Memorandum 3.09, Evaluation of the Earthquake Parameters of the Indira Sagar Dam, by the Department of Earthquake Engineering, Roorkee University.
2. Technical Memorandum 4.12, Seismological Considerations for Indira Sagar Dam. Part-1: Evaluation of Earthquake Parameters for Design of Dam. Part-2: Assessment of Potential for Reservoir-Induced Seismicity in Narmada Basin.
3. Induced Seismicity and Other Geodynamic Processes Associated with Man-made lakes, Guha, S.K., Visiting Seismology Consultant, North Eastern Council, Shillong, India, Sessional Report presented at IVth International Congress, International Association of Engineering Geology, New Delhi, India, 10-15 December, 1982.
4. Hazards Due to Reservoir-Induced Seismicity in India, Guha, S.K. (See item-3 above.)



## SUGGESTED STRATEGIES

Major conclusions related to the effects of RIS considerations on seismic design requirements and the needed plans for seismic monitoring. As for design, it was suggested that reservoir impoundment's by general agreement can trigger significant earthquakes only where tectonic deformations already exist in the geological structures. Thus it was concluded that filling the Indira Sagar reservoir might cause an earthquake to occur sooner, but it would not affect the magnitude or intensity of ground motion associated with the earthquake. Consequently, RIS was assumed to have no influence on seismic design requirements for structures near to the reservoir.

Detailed 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. The Indira Sagar Dam Review Panel considered all available reports and data and recommended that

- To monitor seismicity during the pre and post-impoundment phases. Network of about five stations each be developed in the Indira Sagar, Omkareshwar, and Maheshwar areas .
- To record the ground motion intensity and response of the dams for any significant earthquake in the vicinity, installation of three strong motion seismographs at each dam site.
- To record any significant ground motion that occurs during construction, one strong motion instrument near each dam site

Based on the recommendations of the Dam Review Panel, detailed designs for the dam have been prepared by the Central Water Commission. Accordingly

1. At present, three experimental seismological stations have been established with the guidance of Central Water & Power Research Station, Pune, at Indira Sagar, Omkareshwar and Maheshwar dam sites. The experimental station at Indira Sagar dam site consists of a RV-320 Micro Earthquake Recorder, a Wood Anderson Seismograph and a Digital Recorder - 100 strong motion accelerometer. The results are analysed by the Central Water & Power Research Station, Pune & IMD.
2. In order to study the seismic effects in the Narmada Sagar Complex Zone a network of 10 seismological observatories with sophisticated instruments are proposed to be established based on the recommendations of Erstwhile Dam Review Panel, Central Water and Power Research Station, (CWPRS) Pune and Indian Meteorological department (IMD). It is proposed to monitor pre and post impoundment seismicity also at these seismic stations to help in assessing the adequacy of seismic parameters adopted for designs. The location of these seismic observatories finalised on the recommendations of IMD are (1) Bagli (2) Barwani (3) Chhanera (4) Harda (5) Indore (6) Kannod (7) Khandwa (8) Maheshwar (9) Narmada Nagar (10) Omkareshwar. Order has been placed and supply has commenced



3. Eleven Micro Earthquake (MEQ) recorders were procured by Feb. of which four were already installed and commissioned by March '98 at four observatories viz. (i) Narmada Nagar (ii) Omkareshwar (iii) Maheshwar and (iv) Khandwa. During the period under report two more MEQ's have been commissioned at Barwani and Chhanera. Thus, six (6) MEQs in all, have so far been installed and commissioned. Besides, 12 nos. of Wood Anderson Seismometers and 6 nos. of photographic recorders are being procured from IMD supply has commenced. Procurement of Micro Earthquake recorders is completed.
4. Status of construction of building is as follows

Sl. No.	Name of Stations	Position/Progress of Works
1	Bagli (Chapra)	Status same as on 31.03.'98. Building is completed. Only electrification remains.
2	Barwani	Completed and commissioned.
3	Chhanera	Completed and commissioned.
4	Harda	Status same as on 31.03.'98. Building completed. Electrification in progress.
5	Indore	Building completed.
6	Kannod	Building completed.
7	Khandwa	Completed and commissioned.
8	Maheshwar	Completed and commissioned (The Equipment which were earlier functioning at a temporary accommodation, have since been shifted to the new building).
9	Narmada Nagar	Completed and commissioned.
10	Omkareshwar	Completed and commissioned. (The Equipment which were earlier functioning at a temporary accommodation, have since been shifted to the new building).

The dam is, in effect, over-designed in the interests of public safety. As for the Indira Sagar dam, Seismic design coefficients, though higher than needed, also meaning higher costs have been preferred.

### RESERVOIR RIM STABILITY

The reservoir competency survey has been done by GSI and report is submitted. In the report, GSI suspected loss of water from the Mandla Rajghat reach and suggested further studies for some patches of narrow water divide. However studies carried out by the CWPRS confirmed that there was no loss of water. The water disappearing actually was reappearing after about 4 KM and that it was confirmed that there was no possibility of the impounded water to leach-out to any other basin. The rim was found to be generally stable.



# 7.

## HEALTH ASPECT

Diseases related to water have been classified as water-borne diseases, water-based diseases, water-related diseases, and water-washed diseases. In addition to infective diseases, water resource developments can also have other environmental health impacts. For example, surface water supplies maybe contaminated by chemical substances, either intentionally added to water (e.g. to control pests) or resulting from runoff or upstream pollution. These substances may cause toxic effects in humans using the water for drinking, cooking, or washing. Another effect of irrigation developments that can impact health is the increase in salt levels in groundwater and surface water downstream of the development. For example, irrigation return flow always contains more salts than the original water supplied for irrigation, land thus it degrades the quality of the downstream water system to which it is returned Generally, however, the greatest health hazards are presented by infective diseases.

