WGP Review Paper

A SPWD- SDTT Collaboration

Water Governance in the Narmada River Basin

Rahul Banerjee

December 2009

Introduction

Water governance in the Narmada river basin has been in the eye of a controversial storm from the time of independence. While initially the dispute had been between the riparian states over the apportionment of the use of the waters of the river for large dam centred canal irrigation and hydro-electric power development later the dispute shifted to the appropriateness of this kind of development given the tremendous environmental and social costs associated with it (Paranjpye, 1990). This later problematization of centralized water governance and people's mobilization for a more decentralized, participatory and environmentally sustainable use of water resources has inspired a rich body of thought and action with regard to appropriate water governance not only in the basin but across the country and the world (Sangvai, 2002). The present review begins by detailing the geographical characteristics and resource endowments of the basin followed by a description of the status of agricultural and industrial development and their impact on the water quality. The dispute over river water sharing and its resolution is described next followed by details of some of the major projects under construction in the basin. The problematization of centralized water governance by the Narmada Bachao Andolan and its culmination in the Supreme Court case is detailed thereafter. This is followed by a review of the various problems of large dam centred water resource development. Finally the various traditional and modern alternative approaches to water resource use and governance in the basin are described before concluding the review.

Geographical Characteristics

The water availability in a river basin is primarily determined by its geographical characteristics and this is especially so for the Narmada river which is the only non-snow fed perennial river in India. The various geographical details of the Narmada basin have been described below.

Course

The Narmada is the longest west flowing river in India. It rises from a spring at a height of 1057m above MSL on the summit of Amarkantak hill in Shahdol district of Madhya Pradesh in the Maikal hill range. This area also gives rise to a tributary of the Ganges river, the Son river, just a few kilometres away.

Rahul Banerjee, activist and researcher, works among Bhil adivasis to help them synthesize their traditional qualities with modern skills for equitable and sustainable development as architects of their own future. He is devoted to preserving and promoting indigenous knowledge, livelihoods, resource bases and culture of the Bhil community and countering its internal patriarchy.

Brought Out By:

Water Governance Project
Society for Promotion of Wastelands Development
14 A, Vishnu Digambar Marg
New Delhi- 110002, INDIA
www.watergovernanceindia.org
info@watergovernanceindia.com
wgp_spwd@yahoo.com

The Narmada basin lies between east longitudes 72^0 32' to 81^0 45'and north latitudes $21^0$20' to $23^0$45'. The total length of the Narmada from its source to its outfall into the Gulf of Cambay in the Bharuch district of Gujarat is 1312 kms. The first 321 kilometres of its course winds among the Mandla Hills, which form the head of the Satpura Range till it reaches Jabalpur where it passes through the 'Marble Rocks' and enters the Narmada plains. The river runs another 745 kilometres through the plains before the Vindhyas and the Satpuras come close to the banks of the river restricting it to a narrow gorge that extends for 87 kilometres first forming the common boundary between Maharashtra and Madhya Pradesh and then between Maharashtra and Gujarat. Thereafter it stretches for 159 kms in the plains in Gujarat to its outfall into the sea (CWC, 2006).

Geology

The Narmada Valley is a rift valley situated between the Narmada North fault and the Narmada South fault. These in turn are part of the longer Narmada-Son Lineament, which is an active fault zone, and a distinguishing tectonic feature of central India. Extensive basaltic flows known as Deccan Traps have come out of these faults and underlie most of the basin. Apart from this there are some granite, and the Gondwana shale and sedimentary rocks in parts of the hills and plains and alluvial deposits near the river courses. A layered block called a graben has dropped down in the middle relative to the blocks on either side of the faults due to ancient spreading of the earth's crust. The two faults parallel the river's course, and mark the boundary between the Narmada block and the Vindhya and Satpura blocks, which have risen relative to the Narmada Graben. Between the two blocks there is an alluvial plain area of about 500 kms length and 35 - 45 kms width stretching from Jabalpur district to Barwani district, which overlies the Deccan traps and Gondwanas on both banks of the river.

Watershed

The Narmada watershed includes the northern slopes of the Satpuras, and the steep southern slope of the Vindhyas, but not the Malwa Plateau, the streams from which flow into the Ganges and Yamuna. According to the Narmada Control Authority (NCA Website) the river drains an area of 98,796 sqkm out of which nearly 86% lies in Madhya Pradesh, 1% in Chhattisgarh, 2% in Maharashtra and 11% in Gujarat. There are 41 important tributaries of the Narmada River. The larger ones are Burhner, Banjar, Hiran, Tawa, Chhota Tawa, Orsang and Kundi each having a catchment area of more than 3,500 sq kms. The remaining tributaries have catchment areas ranging from 500 to 2,500 sq kms. The basin has an elongated shape with a maximum length of 953 kms from east to west and a maximum width of 234 kms from the north to south. The basin has five well-defined physiographic zones. They are -

- the upper hilly areas covering the districts of Shahdol, Mandla, Durg, Balaghat and Seoni
- the upper plains covering the districts of Jabalpur, Narsimhapur, Sagar, Damoh, Chhindwara, Hoshangabad, Betul, Raisen and Sehore
- the middle plains covering the districts of East Nimar, part of west Nimar, Dewas, Indore and Dhar
- the lower hilly areas covering Barwani and Jhabua in Madhya Pradesh, Nandurbar in Maharashtra and a part of Baroda and Narmada districts in Gujarat
- the lower plains covering mainly the district of Bharuch in Gujarat

The Central Groundwater Board (CGWB), however, has divided the basin into three sections - lower, middle and upper for their demarcation of watersheds. According to the CGWB website the lower Narmada basin has a catchment area of 9750 sq kms and is mostly in Gujarat with small portions in Maharashtra and Madhya Pradesh. The middle Narmada basin has a catchment area of 40699 sq kms wholly in Madhya Pradesh. The upper Narmada basin has a catchment area of 43129 sq kms mostly in Madhya Pradesh with a small section in Chhattisgarh. In this way the total area of the basin comes to only 93398 sq kms which is at variance with the estimate of the Narmada Control Authority. Similarly the Sardar Sarovar Narmada Nigam Limited (SSNNL website) which administers the Sardar Sarovar Dam at Navagam in Gujarat has estimated the total catchment area of the Narmada basin to be 97410 sq kms. Thus there is a lack of agreement among the leading agencies concerned on the area of the basin.

Forests

On paper forests occupy 32% of the area of the basin covering 28300 sq kms in Madhya Pradesh, 150 sq kms in Chhattisgarh, 268 sq kms in Maharashtra and 1085 sq kms in Gujarat. However most of this legally

designated forest area is highly degraded and the actual dense forest cover by the Forest Survey of India estimates is only about 15%. The hilly regions of the upper basin extending upto the Tawa catchment are well forested with good crown cover of tropical moist species. The bulk of the commercial timber production of the Madhya Pradesh Forest Department is carried out in this region. The forests in the middle and lower basin, which are of the tropical dry deciduous variety, have been heavily denuded over the years with some of the best forests having been submerged by the reservoir of the Indira Sagar dam. Forests are practically non-existent in the parts of the basin in the states of Maharashtra and Gujarat where they have been converted into agricultural and grazing lands. The major challenge to forest management in the basin is the pressure on the forests created by the livelihood needs of those residing in or near them, who are mainly adivasis with very little alternative livelihood sources. The major tree species are teak, salai, dhavra, saja, aonla, reunjha, moyan, anjan, rohan, tendu and mahua (MP Forest Department Website).

Climate

The Tropic of Cancer crosses the Narmada Basin in the upper plains area and most of the basin lies just below this line. The climate of the basin is humid and tropical, although at places extremes of heat and cold are often encountered. In the year, four distinct seasons occur in the basin. They are -

- Winter ranging from November to February
- Summer ranging from March to mid-June
- South west monsoon ranging from mid-June to mid-September
- Post-monsoon ranging from mid-September to October

In the cold weather, the mean annual temperature varies from 7.5° C to 20° C and in the hot weather from 30°C to 42.5°C. During the south west monsoon the temperature ranges from 27.5° C to 30° C. In the post-monsoon season, the temperature ranges between 25° C to 27.5° C. Ten rain gauges were first established in 1867 in the Narmada basin. The number rose to 21 in the year 1891 from when published rainfall data are available. Thereafter, there has been a steady growth of the rain gauge network in the basin. Nearly 60% of the total rainfall is received in the two months of July and August. Another thirty per cent is received in June, September and October. The rainfall is heavy in the upper hilly and upper plains areas of the basin. It gradually decreases towards the lower plains and the lower hilly areas and again increases towards the coast and south-western portions of the basin. In the upper hilly areas, the annual rainfall is, in general, more than 1400 mm but it goes up to 1650 mm in some parts. In the upper plains from near Jabalpur to near Punasa dam site, the annual rainfall decreases from 1400 mm to less than 1000 mm with the high rainfall zone around Pachmarhi in the Satpura Hills in Hoshangabad district where the annual rainfall exceeds 1800 mm (70"). In the lower plains the annual rainfall decreases rapidly from 1000 mm at the eastern end to less than 650 mm around Barwani, and this area represents the most arid part of the Narmada Basin in the lower hill areas. The annual rainfall again increases to slightly over 750 mm in the hills in Gujarat and Maharashtra and 1000 mm in the coastal plains. The evaporation in the upper zone is 1 to 3 mm while in the lower zone it is 12 - 28 mm.

Soils

The soils in the upper hilly regions of the basin are mostly shallow red and yellow with low fertility. The upper Narmada plains are broad and fertile areas well suited for cultivation with deep black soils upto the East Nimar district. These soils are highly water retentive in nature. Thereafter there are medium black soils in the West Nimar, Dewas and Barwani districts mixed with skeletal red and yellow soils. The lower hilly portions in Madhya Pradesh, Maharashtra and Gujarat have mostly shallow red and yellow and skeletal soils of low fertility. There are alluvial deposits on the banks of most of the major tributaries of the Narmada river. The coastal plains in Gujarat are composed of alluvial clays with a layer of black soils on the surface.

Water Resources

The estimation of the water resources in a river basin is a complicated exercise dependent on prior estimation of rainfall, temperature, vegetation, land use, topography, geology and soil cover. Owing to changes in these parameters over time because of natural and human factors the water availability too varies.

Surface Water

An initial effort at estimation of the surface flow in the river at Garureshwar just below the present Sardar Sarovar dam at Navagam in Gujarat was made by the Narmada Water Resources Development Committee headed by Dr A. N. Khosla which submitted its report in 1965. This committee worked on the basis of the actual runoff data available from 1948 to 1962 and hindcasting of the rainfall data for earlier years from 1891 and arrived at an estimate of annual flow of 35.7 billion cubic metres (bcm) at seventy-five per cent dependability. However, this estimate was challenged by the engineers of Madhya Pradesh and Maharashtra and finally after a long dispute the Narmada Water Disputes Tribunal arrived at a political settlement of the annual flow of the Narmada at Garureshwar at seventy-five percent dependability as being 34.5 bcm in 1974. However the actual annual flow in the river at present at seventy-five per cent dependability is only 27.1 bcm. The maximum discharge of 60642 cumecs occurred at Garureshwar on 7.9.1994, while the minimum discharge at this point of 14.05 cumecs occurred on 3.6.1980. The monthly distributions of average daily flow per unit area of catchment intercepted at this point in mm and the average daily sediment in thousand metric tonnes are given in the figure below. These values are for 2002 when the Indira Sagar and Sardar Sarovar dams had already been built on the river to a considerable extent. The maximum annual sediment load recorded at Garureshswar is for 1990-91 before the construction of the above dams when it was 51.54 million metric tonnes.

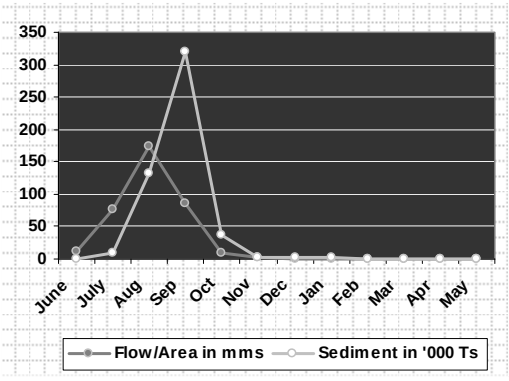

Figure 1 : Flow per Unit Area and Sediment Load at Garureshwar on the Narmada River
Source: *CWC, 2006*

Ground Water

The net groundwater availability in the basin is roughly about 8.5 bcm as calculated from the groundwater data available for the districts that comprise the basin (MPWRD Website). The groundwater yield depends on the underlying rock structure, which as mentioned earlier consists of the following rock classes -

- Granite gneisses and meta-sedimentary rocks in the hilly upper watershed regions.
- Gondwanas comprising sandstones, limestones and marbles in the upper watersheds and also in the plains.
- Basaltic Deccan Traps, which cover most of the basin.
- Quaternary alluvium along the river courses

The alluvial deposits form prolific aquifers where tubewells can yield in the range of 50-80m^3/hr. The yield of tubewells in sandstones of Gondwanas ranges between 20-30m^3/hr, whereas in limestones of Gondwanas it varies between 50-80m3/hr. The yield of tubewells in basalts ranges between 20-30m^3/hr.

Water Use

The extensive use of water both surface and ground for the development of irrigation in the Narmada basin has taken place from the 1970s onwards. Canal irrigation upto 2000 was mainly from small tanks and small dams as among the large and medium projects only the Matiyari, Tawa, Sukta and Barna dams had their command areas fully developed. A detailed discussion of the utilization of surface water through large and medium dams follows later in the section on the exploitation of surface water in the Narmada basin. It is notable that despite the government stress on large and medium dam centred water resource development and utilization it is electricity and diesel powered pumping of groundwater from tanks, streams, rivers and groundwater aquifers that has contributed much more to irrigation in the basin as can be seen from Figure 2 below.

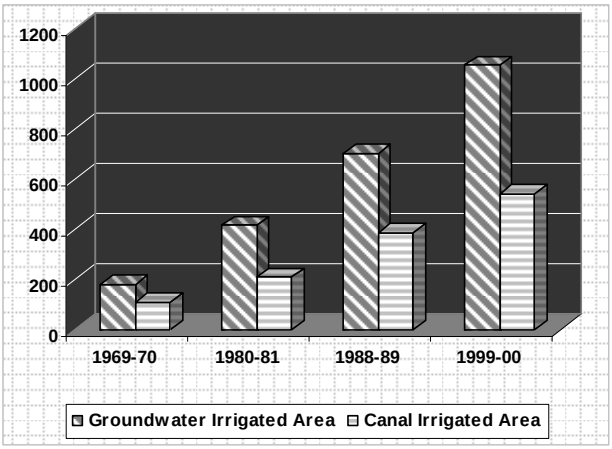

Figure 2: Growth of Irrigated Area in the Narmada Basin in thousand hectares
Source: *GoMP Agricultural Statistics quoted in Ranade, 2005.*

The extent of groundwater development and its criticality with respect to availability is given across the six agro-ecological zones of the basin in Table 1 below.

Agro-ecological Zone	Groundwater Development (%)	Criticality of Zone
Upper Hills	17	Safe
Upper Plains	100	Over-exploited
Middle Plains	30	Safe
Lower Plains	100	Over-exploited
Lower Hills	15	Safe
Coastal Plains	80	Critical

Table 1: Groundwater Development and Criticality in the Narmada Basin
Source: *Calculated from MP Water Resources Department Website district data.*

The average consumption of domestic potable water in the basin is about 35 litres per capita per day as roughly calculated from CWC data which is well below the norm. In this respect the most important project is that of drawing water from the Narmada near Mandleshwar, treating it to potable quality and then pumping it up to a height of 500 m over 70 km to the city of Indore through a pipeline which was implemented in the 1970s and later augmented once in the 1990s. The Asian Development Bank has now sanctioned a loan of Rs 500 crores for further augmentation and renovation of this water supply system. This supply of water to Indore from a distant source much lower in elevation requires a lot of electrical energy in pumping and also involves considerable losses. The unit cost of water supplied is consequently very high and has to be subsidized by the government. The net result is that the running and maintenance of this water supply system has become economically unsustainable and with the phasing out of subsidies now the Indore Municipal Corporation has run up a debt of over a hundred crore rupees with the distribution company of the Madhya Pradesh State Electricity Board.

Mineral Resources

The basin has mineral deposits of good economic value. There is manganese ore in Dindori district in the upper hilly region of the basin, while Mandla district has dolomite deposits. Lower down Jabalpur has coal and ochre deposits. There are limestone deposits in Narsimhpur and Hoshangabad district in the middle plains and dolomite in Harda district. There are substantial deposits of coal in Betul district. There are pyrophyllite and diaspore deposits in Dewas district further down. There are considerable limestone, calcite and dolomite deposits in the lower plains and hills in Khargone, Khandwa, Dhar, Barwani and Jhabua districts. The only flourspar deposits in the country are to be found in Vadodara district in Gujarat. While the coastal region near Ankleshwar in Bharuch district has sizeable deposits of crude oil.

Human Resources

The average population density in the basin is about 195 persons per square kilometre and it is mostly rural with the rate of urbanization being only 20%. There are only two cities with population above one million and these are Jabalpur in Madhya Pradesh and Bharuch in Gujarat. There are four towns with population of around one lakh and these are Khargone, Khandwa, Hoshangabad and Betul. The work participation rate of the whole population is 45% with 42% of the workers being cultivators and another 34% being agricultural labourers thus underlining the predominantly rural and agricultural nature of the workforce. The literacy rate is quite high at about 62% while the life expectancy at birth is 65 years indicating that the population is fairly well educated and healthy.

The proportion of Scheduled Castes is about 11% but they own only about 5% of the cultivable land. The proportion of Scheduled Tribes is quite high at about 40% and they reside mostly in the hilly and forested areas in the upper watersheds of the basin. Their share of the cultivable land is only 32% and most of it is of poor quality (MPHDR, 2002).

Agriculture

The net sown area in the basin is about 45% of the total area and the average cropping intensity varies across the basin with the average being 135%. The average cultivable landholding size is 1.1 hectares and the land distribution is skewed towards large landholders in the plains regions. The distribution of net sown area and net irrigated area across the three states of Madhya Pradesh, Maharashtra and Gujarat are given in Table 2 below. This clearly brings out the preponderance of groundwater irrigation over canal irrigation in the basin.