The Indira Sagar Project would create a 913 km<sup>2</sup> reservoir, a main canal of 332 km. and 1,820 km of distributories. Surveys have been conducted in the Indira Sagar impact areas to investigate existing levels of health and to gather information on specific diseases. In addition to the long term epidemiological studies three specific diseases namely Malaria, Schistosomiasis, and Filariasis were studied as they have the potential to proliferate under condition of the project developments. Other diseases investigated were leishmaniasis and scabies and other water-washed diseases

It was found that , most of the existing diseases in the project area were related to prevailing hygiene. throughout the estuary to the Since the potential to draw down preventive mosquitoes in check.



socio-economic levels , mainly However, Malaria occurs sporadically entire region, from the Narmada source, but at a generally low level. Anopheline mosquito vector has the proliferate in the reservoir, the large strip, and the canals and drains. measures are in place to keep the

- Malaria is increasing in Khandwa and Khargone Districts surrounding the Indira Sagar dam site.
- Cholera and gastroenteritis are endemic in Indore, Dhar and Jabua Districts for more than seven months each year.
- Other common diseases are typhoid and dengue fever, although they are not often found in the project area
  - Filariasis is endemic to at least eight districts of MP, including Chindwara, adjacent to the Indira Sagar Site. The vector mosquito (mainly Culex fatignas responsible for this



parasitic diseases proliferates in dirty water in ponded areas and artificial containers and also to a lesser extent in stagnant irrigation tributaries and lakes.

- Little or no autochthonous leishmaniasis exists at present in MP. This disease is not water related since it is spread by sand flies that do not need water to breed. However, according to NICD, Delhi, leishmaniasis flared up following the construction of the Rajasthan canal.
- Guinea worm disease (dracontiasis) affects 3,000 villages in M.P. This disease is caused by a nematode worm and the vector for its transmission is Cyclops, the fresh water fleas.

NVDA has submitted the revised plan costing Rs.278.95 lacs for the preventive and curative aspects of health. The plan includes establishment a 30 bed hospital at Punasa. Other facilities includes the following :

- Mobile unit
- PHC 3 nos., equipped with 5 beds each, equipments, vehicles, staff etc.
- 2 civil dispensaries with labs
- 24 sub-health centres with equipments etc.

The approved plan is being implemented.

Further regarding preventive aspects, Department of Preventive and Social Medicine, Gandhi Medical College, Bhopal are engaged for the epidemiological studies. Studies are making progress. The geographical reconnaissance study, to identify the potential breeding sites of malaria vector, is being explored.

Pre-impoundment and post-impoundment Limnological studies carried out by three Universities take care of water quality aspect. These studies have been completed and the final report is submitted. Action plan includes continued investigations of the Central and Western Zone of Narmada at selected sites for the identified parameters. In addition, plan proposes biological characteristic study, microphytes, phytoplanktones, zooplanktones, micro invertebrates, biomass etc. The proposal includes continued liminological studies, ecological studied, primary productivity studies, flood plain, deep pools, anthropogenic impacts, sedimentational habitat types, endemic, endangered species for ractification. Study of fish and fisheries which includes faunastic survey and assessment of fish stock are also planned.

J.L.University which carried out initial studies for the planning commission on the aspects related with the use of insecticides and pesticides in the command through there research station at Khandwa have been entrusted with studies on impacts of application of insecticides etc.

Health problems related to these causes are expected to improve when the projects are implemented. The incidence of water-washed diseases should be reduced by the increased availability of water. The point has also been made that large water supply and irrigation projects often cause problems related to the expanded water environment. Plans have been prepared in both project areas to increase public health-related facilities, staffing, and services during project implementation. The incidence of water borne diseases in the Narmada Valley, as elsewhere in MP, is constantly being monitored by GOMP's Directorate of Health Services (DHS).





Means to control schistosomiasis include physical, chemical, and biological mitigation measures. Physical mitigation measures include draining area with standing water, clearing vegetation from water channels and banks, utilising flushing flows, and manipulating water levels. The primary chemical mitigation measure is the use of molluscicides. Biological mitigation measures would include the use of predator species that would eat the secondary host snails. Schistosomiasis is to be kept out of the project area through vigilant monitoring and the prompt use of eradication measures when needed.

Malaria is another disease that requires monitoring and control actions in the project areas. Some experimental resistance of adult mosquitoes to commonly used biocides has been noted under laboratory conditions. Thus research to maintain effective biocides will have to be continued on long term basis. Land levelling and land filling operations as well as appropriate vegetation clearing are being integrated. Control measures will include larva-eating fish in water bodies, mosquito-inhibiting plants, and clearing of vegetation and other actions to destroy breeding sites.



## 8.

**ARCHAEOLOGICAL AND ANTHROPOLOGICAL ASPECT**

From early times, the spiritual philosophy in India was manifested in the establishment of religious places and the practice of visiting these shrines became common. Religious places in India, as elsewhere, were built or established in locations of natural beauty on hilltops overlooking picturesque vistas, on the banks of scenic rivers, or deep inside pristine forests. Over the ages, several places in India have developed as particularly important religious places. Several mountains are held to be sacred and so are several rivers. Taking a bath in a holy river or paying homage to the Lord in a holy temple satisfies the deepest longings of millions of Indians even today. The Narmada valley is marked by a number of religious shrines held sacred by millions of Indians. The river holds a special place dating back to antiquity as a site for sacred rites and holy pilgrimages. The grand pilgrimage practiced in the Narmada River Valley is known as the Parikrama. Traditionally, the Parikrama consisted of a circumambulation of the Narmada River and its tributaries on foot. It took three years, three months, and thirteen days. The Parikrama ritual was initiated by Saint Markandeya. In completing this pilgrimage, the devotee had to walk around the entire Narmada River keeping within 8 to 12 km of the river bank and covering a distance that totals about 2,600 km. Engaging in the pilgrimage was not mere hiking certain rigid norms had to be observed. A devotee had to lead a spartan life. He was not allowed to take any material possessions with him, not even money. In modern times, the Parikrama is completed more by bus than on foot, and completing the circumambulation 100 percent is not considered essential. According to Koteshwar temple records, such Parikrama pilgrims are few in number now and progressively declining.

Investigations of the basin revealed that valley was rich in archaeological belongings:

- ◆ Paleolithic sites are to be found in Nemavar, Kannod, ;Punjabura, Chirapahad, Sitabau, Dhardi, Moretakka, Maheshwar, Kasrawad, Sahastadhara, Khalghat, Dharampuri, Kalibaodi, Manawar, Budada, Barwani, and Kukshi.
- ◆ Mesolithic sites are to be found all over the valley.
- ◆ Chaeolithic sites are to be found in Chikalda, Khedi, Badada, Mohipura, Hathnawar, Piplada, Khalghat, Maheshwar, Nawada, Todi, Kapila Sangam, Veda Sangam and Mardana.
- ◆ Rock-cut caves and sculptures are to be found at Piploda, Dharampuri, Bijagadha, Bagha and Mandogarh.

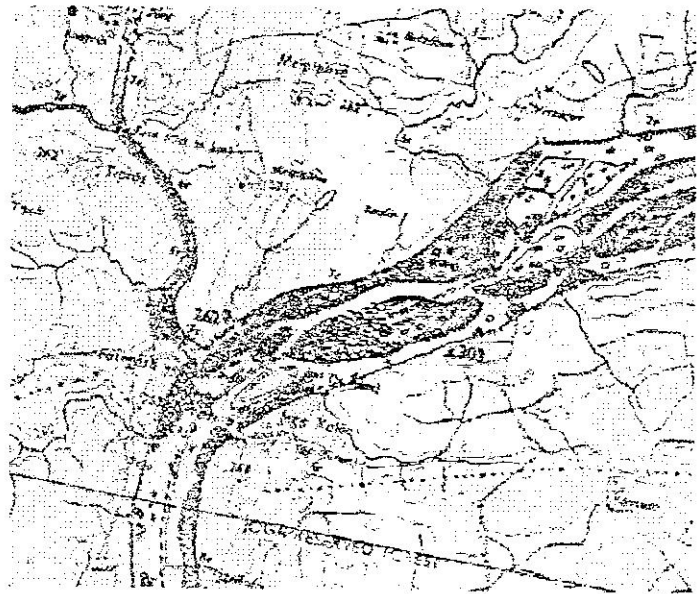


None of the archaeological sites mentioned above, that have special significance would fall within the area of submergence of either project.

**Plan of Archaeological Survey of India for ISP areas**

Archaeological Survey of India, requested by GOMP to survey the entire Narmada Valley in MP, monuments for identification of the monuments of significance with special emphasis on the area to be inundated by Sardar Sarovar and Narmada Sagar Complex projects, completed the survey for 167 villages for centrally protected monuments. Accordingly, only lower bastion in north of the Joga Fort is likely to be affected by scour action of water and action is being taken by the concerned agencies to ensure safety of the monument.

R.L.of plinth of Joga Fort	+ 274.80 M
R.L. of TOP of Joga Fort	+ 284.75 M
R.L. of Main Gate of Joga Fort	+271.035 M
R.L. of TOP of well	+ 261.39 M
F.R.L. of ISP	+ 262.10 M
Observed Highest Flood Level (54,000 cumecs)	+ 264.27 M
HFL corresponding to 1 in 100 year Flood (62,500 cumecs)	+ 265.52 M
HFL corresponding to 1 in 100 year Flood (83,366 cumecs)	+ 266.029M
BWL corresponding to 1 in 100 year Flood	+265.00 M
BWL corresponding to 1 in 100 year Flood	+ 266.637M
Water Level (20.7.98)	+ 252.00 M
River Bank	+ 259.14 M
River Bed	+ 248.00 M



Drawing indicating few important levels

**SOURCE OF IMPACT**

From the above data, it becomes clear that the well situated in the midst of north bastion will be fully submerged at FRL + 262.10 M. However, this will remain submerged for 2-3 months during monsoon when reservoir might be full at FRL. Once the water is released from reservoir for power generation and irrigation, water will be drained through openings made into the bastion surrounding the well.

As far as backwater effect is concerned, the temporary rise due to backwater will be about 0.60 M near well, over and above HFL.



### Plan of State Deptt of Archaeology and Museum

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 the 254 villages which has been completed.

State Department of Archaeology & Museum, M.P. had prepared an Action Plan in 1993. According to which, the film documentation of the monuments affected due to submergence, collection of sculptures, construction of museum at Khandwa and excavation of mound at Khedinama was proposed. Accordingly, the Khedinama mound was excavated, through which not only historical but iron tools building remains belonging to copper-age culture came into light. Recently the state Department have submitted an action plan for relocation of monuments of Archaeological significance. This plan referred to as plan of 1997 is reviewed and updated during January, 1999. As it was not appropriate to relocate all the monuments therefore only significant monuments were considered for relocation.



The action plan proposes shifting of 10 monuments and excavation at five sites in addition to the earlier proposal of collection of sculptures & excavation at Khedinema. In addition, 134 statues were collected from districts Hoshangabad, Dewas and Khandwa and are displayed in the museums there. Photo(s) shown here are of the statute displayed at Dewas museum



Cultural Heritage in ISP Area.