	Net Sown Area	Irrigated Area						%age Irr. Area
		Canals	Tanks	Tubewells	Other Wells	Other Sources	Total	
M. P.	38527	3867	387	2624	5110	1740	13728	35.6
Maharashtra	884	64	-	-	120	-	184	20.8
Gujarat	5622	414	18	647	1137	18	2234	39.7

Table 2: Net Sown Area and Irrigated Area in the Narmada Basin in sq kms (2000)
Source: *CWC, 2006*

There are six distinct agro-ecological zones in the basin with diverse agricultural characteristics as follows -

- The upper hilly region covering Mandla, Dindori and Balaghat districts which is predominantly a rice growing zone with some wheat, pulses and minor cereals. The productivity in this region is low because of poor soil quality and non-development of irrigation facilities.
- The upper plain covering Jabalpur and Narsinghpur districts which is primarily a rice/wheat double crop zone with some pulses and minor cereals. The productivity is high in this region because of rich soil quality and a fair development of irrigation facilities.
- The middle plain covering Hoshangabad, Sehore, Harda and Raisen districts which is primarily a soyabean/wheat double crop zone with some pulses and minor cereals. The productivity in this zone is high because of good soil quality and extensive irrigation development.
- The lower plain covering Khandwa, Dewas, Khargone, Dhar and Barwani districts which is primarily a cotton, jowar, soyabean and wheat multiple crop zone with some pulses and minor cereals. The productivity is high in this region because of rich soil quality and extensive irrigation development.
- The lower hills covering the districts of Barwani and Jhabua in Madhya Pradesh, Nandurbar in Maharashtra and Vadodara and Narmada in Gujarat which is mainly a jowar and maize zone with some soyabean, wheat, minor cereals and pulses. The productivity is low as the soil quality is poor and because of hilly terrain not much irrigation is possible.
- The coastal plain covering the Bharuch district of Gujarat, which is primarily a paddy, jowar, groundnut and cotton multiple crop zone with some wheat, minor cereals and pulses.

The farmers in the Narmada basin mostly cultivate small plots of land on terrain and soils that are unsuitable for flood irrigation and they have traditionally been driven by the desire to produce for subsistence rather than for profit. They had over thousands of years developed a system of agriculture that made the most of the locally available resources in terms of seeds, organic fertilizers, soil moisture and natural pest management. This led Sir Albert Howard, the pioneer of modern organic farming who did most of his work in Indore, situated on the edge of the Basin to observe some sixty years ago, "What is happening

today in the small fields took place many centuries ago. These agricultural practices have passed the supreme test, they are as permanent as those of the primeval forest, of the prairie, or of the ocean" (Howard, 1940). The clever use of rotation of a bewildering variety of crops ensured that despite occasional drought some part of the harvest was always saved. Famines occurred not because of the failure of agriculture but because of socio-economic factors such as excessive levies by kings and colonial rulers or due to usury and hoarding by sahukars (Patnaik, 1991). Indeed the levying of excessive taxes and usury have been a severe constraining factor on the development of agriculture all over the world from ancient times and in most of the Narmada basin this was intensified greatly because the usurious practices of the sahukars or moneylenders was supported by the British colonialists.

Thus what was necessary after independence was to remove the obstacles in the path of development of this traditional agriculture being practised in the basin and strengthen it with further research, extensive land reforms, localized water resource development, cheap institutionalized credit and market support. But this did not happen and agriculture, especially in the dryland areas in Madhya Pradesh gradually became moribund (Vijayshankar, 2005). This was because the new model of industrialized agriculture that was developed in the West since the 1930s in which hybrid seeds, fertilizers, pesticides, big dam irrigation and machines were used to improve agricultural production with huge state subsidies eventually benefited the corporations which not only supplied these inputs but also owned most of the farms and traded in the outputs. So farm gate prices remained low leaving the actual small farmers who had always struggled against usury no alternative but to tread the path of tremendous destitution. Post World War II the excess production of fertilizers, pesticides, tractors and trucks arising from the reorientation of the war time production of plants from explosives and armoured vehicles necessitated the replication of the Western agricultural system worldwide (Wessel & Hantman, 1983).

So at the behest of the research foundations set up by American multinational corporations, with financial support provided by the World Bank and the money from the exports of American wheat to India which were recycled for this purpose, the Western agricultural pattern was promoted with the introduction of foreign hybrid varieties of wheat and rice as green revolution agriculture in the late 1960s and early 1970s in the basin. Simultaneously soyabean was also introduced so as to provide feed for the burgeoning cattle industry in America. Soyabean has had the effect of displacing traditional kharif food crops like sorghum, maize, millets, pulses, gram, sesame and groundnut. Consequently the poorer farmers and the agricultural labourers have lost a cheap source of food and have now to buy their food from the market, which has led to a rise in malnutrition.

This form of agriculture has now become problematical throughout the world. The main problem with artificial input agriculture is that there is a natural limit to the artificial inputs that the soil can take and so the amount of fertilizers, pesticides and water to be applied keeps increasing while the yields go on falling and sometimes the crop fails altogether. Consequently the economic costs go on increasing while the realization of the value of agricultural products in the market does not keep pace (Rahul & Nellithanam, 1998). Inevitably this has led to the farmers falling into the clutches of sahukars and spiralling debt.

The most important consequence arising from the adoption of this agriculture has been in the utilization of water resources in the basin. The stress on production of high water demanding crops like hybrid rice, wheat and sugarcane has led to the concentration of financial resources on mega dam projects by the government on the one hand and the mining of ground water by private farmers through the use of motorized borewell pumps on the other. There has thus been an increasing scarcity of water in the basin. Most of the water needed for irrigation in the basin as we have seen is being provided by groundwater extraction and this has led to a situation of "water mining" wherein water collected in the deep confined aquifers over hundreds of thousands of years has been used up in the space of a decade and most parts of the plains are facing a groundwater drought from the 1990s onwards (CGWB, 1995). Since then there has been increasingly less ground water available for not only irrigation but also for drinking and the cost of its extraction is continually rising. This collapse of agriculture in the basin has created a parallel problem

of massive seasonal or permanent migration from the basin to areas outside it which offer better employment opportunities due to industrial development (Mosse et al. 2002). Within the basin as will be detailed in the section on industries there are only two important industrial centres. However this migration is grossly under reported in the census data and there are no studies specifically on outward migration from the basin.

Industry

Industrial development has not occurred in the basin as there are only two major industrial centres at Jabalpur and Bharuch. The major industry in Jabalpur is the ordnance factory of the Defence Ministry which is a century-old establishment involved in manufacture of arms, ammunition and vehicles for the army. Apart from this there are timber-based industries such as sawmills and furniture establishments. There are also units producing telephone parts, electrical goods and glassware. It is also a major centre for the manufacture of bidis. The major industrial unit in Bharuch is a chemical and fertilizer plant of the Gujarat Narmada Valley Fertilizer Company. Apart from this there are many other chemical and petro-chemical plants in the many industrial areas in Bharuch, Ankleshwar and Dahej. There is also a unit of the Oil and Natural Gas Corporation producing crude oil. In addition to this there is a coal-based thermal power plant in Sarni in Betul district of Madhya Pradesh and a Security Paper Mill of the Finance Ministry in Hoshangabad and some textile mills in Khargone and Khandwa. These two districts also have a few sugar mills.

Water Quality

The limited industrial development in the Narmada basin has meant that the problem of water pollution is considerably less in the river. The river has an average dissolved oxygen level of about 7-8 mg/litre throughout, which is comfortably higher than the safe limit of 5mg/ litre. The river water is slightly alkaline with the average pH level also hovering between the healthy 7 and 8 range though it is slightly on the higher side in Gujarat. The conductivity ranges from 190 mho/cm in the upper hilly region to 1746 mho/cm in the Bharuch area where industrial activity is high. The Total Coliform Count in the river ranges from 3-2400 MPN/100ml, whereas the Faecal Coliform count varies from 2-210 MPN/100ml, which indicates a relatively low level of pollution from human waste. The average Biochemical Oxygen Demand (B.O.D.) levels range from a low of 0.9 mg/litre at Amarkantak to a high of 4.5 mg/litre at Bharuch and Hoshangabad and generally about 1.3 mg/ litre elsewhere. Thus the river has an unacceptable B.O.D only near the urban conglomerations. Similarly the Total Suspended Solids (T.S.S.) are high at 14 mg/litre at Bharuch in the winter when the flow is clear elsewhere in the river. There are also concerns about the groundwater quality in Bharuch with the chemical units there pumping their effluents into the aquifers leading to heavy pollution of groundwater. Tests have revealed that the mercury levels in the groundwater near the Ankleshwar Industrial Estate are more than 100 times the admissible levels. This has been compounded by saline ingress from the sea owing to heavy drawals of groundwater in the area. Throughout the plains areas of the basin there is the problem of chemical residues from agriculture entering the groundwater and this is reflected in the fact that about 40% of the ground water sample collection sites of the Central Ground Water Board in the plains areas of the basin where modern agriculture is practised reported nitrate levels in excess of 100 mg/litre with some sites having levels higher than 300 mg/litre. Some areas in Jhabua and Dhar district where there are fluoride rocks in the aquifers have a high flouride content in the groundwater leading to the prevalence of fluorosis among the population that uses this groundwater. Some steps have been taken by the government to provide alternate treated water to these areas. (CWC, 2006)

Initial Plans for Surface Water Exploitation in the Narmada Basin

The Narmada basin along with other parts of central and western India experienced severe drought conditions in the last decade of the 19th century and this led the then British Governor General to appoint a Famine Commission in 1901 to study the possibilities of irrigation in the Narmada Basin and in Gujarat by construction of dams (Paranjpye op. cit). The commission in its report unequivocally stated that surface irrigation would be counter productive in the mostly deep black soils of the Narmada basin and also in Gujarat. The report mentioned that there were various ingenious systems in place throughout the basin for the conservation of soil moisture in clayey black soils for the cultivation of dryland wheat in the

rabi season and it was inadvisable to introduce flood irrigation that would result in waterlogging and salinity and reduce agricultural production instead of increasing it. This led to the shelving of any plans for dam building in the basin till almost the end of British rule.