	Target	Progress
<b>Relocation of Monument</b>	10	-
Shiv Mandir, Dhari Kotla, Khandwa		
Shiv Mandir, Punghat, Khandwa		
Shiv Mandir, Badkeshwar, Khandwa		
Shiv Mandir, Chandel, Khandwa		
Chhatri Ghisor, Khandwa		
Shiv Mandir, Khudia Mal, Khandwa		
Riddeshwar Mandir, Handia Mal, Khandwa		
Abdul Hasan's tomb, Hoshangabad		
Rock cut sculptures, Dayyat, Dewas		
Sant Singhaji's tomb, Khandwa		



Excavation	6	1
Bijalpur Khurd, Khandwa		
Chhalpa Kala, Khandwa		
Gajanpur, Dewas		
Nabalpura, Khandwa		
Gannaur, Khandwa		

Excavation of the early historic mound in village Khedinama in Hoshangabad distt. was completed earlier. Ancient tools & artifacts were found.

Apart from above works, following are the components of the Action Plan:

### 1. Construction of museum

In accordance with the Action Plan 1993, the building for the proposed museum was constructed later on which was not found suitable for museum. Revised Work Plan 1997 envisages construction of the museum building as per standard norms for museums.

### 2. Collection of sculptures

As per the Action Plan of 1993, collection of sculptures from the submergence areas of ISP was to be done but because of them being worshipped and encased in walls they cannot be collected. Revised Action Plan 1997, envisages collection of identified sculptures after resettlement of the villages at an estimated cost of Rs.50,000/-.

### 3. Construction of replicas

Apart from relocation of monuments, excavation of mounds, construction of museum, replicas of monuments and sculptures belonging to medieval period is proposed which will be displayed at Lal Bagh, Indore. The estimated cost for construction of replicas is Rs. 6 lakhs.

### 4. Documentation

For a live record of the documents related to the monuments affected by submergence, documentation work is proposed at an estimated cost of Rs.32,51,625/-.

### 5. Chemical treatment





To prevent the relocated monuments and the artifacts and historical wealth discovered after excavation of mounds from degradation, chemical treatment is a must. This work of chemical treatment is proposed at an estimated cost of Rs.3,50,000/-.

**6. Publication**

Publication of reports of relocation and excavation work is required so as to reach the general public and shall be available to research scholars. To preserve the documentation and records, filming and drawing work is proposed at an estimated cost of Rs 700000/-.

Mitigation measures are also being planned to re-establish a Parikrama pilgrimage path to take the place of existing passages that will be inundated. The Parikrama is likely to be made easier following the creation of the reservoirs because the margins will be gentler than they are at present. Resting stops and access routes are being identified to replace the one that may get eliminated.



## ANTHROPOLOGICAL STUDIES

The Narmada Valley can be divided into three physiographic units (1) Western Vindhyas (2) Narmada through West and South and (3) Western Satpuras. Some Indologists place the Narmada-Chambal civilisation of Malwa as a contemporary of Indus civilisation. Navada Toli is a site contemporary to Harappa where evidence of early farming villages were discovered. Findings of a hominoid scul from Hathnora indicated the possibilities of the existence of human bio-cultural remains within the basin.

A series of studies have been conducted for salvaging the Narmada Basin from anthropological point of view which includes Paleo-Anthropological, human ecological, ethnography and pre-historic aspects. Besides studies on contemporary culture and collection of ethnographic specimens were collected and leading anthropologists were associated.

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

- *Rashtriya Manav Sanghralaya* has constituted a working group for the retrieval of bio-cultural material in Narmada Basin this includes studies on taphonomy and paleo ecology, excavation of upper paleo lithic sites, collection and documentation of material culture objects from tribal, artisan and folk culture.
- Survey of tribal art and handicraft entrusted to *M.P. Adivasi Kala Parishad* is completed and report is available. The report gathered details from the 24 submergence villages and identified 75 sculpturists and eight groups of exhibitionists besides documentation of identified important sculptures. Cultural aspects of the tribes including marriages and their lifestyle were collected.
- The Bhil Track, a study of displaced tribals, sponsored by NVDA, of the 17 submergence villages of SSP compiled the information on their status, layout of their resettlements, construction of houses, social structure, division into clans, economic structure, in-depthness, dependence on forests for living, inter-community relationship, leadership pattern, women's role, religion, superstitions and festivals.
- 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 7 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.



## Chapter-V

### CONTEXT AND COMPLIANCES : ENVIRONMENTAL AND FORESTRY CLEARANCES

#### ENVIRONMENTAL CLEARANCE

The clearance letter from the Ministry of Environment and Forests notes that although "field surveys are not yet completed, details have been assured to be furnished. The letter contained a schedule for some of the incomplete survey(s). Eight parameters were included: rehabilitation master plan; phased catchment area treatment scheme; compensatory afforestation plan; command area development, survey of flora and fauna; carrying capacity of surrounding area; seismicity and health aspects. The clearance letter notes that the Narmada Control Authority had been expanded to ensure that the environmental safeguard measures would be planned and implemented in depth and the pace of its implementation would be pari passu with the progress of the work on the Projects. The four conditions of the clearance were:

#### Condition No.1

**The NCA will ensure that environmental safeguard measures are planned and implemented pari-passu with progress of works on projects.**

Following the recommendations of environmental appraisal committee, Ministry of Environment & Forests to constitute Narmada Management Authority with powers inter-alia to stop work on Engineering & other works, if the progress on Environmental Management Measures was not found satisfactory & pari-passu with the engineering works and subsequent discussion held by Secretary Ministry of Environment & Forests with Secretary, Ministry of Water Resources on the issue, the scope of the Narmada Control Authority was enlarged through amendment brought out by MOWR under clause 9(i)4 9(2) a of the gazette notification. The functions of NCA were modified to include major functions of co-ordination & direction of the implementation of all the projects including the environmental protection measures and to ensure the faithful compliance of the conditions attached by GOI while granting clearance to these projects. Besides NCA was to form subgroups to discharge delegated functions.

#### SUB-GROUPS ON ENVIRONMENT AND REHABILITATION

NCA had constituted among others a sub-group namely Environment sub-group under the Chairmanship of Secretary, Ministry of Environment & Forests, GOI. However on the issues of R&R, the Environment Sub-group is guided by the deliberations of the Resettlement & Rehabilitation sub-group formed under the chairmanship of Secretary, Ministry of Welfare, GOI. Periodic peer reviews, aided by field visits, is being carried out through a number of formal and informal specific expert committees. The recommendations of the expert committees are considered by the Sub-groups.



## **REVIEW COMMITTEE OF NCA**

Through the gazette notification brought out by MOWR special status was granted to the environmental issues by modifying the composition & function(s) of the review committee. Vide notification No. 554(E) dated 3.6.87. Accordingly not only that Union Minister of Environment & Forests was included as a regular member to the review committee but also a provision was made that Review committee *suo-moto* on the application of Secretary, MOEF may review the decision of the authority. In urgent cases Chairman review committee was empowered to grant stay of any order of the Narmada Control Authority pending final decision on review.

## **ENVIRONMENT AND REHABILITATION WING OF THE NCA**

To monitor provisions of the acts related to Narmada river basin projects and the necessary clearances granted by Ministry of Environment & Forests and also in accordance to cope up with the modified role bestowed to the Narmada Control Authority, Environment & Rehabilitation Wing was formed in NCA. Key functions of the E&R Wing includes among others the following :

1. Ensuring in-depth planning, surveys and implementation of the needed environmental safeguard in the water resources projects.
2. To work out the environmental safeguard measures to be planned and implemented for the entire Narmada Basin so that environmental safeguard measures are executed and remain fully in consonance with the requirement of environmental control.
3. To determine the terms of reference of required surveys and studies necessary for implementation of environmental safeguard measures inclusive of data base required, the methods by which the data base is to be prepared and also to identify the institutions/individuals to undertake the preparation of such documents.
4. To identify, quantify and assess the mechanism so that the action plans related to environmental management and rehabilitation are effectively implemented.
5. To assess and device the strategies for the development of necessary organisation with management capability for adequate implementation of environmental programmes.
6. To undertake all measures necessary to assist NCA in the planning and implementation of environmental safeguard measures.
7. To monitor the progress of land acquisition in respect of submergence land by the projects.
8. Assessment of the progress of implementation of the plan of rehabilitation of affected villages.
9. To review, analyse and provide scientific inputs to the reports of the agencies entrusted with the rescue inventory and impact assessment in the matter of environment and rehabilitation.



E&R Wing provides support to the Sub-groups on Environment and Rehabilitation for laying down the guidelines for development of water resources projects in the Narmada basin in accordance with the requirement of environmental control.

## Condition No.2

**The detailed surveys/studies assured will be carried out as per the schedule proposed and details made available to the Department for assessment.**

The prime concern was to ascertain loss of biological diversity and whether the wildlife would be able to sustain itself after the modification of its habitat specially on the Southern side which is surrounded by agriculture fields.

The following studies were considered essential to determine the loss of flora and the adequacy or otherwise of the left-over habitat to sustain the wildlife :

- A wildlife census of the area,
- Preparation of a Master Plan showing all protected areas, i.e., National Parks, Wildlife Reserves, Reserve and Protected Forests etc. on which should be superimposed the areas cannot be taken up for various reservoirs, roads, canals, settlement colonies etc.
- Study of the carrying capacity of the surrounding areas where the wildlife from the submergence area will disperse.

The work initiated by BSI and ZSI at the request of the project authorities was to be completed by 1989.

## Status

Current status of the survey, studies and activities, preparation of Action Plan and their implementation is discussed in subsequent chapters.

Botanical exploration of Indira Sagar Dam was carried out by Botanical Survey of India during 1985. Besides, wetland and aquatic flora of Narmada Valley in Madhya Pradesh was also published in 1991 in Vol 15 No.3 in J.Econ. Toxicology Bot.

Studies on these aspects were entrusted to the Wildlife Institute of India, Dehradun in December 1989 and were completed by March 1994. The final study report is submitted to MOE&F & NCA.

Besides this, the Friends of Nature's Society, Bhopal, has completed the preparation of Wildlife. Retrieval and Conservation Plan. Implementation of the plan awaits submergence.

Actions have been taken by NVDA to implement the recommendation of the WLI regarding declaration of National Park & protected areas. Matter is under consideration of the State Govt.

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. Accordingly Action Plan has also been drawn up & is presently under scrutiny of NCA.

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.

### Condition No.3

The catchment area treatment plan and the rehabilitation plans be so drawn as to be completed ahead of reservoir filling.

## REHABILITATION

As per the clearance given by the MOEF, the rehabilitation plan was to be drawn up for completion ahead of reservoir filling.

Govt. of Madhya Pradesh proposed rehabilitation in five phases. The Phase-I was to cover 12 villages with a population of 8,291. Identification and socio-economic survey was completed. A rehabilitation plan for Phase-I was submitted to the MOEF during 1987. Subsequently, Govt. of M.P. formulated a new rehabilitation policy during November 1987 which was more comprehensive, liberal than the earlier approved policy and was discussed during 1<sup>st</sup> meeting of the Environment Sub-group held during January, 1988. Govt. of M.P. have revised their policy on 13.7.98 to further liberalise the same.