The governments of the Central Provinces and Berar and Bombay presidencies requested the Central Waterways, Irrigation and Navigation Commission (CWINC) to take up investigations on the Narmada river system with respect to the possibilities of flood control, irrigation, power and navigation. The CWINC recommended that preliminary investigations should be taken up at seven different sites, which were ideal for the construction of storage reservoirs on the river. In 1948 a three member ad hoc committee appointed by the Ministry of Power to study these recommendations headed by the then chairman of the CWINC Dr A. N. Khosla suggested that given the paucity of resources detailed investigations should be conducted at only the four sites in Bharuch district, Punasa in Khandwa district, Tawa in Hoshangabad district and Bargi in Jabalpur district. The investigations were taken up and after the CWINC was renamed the Central Water and Power Commission (CWPC) in 1955 the detailed project reports of all the four projects were finally ready by 1963. The CWPC also carried out a study of the hydroelectric potential of the basin in 1955 and identified 16 sites, which could generate upto 1300 MW of electricity.

A meeting of the representatives of the Bombay and Madhya Pradesh states was held in 1957 where the chairman of the CWPC informed them of the potentialities of the Narmada basin. It was decided at this meeting to study a few more sites than those mentioned above and the cost of the investigations was to be borne equally by both the states. While conducting these further investigations it came to light that the site at Navagam in the present Narmada district of Gujarat had exposed rock from the riverbed, which could provide lateral supports for the construction of a high dam. On the basis of this the CWPC submitted a report to the Bombay government for the construction of a dam at Navagam in two stages. The first stage would have a full reservoir level (FRL) of 48.8 metres with a provision for later enhancement of the FRL to 91.4 metres. A panel of consultants appointed by the Ministry of Power and Irrigation to review this proposal recommended that the dam should be built at one go upto an FRL of 97.5 metres and a high level canal would make it possible to extend irrigation upto Saurashtra and Kacch. Notably unlike in British times in all these deliberations the suitability of irrigation in black cotton soils was not investigated at all. Thus the approach to water resource utilization was not related to the local specificities prevailing in the basin but to the general nationwide thrust for the building of large dams. On May 1, 1960 the new state of Gujarat was formed and it gave its approval to this enhanced height of the project and subsequently in April 1961 the then Prime Minister Jawaharlal Nehru inaugurated it thus initiating the process of dam building for the purpose of large-scale utilization of its waters on the river Narmada.

The proposal to irrigate Saurashtra and Kacch needed substantiation as to whether there was enough water available in the river at Navagam for this to be possible. The Gujarat government itself conducted a study and also contracted the Survey of India to do another to investigate the water availability from the free draining catchment of the river between Navagam and Punasa. On the basis of these studies the Gujarat government proposed that the dam height at Navagam should be enhanced to an FRL of 140.2 metres for full utilization of the untapped flow below Punasa.

Subsequent to this a meeting was held in November 1963 in Bhopal in which the Union Power Minister Dr. K. L. Rao and the Chief Ministers of Gujarat and Madhya Pradesh participated and it was supposedly agreed that -

- The FRL of the Navagam dam in Gujarat would be 129.6 metres and Gujarat would enjoy all the benefits.
- The FRL of the Punasa dam in Madhya Pradesh would be 259.1 metres and the cost and power benefits should be shared between Gujarat and Madhya Pradesh in the ratio of 1:2. Maharashtra would provide a loan to the extent of one-third of the cost of the Punasa dam and would in return be entitled to half of Madhya Pradesh's share of the electricity for a period of 25 years.
- The FRL of the Bargi dam in Madhya Pradesh would be 416.2 metres and it was to be implemented totally by Madhya Pradesh with

loans of Rs 10 crore being provided by Gujarat and Maharashtra.

However later the Chief Minister of Madhya Pradesh retracted from this agreement and reiterated that the height of the Navagam dam should be restricted to an FRL of 49.4 metres which was the bed level of the river at the Gujarat - Madhya Pradesh border. This led to the beginning of a bitter dispute over the use of the surface flows of the Narmada river.

The Inter-State Dispute Over Sharing of Narmada Waters and its Initial Resolution

The Union government constituted the Narmada Water Resources Development Committee under the chairmanship of Dr. A. N. Khosla in 1964 to resolve the dispute between the states over the sharing of the benefits of the utilization of Narmada waters. This committee was given the responsibility of preparing a Master Plan for the optimum and integrated use of the flow of the Narmada river and drawing up a phase wise timeline for its implementation with special reference to the details of the dam at Navagam. While this committee was deliberating on the various issues before it the governments of Madhya Pradesh and Maharashtra entered into an agreement in 1965 for the construction of a dam on the Narmada river at Jalsindhi just before the Gujarat border sharing the costs and benefits associated with the project. After this the Khosla Committee produced its report recommending 13 major projects in the basin on the Narmada and its major tributaries, namely Rosra, Basanta, Burhner, Bargi, Chinki, Sitarewa, Barna, Hoshangabad, Tawa, Kolar, Punasa, Omkareshwar and Navagam.

Regarding the Navagam dam itself the Khosla Committee recommended an FRL of 152.4 metres, the full supply level for the irrigation canal as RL 91.5 metres and the total installed capacity at the river bed powerhouse as 1400 MW. The committee also for the first time included Rajasthan in the share of irrigation benefits. As before the Khosla Committee did not go into the suitability of flood irrigation in black soil areas and the added measures needed to be taken in terms of lining of canals and construction of proper drainage channels to ensure that waterlogging and salinity did not occur. It also downplayed the environmental and social costs of the submergence of the gorge that begins at Harinphal at the point where the river becomes the boundary between the states of Maharashtra and Madhya Pradesh and the dam site at Navagam thus undervaluing the forests and the adivasis living in them. The main thrust of the committee was to ensure that most of the water in the river was used up for irrigation and power generation irrespective of the social and environmental costs involved.

While Gujarat accepted the Khosla Committee's recommendations, Madhya Pradesh and Maharashtra rejected them. The Madhya Pradesh government came up with the alternative idea of diverting the waters of the Narmada into the Ganges basin rather than their diversion into central and north Gujarat. Maharashtra was interested in the construction of a dam higher up so that it could get greater benefit from power generation. Several meetings between the Chief Ministers of the three states remained inconclusive and finally in 1968 the Gujarat government petitioned the Union government to appoint a tribunal invoking the Inter-State Water Disputes Act of 1956 (ISWDA). The tribunal was constituted in 1969 and the dispute over the apportionment of the waters of the river Narmada between the states of Gujarat, Rajasthan, Madhya Pradesh and Maharashtra and the height of the Navagam dam were placed before it for resolution.

The constitution of the Narmada Water Disputes Tribunal (NWDT) was challenged as ultra vires of the Inter-State Water Disputes Act by the Government of Madhya Pradesh in 1969 first before the tribunal itself and then when this challenge was dismissed by the tribunal, the government of Madhya Pradesh went to the Supreme Court and obtained a stay in 1972. Subsequent to this the Chief Ministers of the four states decided on trying for an agreement out of court with the assistance of the Prime Minister of India and after several parleys came to the agreement in 1974 that the yield of the river available at Navagam should be taken as 34.5 billion cubic metres at seventy-five per cent dependability. Of this 0.31 bcm was to be allotted to Maharashtra and 0.62 bcm to Rajasthan. So the NWDT was left with adjudication on the apportionment of the remaining 33.57 bcm of water between the states of Gujarat and Madhya Pradesh and the benefits of the hydel power generated. Thus this political settlement estimated the annual yield of the Narmada at Navagam at seventy-five per cent dependability at a value well above the assessment by

the NWDT's own technical experts of 27.4 bcm. The tribunal finally passed its orders in 1978 resolving all the contentious issues before it.

The Narmada Water Disputes Tribunal Award

The basic design data of yield of the Narmada river at Navagam was flawed as mentioned above because it was based on arbitrary assumptions for the values of the surface runoff, evaporation losses at reservoirs, return flow from upstream storages and from the groundwater aquifers and the carry-over storages without doing any detailed sampling and simulation studies to estimate these values properly. This arbitrariness plagued the estimation of other variables also that were used to decide the apportionment of waters between the states of Gujarat and Madhya Pradesh and the heights of the Sardar Sarovar dam at Navagam and the Indira Sagar dam at Punasa leading to the overdesign of the height of both dams and the consequent greater costs - economic, environmental and social. The broad contours of this design fiasco are detailed here. The ISWDA does not specify the principles based on which a tribunal constituted under it shall adjudicate on the apportionment of the waters of a river between the disputant states and so the NWDT relied on the Helsinki Rules on the Use of Waters of International Rivers that were framed by the International Law Association in 1966 as this customary international law also governed the use of waters of a river basin that spans more than one sub-national province. According to the Helsinki Rules (ILA Website) the principles on which the water resources of a basin are to be reasonably and equitably shared are as follows

The relevant factors to be considered include, but are not limited to:

- Geographic, hydrographic, hydrological, hydrogeological, climatic, ecological, and other natural features;
- The social and economic needs of the basin States concerned;
- The population dependent on the waters of the international drainage basin in each basin State;
- The effects of the use or uses of the waters of the international drainage basin in one basin State upon other basin States;
- Existing and potential uses of the waters of the international drainage basin;
- Conservation, protection, development, and economy of use of the water resources of the international drainage basin and the costs of measures taken to achieve these purposes;
- The availability of alternatives, of comparable value, to the particular planned or existing use;
- The sustainability of proposed or existing uses; and
- The minimization of environmental harm.