According to the information received, 8 villages shall be impacted by the submergence to be caused by the monsoon of 1999. Action Plan has been drawn up and is under implementation. For development of the proposed sites, an amount of Rs.1,45,00,000/- was made available to Chief Engineer, PWD. The total budget provisions of Rs.30 million for these works have been made for the current financial year.

## PHASED CATCHMENT AREA TREATMENT

As per the clearance given by the MOEF, the catchment treatment plan was to be completed ahead of reservoir filling. It was expected that commencing 1987 prioritisation works could be completed within two to three years time.

The AIS&LUSO was requested to take up Narmada catchment for priority delineation. AIS&LUSO completed the survey and submitted its report. Report identified that some 28% of the catchment area required treatment, on priority. Subsequently, Govt. of India ruled that

- Package for treatment of the watershed around the reservoir rim for improving their carrying capacity will have to be looked into on a case-to-case basis and settled in consultation with the MOEF at the time of clearance of the project. But the objective would be to keep this treatment to a reasonable extent and not to



unduly burden the project with the general land improvement activities as such. The Planning Commission in consultation with the Ministry of Agriculture and the MOEF should separately review the provisions required for improving the degraded lands in the different basins. These provisions and the programme thereof need not be tagged with any specific project in reservoir basin as such.

- The works necessitated on account of the immediate and direct adverse impact of the project during the construction phase along with the work on the direct draining sub-watersheds for improving the carrying capacity of the degraded/highly degraded lands along the reservoir should be carried out pari-passu with the construction programme of the project and provided for on the cost estimates of the project.

The freely draining area of Indira 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 and 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 watersheds was entrusted earlier to SGSIT&S, Indore. Later on, as per GOI's instructions the prioritisation survey was entrusted to the All India Soil & Land Use Survey Organisation, New Delhi. The Survey has been completed by AIS&LUSO, New Delhi. 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. Progress of works is summarised in subsequent chapters.

#### **Condition No.4**

**The Department should be kept informed of progress of various works periodically.**

E&R Wing of the NCA is publishing periodic Status Reports to bring out current status of survey/studies, action plan and their implementation. These reports are being sent, regularly to the Ministry of Environment and Forests, Govt. of India and reviewed periodically during the meetings of the Sub-groups. Environment Subgroup have met 32 time whereas the Rehabilitation Sub-group have met 42<sup>nd</sup> time during the last about one decade.

### **Forest Clearance**

#### **Condition No.1**

**The State Govt. of Madhya Pradesh will intimate by 31<sup>st</sup> December 1987, the complete details of equivalent non-forestland identified for compensatory afforestation, preferably in project impact area.**

- Govt. of M.P. vide their letter dated 31.10.88 certified the non availability of the non forestland for compensatory afforestation works and submitted a certificate to this



effect of the Chief Secretary, Govt. of M.P. as laid down under the act and desired by Secretary, MOEF vide his letter dtd. 4.4.88.

- Govt. of M.P. prepared a revised plan during 1986 for raising compensatory afforestation on 10,142 ha non-forest and 73,387 ha degraded forest. This plan was presented to the MOEF and discussed in the meetings of the Environment Sub-group of NCA.
- Environment Sub-group of NCA on 18.11.88 requested Addl. Secretary, MOEF to visit Bhopal and to sort out the issue of availability of additional non-forestland for the programme. He after the visit suggested that GOMP may explore the possibility of identifying land along river banks in width upto 2 km. for the purpose. GOMP, however, expressed inability due to practical difficulties in acquiring the land.
- The issue was discussed again by the Environment Sub-group during 5<sup>th</sup> meeting and Dr. Maudgal, Advisor, MOEF was requested to ascertain the availability of additional land even if away from the project site. Findings of Dr. Maudgal were discussed in Environment Sub-group meeting and GOMP was requested to expedite planned compensatory afforestation in 10 years time. Govt. of M.P. have raised plantations over an area of 67,133 ha against a target of 80,945 ha. It is proposed to complete the plantation works within the scheduled time.

## Condition No.2

**The work of compensatory afforestation will be completed in five years' time. Depending upon the availability and selection of suitable area in the non-forest/forestland, a detailed scheme will be prepared by the State Govt. showing yearwise targets and expenditure, keeping in view the cost escalation on account of inflation. The project will release the amount for these annual plantation programmes as per the scheme in the beginning of each financial year in the non-voted fund to the forest department of the State Govt. The State Govt. would ensure that these amounts would be in addition to the normal forestry budget.**

- The Action Plan for compensatory afforestation drawn and submitted to GOI, MOEF by State Forest Department vide its No.5/III/84/10/2 dated 18.11.87 envisages plantations over a period of 5 years time. However during the subsequent discussions in Environment Sub-group which reviews the progress of construction *vis-à-vis* implementation of the environmental safeguards it was agreed that plantations may spread over 10 years period commencing 1989-90. The pace of construction is further slowed down due to other bottlenecks.
- The amount for the annual plantation programme is released from the project fund. The budgetary provision is in addition to the normal forestry budget.



**Condition No.3**

Since the project involves violation of Forest (Conservation) Act, 1980, compensatory afforestation will be carried out over suitable degraded forestland double the diverted forest area in extent and in addition to the equivalent area in non-forestland. For this purpose, the area offered by the State Govt. vide their letter No.5/III/84-10-3, dated 14.10.1986 will be accepted and compensatory afforestation raised at the cost of the project in this area.