The weight of each factor is to be determined by its importance compared with other factors. In determining what is a reasonable and equitable use, all relevant factors are to be considered together for reaching a conclusion.

The NWDT rejected the Madhya Pradesh government's claim that the apportionment of waters should be made only on the basis of the first factor according to which Madhya Pradesh's contribution to the drainage area was 88% and its contribution to the flow at 75% dependability was 91%. The tribunal instead laid more stress on the second and third factors relating to social and economic needs and the dependent population of the basin states. Consequently the tribunal entered into an exercise of estimating the cultivable command areas (CCA) for arriving at the irrigation needs, the conveyance losses in taking the water from the dam to the fields and the civic and industrial needs. While estimating the cultivable command area in Gujarat the tribunal subtracted the contribution to this from the Mahi command but did not take into consideration the area already under groundwater irrigation. Nor did it apply its mind to the fact that surface water irrigation in the deep black cotton soils would lead to the problem of waterlogging and salinity which could only be resolved through the complete lining of canals, conjunctive pumping out of groundwater and the laying of appropriate drainage channels at a huge extra cost which would be economically and also physically unfeasible. This has been proved with the occurrence of waterlogging and salinization in vast areas of the country due to canal irrigation and especially so in the command of the Ukai dam.

Moreover the laying of drainage channels would also mean that more rainfall would be drained away rather than being recharged into the soil. So in years of drought when there would be less water for irrigation

available from the dam the groundwater would also be less because of less recharge leading to a severe water crisis instead of an improvement due to the dam. Apart from this the NWDT calculated a high conveyance loss of 50% from the dam to the fields to allow for seepage from the canals thus further inflating the water demand. This wrong logic was applied to the calculation of culturable command area for Madhya Pradesh also. Thus the NWDT arrived at a much higher cultivable command area for surface irrigation from dams for the basin than is practically and economically feasible with 120.3 lakh hectares for Gujarat and 254.6 lakh hectares for Madhya Pradesh. These areas were then multiplied by a delta factor for the amount of water required for surface flood irrigation to arrive at an irrigation water requirement of 13.1 bcm for Gujarat and 22.1 bcm for Madhya Pradesh which was more than the 33.6 bcm of water agreed on for apportionment between the two states! Adding the empirical estimates for civic and industrial water use and also giving some consideration to the greater drainage contribution of Madhya Pradesh the NWDT finally apportioned 22.5 bcm of water to that state and 11.1 bcm to Gujarat.

Similarly the determination of the height of the Navagam dam too was based on considerations that had little to do with reasonable use. The first basic parameter was that Rajasthan had to be supplied with 0.62 bcm of water through canal gravity flow. This would require a Full Supply Level (FSL) at the canal head of 91.5 metres so as to provide enough head and gradient for ensuring that water reached Rajasthan. Madhya Pradesh and Maharashtra argued that just to supply water to Rajasthan the height of the dam should not be increased. Instead Gujarat should be given Rajasthan's supply of water and asked to supply the same amount to Rajasthan from the Kadana river basin in north Gujarat. However, this proposal was rejected by the tribunal. The dead storage level at the dam was settled at 93.6 metres to take care of the losses in the canal head regulator and the transport of water from the dam to the canal head. The live storage level required above this for the supply of 11.7 bcm to Gujarat and Rajasthan was 132.9 metres. However, since Madhya Pradesh had earlier made a submission that it wanted to build a dam just inside its territory to a level of 141.8 metres to exploit the hydro-electric power potential the Full Reservoir Level (FRL) of the dam was settled at 138.7 metres and the Maximum Water Level (MWL) with the provision of a flood cushion was fixed at 140.2 metres. The full use of this heightened reservoir capacity could only be made with the help of regulated releases of 10 bcm from the Indira Sagar dam at Punasa and orders were given to this effect by the tribunal. However, no consideration was given to the fact that given the much less actual flow of the river and also the less return flow due to heightened groundwater extraction in the basin there was minimal possibility of such regular releases being made and so the water level in the dam would very quickly fall well below the FRL subsequent to the monsoon months when the flow would be reduced and the offtake of the canal would begin.

The NWDT also did not assess and deliberate on the various environmental consequences of building big dams beginning with the problems arising from submergence of forests and the denudation of the catchment to the changes that would be wrought on the environment of the river downstream of the dam. Nor did the NWDT take into consideration the effects of increased groundwater exploitation in the basin on the return flow from the aquifers into the rivers. Thus the NWDT in its deliberations and in giving its final order totally ignored the several other factors in the Helsinki Rules relating to the effects of the use or uses of the waters in one basin state upon other basin states, existing and potential uses of the waters of the basin, conservation, protection, development, and economy of use of the water resources of the basin and the costs of measures that have to be taken to achieve these purposes, the availability of alternatives, of comparable value, to the particular planned or existing use, the sustainability of proposed or existing uses and the minimization of environmental harm. These principles in the Helsinki Rules have later been endorsed by the United Nations Convention on the Law of the Non-navigational Uses of International Watercourses that was adopted by the General Assembly in 1997 (UN Treaty Website).

The Sardar Sarovar Project

The thirtieth and terminal large dam[1] on the Narmada river, Sardar Sarovar at Navagam, has a reservoir length behind it of 214 kms with an average width of

[1] When the height of a dam from bed level to maximum water level is more than 30 m it is considered to be a large dam and for a height between 30 and 10 m it is a medium dam.

1.77kms. In terms of the volume of concrete involved for gravity dams, this dam ranks as the second largest in the world with an aggregate volume of 6.82 million cu.m. Its spillway discharging capacity is 87,000 cumecs. The chute spillway radial gates are 7 in number and of size 18.3 m x 18.3 m and the service spillway has 23 radial gates of size 18.3 m x 16.8 m which are to be used to handle the design flood flow. Another set of 4 permanent river sluices are provided at RL 53.0 m. The design of the dam allows for a horizontal seismic coefficient of 0.125g and it also covers an additional risk due to reservoir induced seismicity. The FRL of the Sardar Sarovar Dam is fixed at RL 138.68 m. The Maximum Water Level is 140.21 metres, while MDDL is 110.64 m. The normal tail water level is 25.91 m. (NCA Website)

The gross storage capacity of the reservoir is 9.5 bcm while the live storage capacity is 5.8 bcm. The dead storage capacity below minimum draw down level is 3.7 bcm. The annual evaporation loss is 0.616 bcm. The submergence at Full Reservoir Level (FRL) is 37,690 ha, which comprises 11,279 ha agricultural land, 13,542 ha forests and 12,869 ha riverbed and wasteland. In all, 245 villages of the three states, viz. 193 villages of Madhya Pradesh, 33 villages of Maharashtra and 19 villages of Gujarat are affected. Only 3 villages of Gujarat are fully affected, while the remaining 242 villages are partly affected. In Madhya Pradesh, out of 193 villages, more than 10% agricultural land will be submerged only in 79 villages, in 89 villages less than 10% agricultural land or only houses will be submerged under FRL, due to back water of 1 in 100 years flood. In 25 villages, only government wasteland will be submerged. The project envisages irrigation to 17.92 lakh ha land of Gujarat covering 3360 villages of 62 talukas in 14 districts.

The Narmada Main Canal, which is a contour canal, is the biggest lined irrigation canal in the world. It is about 458 kms long up to the Gujarat -Rajasthan border having discharging capacity 1133 cumecs at its head tapering to 71 cumecs at the Gujarat - Rajasthan border. The canal will extend a further 84 kms in Rajasthan to irrigate areas in Barmer and Jalore districts of Rajasthan. The cross section of the canal at its head is 73.1m x 7.6m (bed width x full supply depth) with 2:1 inner side slope having canal velocity at head as 1.69 m/sec. The entire length of the Main Canal is proposed to be lined with in-situ plain cement concrete to minimize seepage losses, to allow higher velocities and control waterlogging problems in the command in future. In all, there are 593 structures on the Narmada Main Canal. Out of this 320 structures are cross drainage structures, comprising 5 aqueducts, 15 canal syphons, 177 drainage syphons, 26 canal crossing and one super passage. There are 96 regulating structures comprising 1 main head regulator, 44 branch head regulators, 38 cross regulators and 13 escapes. There are a total of 273 road bridges. Narmada Main Canal has been completed up to 357 kms and water has flown through it. There are thirty-eight (38) branch canals proposed for off taking from Narmada Main Canal.

The project aims at supplying 3571 million litres per day (MLD) of drinking water (2900 MLD for domestic consumption and 671 MLD for industrial consumption) to 8215 villages and 135 towns in Gujarat which presently suffer from acute shortage of water. Also the project aims to provide drinking water facilities to a population of about 13.71 lakhs in 1107 villages and the two towns of Jalore and Barmer in Rajasthan. There are two powerhouses for the Sardar Sarovar Project (SSP). There is 1200 MW of installed capacity at the river bed power house, which is fitted with reversible turbines that can act as pumps to pump up the water back into the reservoir with the surplus electricity produced at off peak hours so as to be able to reproduce this electricity during peak hours. The installed capacity is 250 MW at the canal head powerhouse. The dam has been completed upto 121.92 m in the river bed section and the concrete works are complete. Only the sluice gates remain to be fixed. The main canal upto 357 kms has been built. The amount spent is about Rs 25,000 crores so far.

The Narmada Basin Master Plan in Madhya Pradesh

The Madhya Pradesh government formulated a master plan for the development of the water resources in the Narmada basin in 1972 on the basis of the assumption that the yield of the Narmada at Garudeshwar at 75% dependability would be 34.5 bcm and the Madhya Pradesh share of this would be around 29.7 bcm (NVDA Website). Typically this master plan concentrated only on the construction aspects of the dams and canals without taking into consideration the tremendous environmental and social costs associated with such construction. In an absurd denouement the design parameters of the dams were not modified

after the NWDT awarded a lower amount of 22.5 bcm to Madhya Pradesh. Only the amount of water to be utilized was reduced and for the various projects this is as under:

Category	Area to be Irrigated (Lakh Ha.)	Water Use (bcm)
29 Major Projects	14.15	14
135 Medium Projects	6.7	3.55
3000 Minor Projects	6.7	3.1
Total	*27.55*	*20.65*
Domestic & Industrial Use	-	1.85
Grand Total	*27.55*	*22.5*

Table 3: Details of Projects to be Undertaken in the Narmada Basin
Source: *NVDA Website*

The estimated costs and the benefits in terms of irrigation potential to be created and hydel power to be generated of the 29 major projects to be constructed are as follows:

Name of Project	Estimated Cost (Rs. in crores)	Irrigation Potential (Lakh/ha.)
Matiyari (Dhoba Toria)	30	0.1011
Barna	18.9	0.548
Tawa	113	2.469
Kolar	120	0.451
Sukta	12.6	0.166

Table 4: Completed Projects
Source: *NVDA Website*

Name of Project	Estima-ted Cost	Irrigation Potential (Lakh ha.)	Hydel Power Installed Capacity(MW)
Bargi (R.A.B.S.)	2120.84	4.02	R.B.P.H. 90 M.W. (2 x 45 MW), C.H.P.H. 15 MW (2 x 7.5)
Indira Sagar	5000	1.23	1000 MW(8 x 125 MW)
Omkareshwar	1784.29	1.47	520 MW (8 x 45 MW)
Maheshwar	1570	----	400 MW
Man	140	0.15	----
Jobat (Chandra Shekhar Azad)	117.45	0.0985	----

Table 5 : Projects Under Construction
Source: *NVDA Website*

Name of Project	Estimated Cost	Irrigation Potential (Lakh/ha.)	Hydel Power Installed Capacity(MW)
Upper Narmada	211.92	0.1862	
Raghavpur	26.64	----	20 MW
Rosra	32	----	35 MW
Basania (Shingarpur)	165.72	----	60 MW
Upper Burhner	56.8	0.0942	
Halone	160	0.1173	
Ataria	30.16	0.1295	
Chinki	76.57	0.7082	
Sher Machhrewa Sakkar	93.23	0.6476	
Sita Rewa	4		15 MW
Dudhi	42.36	0.506	
Morand Ganjal	64.1	0.522	
Punasa Lift	672.98	0.256	
Upper Beda	89.17	0.099	
Lower GOI	164.45	0.137	

Table 6 : Projects Proposed in the Second Phase
Source*: NVDA Website*

The Indira Sagar Project

The catchment area of the Indira Sagar dam is 61,642 sq kms with an average rainfall of 1288 mm. Thus the estimated yield at 75% dependability is 26.5 bcm giving a standard flood outflow of 65,670 cumecs and a probable maximum flood outflow of 83,534 cumecs. On the basis of these design parameters the FRL of the dam has been fixed at 263.4 m and the MWL at 263.4 m, while the MDDL is 243.2 m and the crest level of the spillway is 245.1 m. The water spread area at FRL is 913.5 sq kms with a gross storage of 12.2 bcm, a live storage of 9.8 bcm and a dead storage of 2.4 bcm. The total length of the dam is 653 m with an overflow length of 495 m and a non-overflow portion of 158 m. The maximum height of the dam is 92 m. There is also a saddle earth dam 815 m long with a height of 10.7 m. There are 20 radial crest gates with length of 20 m and height of 17 m. A total of 249 villages are to be submerged of which 69 totally and 180 partially with cultivated area of 44,363 ha, other land of 5565 ha and forest land of 41,348 ha. A 3.7 km long and 8.2 m diameter tunnel with a discharge of 180 cumecs is to connect the reservoir to the main irrigation canal on the left bank. The main irrigation canal is to be 248.7 kms long with a head discharge of 160 cumecs. The Indira Sagar Project has an installed power capacity of 1000 MW, with annual energy generation of 2698 Million Units in Stage - I, 1850 Million Units in Stage - II and 1515 Million Units in Stage - III and annual irrigation of 2.65 lakh ha on a Cultivable Command Area (CCA) of 1.23 lakh ha.

As mentioned earlier the design of this and the other major dams was not altered even though the actual yield of the river had fallen from that estimated earlier. Thus the possibility of achieving substantial reductions in the social and environmental costs which were grossly underestimated when calculating the cost of the project were foregone. Such a redesign would have involved the exploration of alternative methods of conserving and using water and a more reasonable and equitable distribution of costs and benefits. As a consultant of the World Bank sent to assess the Indira Sagar Project for loan support has stated, "the analytical methodology used in sizing reservoirs and power stations was empirical rather than based on the latest techniques. Similarly, little scientific analysis was made of the complex hydrology of the river system. The 1972 Master Plan was prepared against a background of riparian conflicts - with the objective to demonstrate the greatest potential for irrigation development in order to justify the greatest possible allocation of water. However .... the Tribunal allocated to Madhya Pradesh less than three quarters of the water claimed by the states. Thus, the Tribunal's award necessitates a careful reassessment of the Master Plan to ensure that the water is put to the 'best' use from both an economic and social point of view." (Ljung, 1983, p. 8). So far only the dam, powerhouse, diversion tunnel and the canal head structures have been completed and so electricity is being generated but no irrigation benefits have accrued. The amount spent so far is about Rs 5500 crores.

Details of Some Other Major Projects in the Basin

The Bargi dam has been built on the Narmada river in Jabalpur district and has a catchment area of 14556 sq kms with a 75% dependable yield of 5.4 bcm. The FRL of the dam is 422.8 m and the MWL is 425.7 m, while the MDDL is 403.6 m. The gross storage is 3.92 bcm with 3.18 bcm of live storage and 0.74 bcm of dead storage. The reservoir has submerged an area of 26,797 ha covering 162 villages. The length of the masonry dam is 827 m, while its maximum height is 69.8 m and the length of the earthen dam is 4530 m. The design length of the left bank canal is 137.2 kms with a head discharge of 124.6 cumecs and a full supply level head of 404.1 m. The cultivable command area is 2.19 lakh ha and the gross command area is 2.57 lakh ha. The installed capacity of the powerhouse at the toe of the dam is 90 MW and that of the canal head powerhouse is 15 MW. The main canal is still under construction and the total amount spent so far has crossed Rs 800 crores.

The first major dam to be completed in the basin in 1975 was the Tawa dam situated at the confluence of the Tawa and Denwa rivers in Hoshangabad district. The head works comprise an earthen dam of average height 22.5 m and masonry dam of 57.9 m height with a central masonry spillway having 13 radial gates each of size 15.24 m x 12.192 m at the spillway crest at an R.L. 343.2 m. The M.W.L. of the dam is 356.7 m. The FRL is 355.4 m. The catchment area is about 6000 sq kms. The reservoir area is 20,050 ha at FRL covering 44 villages. The right bank canal has a culturable command area of 98079 ha and a gross command area of 11878 ha. The left bank irrigation canal has a

culturable command area of 1,86,162 ha and a gross command area of 2,56,904 ha. The cost of the dam and canal system was Rs 150 crores upto 1998. The installed capacity of the left bank canal head powerhouse is 13.5 MW established at a cost of Rs 74 crores in 1998.

The Man dam has been constructed at village Jeerabad of Manawar Tehsil of District Dhar. The dam has an FRL of 297.7 m. The maximum height of the masonry dam above riverbed level is 52.4 m, in the overflow section the height is 44.09 m and the earth dam is 33.9 m high. The MWL is 300.4 m and the MDDL is 278.7 m. The full reservoir capacity is 0.145 bcm, the live storage is 0.128 bcm and the dead storage is 0.017 bcm. The canal outlet Level is 277 m with the L.B.C. flow being 3.34 cumecs and the R.B.C. flow being 8.28 cumecs. The length of the Right Bank Canal is designed to be 11.64 m and of the Left Bank Canal 10.02 m. The Culturable Command Area of the project will be 15,000 hectares with proposed annual irrigation going upto 19,200 ha and it covers 48 villages. The catchment upto dam site is 690 sq kms. The project has no power potential. The reservoir submergence is 1094.9 ha covering a total of 17 villages. The dam was completed in 2004 and the canal system is still under construction. The cost so far has been Rs 160 crores. The Jobat project is a 38.6 m high and 452.5 m long composite gravity dam near village Baskal, in Jhabua district on the river Hathni, a tributary of the river Narmada. The project will provide irrigation of 9848 ha benefiting 27 villages. The estimated cost of the project is about Rs.117.45 crores. Submergence will partially affect 13 villages and 1310 ha of land which includes about 123.32 ha of forest land. The construction of the dam is still in progress.