This condition read with condition no.3 of the order of the State Forest Department which read stipulators as follows:

*जितने वन क्षेत्र पर वन विभाग की अनुमति के बिना कार्य कर वन ; संरक्षण व अधिनियम का उल्लंघन किया है उसके दुगुने बिगड़े वन क्षेत्र पर वृक्षारोपण किया जाये तथा समतुल्य अन्य क्षेत्र पर तो वृक्षारोपण किया ही जायेगा । शासन के समसंख्या पत्र दिनांक 14-10-1986 से भारत सरकार को प्रेषित वृक्षारोपण योजना के अन्तर्गत प्रस्तावित क्षेत्र इस कार्य हेतु मान्य होगा । वृक्षारोपण पर होने वाला पूर्ण व्यय परियोजना के लिये उपलब्ध राशि में से किया जायेगा ।*

- Area offered in the plan of M.P. which is presently under implementation was accepted by MOEF.
- Provision for diversion of forestland for non-forestry purpose is provided for in the Forest (Conservation) Act. However the absence of formal notification for an area of about 621.98 ha taken over earlier by the Project Authorities was considered as violation of the forest conservation act. This resulted in imposition of the penalty, the extent of which is clarified in the order of the State Forest Department.
- Compensatory afforestation is being raised at the cost of the project

**Condition No.4**

The areas will be surveyed, demarcated and declared protected forests and placed under the control of the Forest Department for compensatory afforestation at the cost of the project. Areas not found suitable will be substituted by suitable areas.

- The proposal for declaring identified areas as protected forest was prepared. Accordingly, It was informed by Govt. of M.P. that about 470 ha. of these areas have been declared as protected forests whereas the rest of the areas are in the process of being declared as protected forests.



**Condition No.5**

The State Govt. will also intimate details of the non-forestland identified for rehabilitation of the oustees and draw up by 15<sup>th</sup> December, 1987 a rehabilitation plan to the satisfaction of the Govt. of India.

The rehabilitation plan as envisaged in this condition was submitted to the MOEF vide letter dtd. 18.11.87.

**Condition No.6**

No work on the project in forest area will commence unless conditions (1) & (5) above are fulfilled.

- It was informed by Govt. of M.P. that no works in the forests of submergence area were started.

**Condition No.7**

Under item (2) of paragraph 2 above only 50 hectares should be utilised for construction of the power house only. The proposed colony in the Power House area should be accommodated in the area of 621.98 hectares already utilised under item (5).

- Govt. of India gave permission for diversion of 308.47 ha. for additional forestland for power etc. vide their letter dated 25<sup>th</sup> July 1990.

**Condition No.8**

Sand quarry should be located in the submergence area. Therefore, the area of 72.50 hectares for sand quarries and 41.15 hectares for approach road for sand quarries is not being permitted for non-forest use.

- This is being adhered to

**Condition No.9**

For conservation and management of wildlife, a committee will be constituted by the State Govt. by 15<sup>th</sup> December 1987 which will include a representative from the Govt. of India. The Committee will suggest the necessary steps to be taken and draw up a plan which will be implemented at the cost of the project.

- A committee for the conservation of management of wildlife has been constituted by the State Govt. through their letter dtd. 8.1.88. Planning and mitigation are being processed through this committee by GOMP.





**Condition No.10**

**Forest clearance will be done only upto 4 M below FRL.**

- It was informed by Govt. of M.P. that forest clearance shall be done upto 4 m below the FRL only.

**Condition No.11**

**A plan for the treatment of the catchment area will be prepared by 15<sup>th</sup> December, 1987 and implemented at the cost of the project.**

- Catchment area treatment plan was drawn up and submitted to the State Forest Department vide letter dtd. 11.12.87 and was copied to MOEF dtd. 6.1.89. This plan was revised in the light of recommendations of AIS&LUSO and sent to MOEF vide NVDA letter dated 1.1.1994. This plan is being implemented at the cost of the project in accordance with the guidelines issued by the Govt. of India. It was informed by Govt. of M.P. that by the end of March, 1999 an area of 39,653 ha. was treated up against a target of 62,975 ha.

**Condition No.12**

**Tree planting will also be done on either side of canal, road and foreshore of the reservoir lands under the control of the Irrigation Department in the command area.**

- It was informed by Govt. of M.P. that this point shall be integrated into the command area development plan which is on the anvil.

**Condition No.13**

**Water should be supplied free of cost to the Forest Department for raising nursery and irrigated forest plantations in the command area.**

- It was informed by Govt. of M.P. that this will be taken up.

**Condition No.14**

**In order that the construction labour and staff while working on the project in the forest area may not cause destruction of forests for meeting their fuelwood free of cost to the labourers.**

- It was informed by Govt. of M.P. that fuel depot was set up at Narmada Nagar during March, 1989 with an initial stock of 500 quintals of firewood where fuel wood is being



supplied to the labourers free of cost and at the subsidised rates to other staff and alternate arrangements for the supply of fuel like coal, kerosene, LPG, electricity etc. also exists.

**Condition No.15**

**Satisfactory fulfilment of the above conditions will be a deciding factor for the future proposals of the State Govt. for diversion of forestland under Forest (Conservation) Act, 1980.**

- It may be noted that more than 20 project has also been cleared in Madhya Pradesh by the Govt. of India during the period 1989 to 1996.

**Condition No.16**

**Legal status of the forestland will remain unchanged.**

- Legal status of the forestland going under the submergence shall remain unchanged.

**Condition No.17**

**No forestland will be utilised for the rehabilitation of oustees.**

- No forestland is diverted for R&R purposes.



## CONCLUSION

Availability of water in a river basin is fundamental to planning of water resources projects, where planners and environmentalists share a common concern. While planners' intention is to put all available water resources to productive uses, an environmentalist's efforts are directed for maintaining the water supplies on sustainable basis.