There are two dams on the Narmada river downstream of Indira Sagar dam that are to take advantage of the regulated releases from the latter for the SSP to generate electricity and also irrigate agricultural land. The Omkareshwar project envisages construction of a 73.12 m high and 949 m long concrete dam with gated spillway, to irrigate 1.468 lakh ha of culturable command area through a 142 km long left bank canal and a 64 km long right bank canal with another 83 kms of lift canal. A river bed power house of 520 M.W. installed capacity (8x65 MW) has been built on the right bank. The reservoir has 0.3 bcm live storage capacity and the submergence will affect 30 villages spread over 5829 ha forest land, 4059 ha and of private and revenue lands. Compensatory Afforestation in 11660 ha and Catchment Area Treatment in 79,886 ha has to be done. The cost of the project is about Rs 3000 crores. The Maheshwar project is solely a hydel project located about 40 kms downstream of the Omkareshwar project near Mandleshwar town in Khargone district and envisages construction of a 35 m high concrete dam with 670 m long spillway having earthen flanks on the left and right banks of lengths 1573 M and 464 M respectively and a surface power house of 400 MW (10x40 MW) on the right bank. Similar to the SSP and the ISP the design and implementation of these projects too have been fraught with various inconsistencies leading to many problems which will be discussed later.

Initial Problems with the Implementation of the Narmada Basin Development Plans

Given the fact that the environmental and social costs associated with large dam centric utilization of river waters and the history of governmental apathy and inefficiency in mitigating these costs it is not surprising that such development in the Narmada basin came up against opposition right from the beginning. Immediately after the NWDT award in 1978 there was a "Nimar Bachao Andolan" in the lower plains in the Nimar region consisting of the districts of Khargone and Dhar against the submergence of fertile land there due to the enhanced height of the Sardar Sarovar dam. The Gujarat government had applied to the World Bank for a loan to facilitate the construction of the SSP. The first reconnaisance mission in its report recommended that certain impact assessment studies should be first carried out before proceeding with the construction of the dam. This delayed matters till 1980 when the Environment Protection Act was passed by parliament which made it mandatory to get permission from the Ministry of Environment and Forests (MoEF) for diversion of forest land for non-forest use. An Environmental Impact Assessment (EIA) of a project detailing the various impacts and the remedial measures necessary and their costs was mandatory for obtaining permission from the MoEF. This procedure for impact assessment also included a provision for public hearings in the project area in which the affected people could register their views. In accordance with the orders of the NWDT the Narmada Control Authority (NCA) was also set up in 1980 to ensure the implementation of its award and also to

oversee the proper measurement and development of water resources in the basin. This authority was to be headed by the secretary of the Water Resources Ministry and have as its members secretaries from the Power, Environment and Forest and Welfare and also the chief secretaries of the four states of Gujarat, Rajasthan, Maharashtra and Madhya Pradesh. This authority has subgroups dealing with the issues of environment, resettlement and rehabilitation, power, hydrometrology and implementation and regulation and so all works in and management of the Narmada basin are first discussed and approved here.

This effectively meant that the work could not start on the two main dams SSP and NSP without all the studies and permissions in place. While deliberations were continuing at the governmental and World Bank level the project-affected persons in Gujarat first began to protest under the leadership of the Chhatra Yuva Sangharsh Vahini regarding the provision of poor resettlement and rehabilitation. They made the provisions of the NWDT with regard to resettlement and rehabilitation their main agitational plank. The NWDT had made what were till then the most progressive provisions for rehabilitation and resettlement. Since most of the displacement due to the SSP was to take place in Madhya Pradesh and Maharashtra these states had fought hard for good rehabilitation and resettlement provisions for the oustees and the demands had been upheld by the NWDT. This movement for proper rehabilitation picked up steam in Maharashtra and Madhya Pradesh. From 1985 onwards and very soon the Narmada Bachao Andolan (NBA) was born which did not restrict itself just to the issue of rehabilitation but raised other issues related to the inflated claims of flow and the over design of dams, canal systems and command areas, waterlogging and salinity, siltation and the effects of seismicity and reservoir induced seismicity due to the active basin fault lineament.

The World Bank produced a Staff Appraisal Report in 1985 (World Bank, 1985) which stressed the conduct of environment impact assessment studies and provision of proper rehabilitation and resettlement to the oustees recommending that even landless people and encroachers on forest land should be given land and other facilities in compensation on par with the landed oustees. The loan that was sanctioned by the World Bank for the SSP in 1986 had a special component just for rehabilitation and resettlement. However the Ministry of Environment and Forests issued a note in the same year stating that the environment impact assessment for the SSP and the ISP were not complete and problems arising from improper environmental treatment would be quite severe. Apart from this enough land had also not been identified for the rehabilitation of the oustees. So there was a case for reducing the height of these dams to minimize the environmental and social costs.

The Ministry of Water Resources while agreeing with this assessment at the same time stressed that since the governments of Gujarat and Madhya Pradesh were keen to go ahead with the projects they should be given a green signal. Succumbing to political pressure at the highest level the Ministry of Environment and Forests finally gave a conditional sanction to both the projects in 1987 stipulating that appropriate catchment treatment and compensatory afforestation would be undertaken and rehabilitation and resettlement done properly. The department agreed to the release of forestlands for the purpose. This finally paved the way for the work on both the projects to start in full swing. However, the World Bank sent a letter to the Union Government pointing out the shortcomings of the existing rehabilitation and resettlement provisions and the environment treatment works stressing that these lacunae needed to be removed.

The Struggle between Two Opposing Views on Water Resource Management

Before the large dams on the Narmada river all such mega projects, beginning with the Bhakra-Nangal project on the river Sutlej in the 1950s, had witnessed the downplaying of the immense environmental and social costs associated with them leading to deleterious impacts in these spheres. Moreover, the claims of command area development too had been belied and so the actual irrigated area was far below that initially claimed at the planning stage. Over and above this the area actually irrigated had become plagued with waterlogging and salinity because of excessive flood irrigation and seepage from the canals and channels. Thus the NWDT award in favour of proper rehabilitation and resettlement whose implementation was to be monitored by the NCA was a pioneering progressive step towards people-centred water governance in India. Similarly the mandatory

requirement of EIAs and conduct of public hearings among the affected people for getting sanction from the MoEF for such projects was also a progressive step towards such people-centred governance. Thus the bypassing of these two legal provisions by the government which is supposed to be the upholder of the rule of law in a liberal democratic state was a gross violation of the fundamental right of the common people to decide on an appropriate mode of water resource development.

The government's unjust decision led to the escalation of the opposition to large dam building not only in the Narmada basin but all over the country under the aegis of the NBA giving rise to the powerful voicing of an alternative people-centred perspective on water resource management for "reasonable and equitable" use of the waters of a river basin in line with the provisions of the UN Convention on Non-navigational Uses of International Watercourses. The struggle involved not just the affected people in the Narmada valley but also others across the country and the world in a never-before-seen mobilization that used the techniques of mass action, legal action, lobbying and media advocacy to put forward its alternative views on people-centred water resource management. The movement was so universal that it included even people in Gujarat. The movement included those who had been displaced by the establishment of the colony at Kevadia village near Navagam in 1961 but were not considered as project affected persons (PAP) eligible for rehabilitation under the NWDT award, those who were to lose their land in the massive canal network but had not been considered to be PAPs, those of the PAPs who had been rehabilitated on land unsuitable for cultivation and those in Kachh and Saurashtra who were convinced by the NBA's critique that showed that water would actually either not flow or flow in greatly reduced quantities to that region belying the claims of the government (Sangvai, op cit).

This mass mobilization by the NBA reached its peak during the Sangharsh Yatra from Barwani to the dam site of the SSP in January 1991 which was stopped at the Gujarat - Madhya Pradesh border by the Gujarat Government. After a twenty-one day hunger strike by five activists the dharna at the border was withdrawn on the assurance given by the World Bank of instituting a first time ever independent review of its funding of the Sardar Sarovar Project. The NBA also made the public assertion at this point that given the apathy of elected governments towards the problems of the people it would henceforth work for the establishment of a people's government with the slogan of "Hamara Gaon Mein Hamara Raj" which specifically included local area watershed development as an alternative to large river basin and inter-basin projects. This was a very significant statement at the time as it anticipated the pathbreaking 73rd Constitutional Amendment of 1993 making Panchayati Raj a mandatory third tier of governance throughout the country. After this directly as a consequence of the pressure created by the agitation of the NBA the governments of Maharashtra, Madhya Pradesh and Gujarat stepped up their rehabilitation activities in accordance with the provisions of the NWDT award and the World Bank stipulations. So a major portion of the oustees chose to accept the better rehabilitation on offer and disassociate themselves from the NBA. Consequently the work on the projects in the Narmada valley proceeded apace despite the NBA's opposition.