However, river basin water, mother of all life, has to be regulated through creation of dams to draw maximum life support from this precious resource. Building of dams brings alterations in the environment. Its area of influence includes the catchment contributing to the reservoir projects and the area below the dam down to the estuary, coastal zone and offshore. While there are direct environmental impacts associated with the construction of the dam like power transmission corridors, pipeline, canals tunnels relocation, access roads borrow and disposal areas and construction camps. The greatest impacts results from the impoundment of water, flooding of land, alteration of water flow downstream. These effects have direct impacts on soils, vegetation, wildlife, fisheries, climate and specially the human populations in the area for whom efforts are required for resettlement or compensatory tacts. Migratory route of wildlife or fish, public health are the issues which relates to environmental conservation, making it necessary for one to understand the interaction between growth and the environment.

The Narmada Sagar Complex would add large, dependable power sources to a Western Region grid badly needing additional power sources, in addition to providing irrigation in the command area which will enhance agricultural production. Supplementary benefits could be in form of providing opportunity for development of fish resources and other similar opportunities.

Power benefits from ISP would be realised both in the Sardar Sarovar Project area and in the Indira Sagar Project area. In general, in the Sardar Sarovar Project area, the effects of water releases will be that (1) energy production returns at RBPH during the high-flow monsoon season would be reduced, (2) energy production returns at RBPH during the low-flow season would be increased by 44 to 67% in all but the full development stage, and (3) most important, firm power generation at RBPH would be increased by 38 to 50% during the early stages but would be essentially unchanged during later stages of project development. The installed capacities of the powerhouse facilities in the Narmada Sagar Complex are 1,000 MW, Indira Sagar Project; 390 MW, Omkareshwar power plants; and 240 MW, Maheshwar power plant. Thus, the total NSC installed capacity would be about 1,630 MW. The 1,000 MW powerhouse at the Indira Sagar dam would constitute a significant addition to India's Western Region grid. Indira Sagar power would not only increase the capacity of the Western grid but it would also eliminate the need for equivalent new thermal (base load) capacity and for the utilisation of existing thermal plants in the peaking mode.



The Environmental Resources Report has identified many of the losses that will be associated with the Narmada Sagar Complex, particularly the Indira Sagar Project and the steps taken by project authorities/State Govts. so that the benefits of the project can be harmonised with environmental alterations for sustainable development.

The most serious consequence would be the need to resettle and rehabilitate some 90,000 people who would lose either their place of residence, or most their farm land, or both. One town and 253 villages would be completely or partially submerged within the planned Indira Sagar reservoir area. Not included, however, are the 9,400 ha Omkareshwar reservoir and the 4,850 ha Maheshwar reservoir. Of course, the combined area of these two reservoirs totals less than 16% of the area of the Indira Sagar reservoir and planning for these projects is much behind the planning for the ISP.

Resource losses associated with the Indira Sagar reservoir include 35,000 ha of lands classified as forests, although about one-third of this land consists of open, degraded forests. Another 31,000 ha of this land can continue to be used for draw-down agriculture after the project is implemented.

No doubt, the Indira Sagar dam would exerts profound effect on water, land & air bringing chemical, biological and physical changes and in their interrelationships. The impounding of such a quantum will bring in changed ecological manifestations in the present fluvial ecosystem, this may exert negative pressure on the biotic components with regard to their adaptability to the changing environment. As such, an aberration in the biotic components from predominant lotic to lentic will be observed, resulting in succession of diversity type. The consequences of the reservoir development on environment are many and each of them have to be considered on merit. Efforts for conservation of lake are studied through a large number of studies, for addressing the issue of submergence of forest, fluctuations in water level, physico-chemical changes in the basin in the catchment benthic environment, water column & consequent impact on food chains & the related ecological risks and socio-economic considerations, for planning and implementation of mitigation measures..

Since agriculture is of prime activity, it is from the use and misuse of the land that most of the environmental issue emanates and therefore need to be addressed in upstream, downstream and in the command area of the projects. It is in this context that catchment area treatment, command area development, flora, fauna and carrying capacity, health aspects etc. have been integrated the planning process of the Indira Sagar Project.

Reservoir inundation will lead to the loss of habitat for the humans and wildlife both while on the rehabilitation for the project affected persons State Govts. have devised a process called sauda chitthi for the compensation for land. However, this policy has been criticised by those opposed to the projects. Govt. claims that interest of the people of their State is paramount and reiterate its commitment for helping them regain the standards of living. For the wildlife habitat, adjoining forestlands may be able to accommodate some of the displaced wildlife and a national parks being established shall help to mitigate the wildlife losses. Catchment area treatment is a general land improvement activities which also regulates the underground flow through increased percolation. Project would be treating all those catchment identified as critically degraded directly draining at the cost of the project. Compensatory plantations to mitigate the losses of submerging the forest land are in no way a



true compensation but are helpful in achieving the national objectives of bridging the gap between demand and supply and to ease pressure on the existing resources.

The Indira Sagar reservoir will be largest man-made water body in India. There is apprehension that a reservoir of this size, particularly in combination with planned nearby reservoirs at Omkareshwar and Maheshwar will have seismic implications that may not be completely predictable. Seismologists who have studied the matter have concluded that reservoirs like the Indira Sagar do not increase the severity of a possible earthquake. The potential severity is said to be related to existing tectonic deformations in the geological structures of the area. However, the seismic stations are being established to collect the data of occurrence of an earthquake for its analysis and application.

However, environmental safeguard measures are evolutionary in nature and are confined to our present day knowledge. In the developing countries; most of the environmental problems are caused by under development. Millions of men still live well under the lowest levels not compatible with the decent human life, deprived of the necessities as far as food, clothing, housing, education, health and hygienic are concerned. People living the submergence areas are poor, living below the poverty line and are cultivating, increasingly degraded areas. Health facilities are rare. Indira Sagar Project aims to bring in changes in the lifestyle with proper implementation of the environment safeguard. Project aims to direct efforts towards development, taking account of their priorities and the necessity of preserving and improving their environment.