The Report of the Independent Review Committee Commissioned by the World Bank

The World Bank Independent Review team led by Bradford Morse conducted a thorough review of the Sardar Sarovar Project and prepared a report in 1992 that was critical of the SSP (Morse, 1992). This criticism is important as it is in line with the provisions of the Helsinki Rules and the UN Convention on International Watercourses and is given in detail here as it states clearly the fundamental social and environmental problems with the planning and implementation of such mega projects. The main points of criticism are -

- Both the World Bank and the Indian Government failed to carry out adequate assessments of human impacts of the Sardar Sarovar Projects and the difficulties in implementation have their origin in this failure.
- There was virtually no basis, in 1985, on which to determine what the impacts leading to an inadequate understanding of the nature and scale of resettlement.
- This inadequate understanding was compounded by a failure to consult the people potentially to be affected and this had resulted in opposition to the projects, on the part of potentially affected

people, supported by activists. Also adequate account was not taken of the fact that a large proportion of those at risk from the development of the Sardar Sarovar Projects are tribal people. In addition, the overarching principle embodied in the 1985 credit and loan agreements by which resettlement and rehabilitation were to be judged, namely that oustees improve or at least regain their standard of living as quickly as possible, was not consistently advanced or insisted upon with sufficient force or commitment.

- The effects of the projects on people living downstream of the dam was not taken into account. These effects should also be mitigated.
- The distinction between "landed" and "landless" oustees failed to recognize the realities of life in the submergence villages and the rights of encroachers, mostly tribals, were not acknowledged.
- The people of the six villages affected by construction and development of Kevadia Colony were not appropriately and adequately compensated.
- Relocation and resettlement of the people of the rock-filled dyke villages was implemented in a way that was far from satisfactory.
- Those affected by construction of the canal and irrigation system should be entitled to resettlement benefits at par with those being affected due to reservoir submergence.
- The policies of the riparian states failed to anticipate the needs of major sons, and adopted what we regard as an unduly restrictive interpretation of the Tribunal award's provision for major sons. Maharashtra and Madhya Pradesh continue to maintain this interpretation and provide inadequate benefits to major sons of landed families. In 1987-88 the Government of Gujarat expanded its resettlement and rehabilitation policies to provide two hectares of irrigable land to all oustees, including the landless, encroachers, and major sons. This represented a policy package that came nearer than any thus far set out anywhere in India to establishing a basis for successful resettlement. Despite Gujarat's improved policy, Maharashtra and Madhya Pradesh continued to limit the provision of two hectares of land to "landed" oustees. This means encroachers and major sons (including the major sons of landed oustees) are not entitled to benefits in their own states that meet the overarching principles of resettlement and rehabilitation. The proportion of oustees thus vulnerable to a reduced standard of living is at least 60 per cent.
- The disparity between Gujarat's policy and the policies of Maharashtra and Madhya Pradesh has meant that oustees' right to choose between relocation in Gujarat and their own state has been rendered meaningless.
- Implementation of resettlement in Madhya Pradesh has been limited by policy deficiencies, inadequate institutional commitment, continuing failure of consultation, and limited availability of suitable resettlement land. This state of affairs in Madhya Pradesh has produced a situation in which, even if Madhya Pradesh were to adopt a policy with benefits equal to Gujarat's, such a policy could not now be implemented, given the time necessary to meet the requirements of the Sardar Sarovar Projects.
- Resettlement of oustees in Gujarat has entailed a scattering of families and villages among many different sites. This is in part a result of choices made by oustees. It is also a result of inadequate land at resettlement sites to accommodate all oustees who wish to have land there. This has contributed to some separation of families, especially in the case of oustees from the rock-filled dyke villages. Gujarat is unlikely to be able to resettle a large proportion of oustees from Maharashtra and Madhya Pradesh. Even if land were available for relocation sites, resettlement and rehabilitation at these sites presents major problems.
- Measures to anticipate and mitigate environmental impact were not properly considered in the design of the projects because of a lack of basic data and consultation with the affected people.
- The World Bank's appraisal took no account of the fact that environmental clearance in India was not forthcoming in 1983 from the Ministry of Environment and Forests because of insufficient information.

- Under the 1985 credit and loan agreements, the World Bank required an environmental work plan to be developed by the end of 1985, later extended to 1989. It is still not available, resulting in a disjointed, piecemeal approach to environmental planning that is both inefficient and ineffective. In 1987 India's environmental clearance for the projects was given, despite the fact that the information required before the projects' clearance was unavailable. In order to overcome this deficiency, studies were to be conducted pari passu with construction. The clearance was conditional on completion of these basic studies by 1989. Most remain to be completed. The pari passu policy greatly undermines the prospects for achieving environmental protection.
- Significant discrepancies in the hydrological data and analyses indicate that the Sardar Sarovar Projects will not perform as planned either with or without the upstream Narmada Sagar Projects. A realistic operational analysis of the projects upon which to base an impact assessment has not been done.
- The cumulative impacts of the Sardar Sarovar Projects together with the related upstream developments, especially the Narmada Sagar Projects, are very likely to be far reaching, yet they have not been studied.
- The afforestation and catchment area treatment programmes proposed upstream are unlikely to succeed within the timetable of the projects because of the lack of consultation with, and participation of, villagers in the affected areas. The compensatory afforestation approach being taken by Gujarat in Kutch, if continued, will lead to a steady decline in the quality of forests. The practice of replanting marginal forest lands in substitution for better lands that will be submerged, means that the forests will be diminished in value.
- The impact associated with the backwater effect of sedimentation in the upper reaches of the reservoir has not been considered. Our assessment has concluded that it will be significant.
- The downstream ecological implications of dam construction have not been considered. Important but limited data have only recently begun to be collected. The downstream impacts are likely to be significant, including severe losses to, if not the elimination of, the last important hilsa fishery in western India.
- There has been no comprehensive environmental assessment of the canal and water delivery system in the command area. Information gathered leads to the conclusion that there will be serious problems with waterlogging and salinity. Many of the assumptions used in project design and for the development of mitigative measures are suspect.
- Despite the stated priority of delivery of drinking water, there were no plans available for review.
- The existing threat from malaria within the command area is serious. The projects have been designed and executed without appropriate safeguards to reduce the likelihood of the spread of malaria will have serious consequences in the future.
- The newly proposed Narmada Basin Development Project, although it appears to address some of the problems highlighted in our review, fails to address key issues, delineated above. The Basin Development Project adopts a piecemeal approach, falling far short of that needed for proper basin development. The implications of Narmada Sagar for basin development are overlooked.

Later developments have shown that these criticisms have been borne out not only for the SSP but also for the ISP and the many other large dams under construction in the Narmada basin as will become clear by and by. Intense international pressure brought on the World Bank by environmental, human rights and tribal rights groups around the world led to its withdrawing from funding the SSP and rejecting the pending proposal for funding of the NSP in a pyrrhic victory for the NBA.

The Battle in the Supreme Court

Seeing no other alternative the NBA filed a writ petition in the Supreme Court in 1994 arguing that the fundamental right of the oustees especially the tribals was being denied by the SSP which was not in the public interest as it was not only incapable of providing proper rehabilitation and resettlement but it would also cause considerable environmental harm through waterlogging, forest submergence (not

totally compensable by compensatory afforestation), siltation (not totally preventable by catchment treatment), estuarine saline ingress, estuarine fisheries destruction and spreading of malaria epidemics. The project would also not fulfil its claims of irrigation development, drinking water supply and power generation and so the project should be scrapped. Apart from this the provisions of the Constitution of India regarding the governance of tribal areas falling under the Fifth Schedule and the provisions of the International Labour Organization Convention no 169 of 1989 on Indigenous and Tribal Peoples were also relied on by the NBA. The Supreme Court granted a stay on the construction of the SSP till the issues raised by the NBA were adjudicated on and so the work on the dam temporarily came to a halt.

After four long years of arguments and deliberations the Supreme Court pronounced its judgment in 1998. The court held that it had basically been petitioned to decide whether the policy decision taken by the government in 1987 in the face of pending environmental clearances of going ahead with the SSP was good or bad. It decided that while the decision was a hard one it was good and so the SSP could not be scrapped. Generally the Supreme Court agreed with the government's assessment that the SSP would solve the problem of scarcity of water, both for irrigation and drinking purposes, and of power as would the other dams on the Narmada and averred that in the post independence period dams had helped to overcome the food shortage in the country. On the contentious points of rehabilitation and resettlement and environmental mitigation the court held that these and the studies and impact assessments which would form their basis could be done pari passu with the building of the dam. The court refused to consider the Morse Committee Report since the government had refused to accept it and stated that there was no reason to doubt the veracity of the government's own assessment in this regard. The court also felt that the NWDT had made adequate provisions for rehabilitation and resettlement of the oustees and that the institution of the NCA set up in accordance with its order was quite capable of looking into all the outstanding issues with regard to environmental and social concerns. Moreover the court also noted that a Grievance Redressal Authority had been set up to look into complaints regarding rehabilitation and this institution would provide relief when approached. Thus the court felt that there was no need to approach it again on these matters as there was a competent institutional setup in place to take care of complaints.

The Supreme Court thus through this judgment laid down some crucial postulates regarding governance in the water sector in the Narmada basin in particular and in India in general as follows -

- The government and its agencies know best regarding the "reasonable and equitable" use of water resources and any citizens or groups of citizens challenging the government's understanding cannot claim any authenticity for their reasoning.
- The government and its agencies have to be trusted when they affirm that they will carry out the studies and activities required to offset negative environmental and social impacts resulting from a particular mode of water resource utilization.
- That tribals would benefit from being displaced by mega projects as they would then move out of the remote forested corners in which they reside and become part of the mainstream economy and society.

The reality since the handing down of this judgment, however, has belied these postulates. Neither the environmental mitigation activities nor the rehabilitation and resettlement has taken place in accordance with the guidelines in the SSP and so even a decade after the dam is still incomplete as the NBA has continually appealed to the NCA and also petitioned the Supreme Court again complaining about this and had the work of the dam stopped. This laxity with regard to environmental mitigation and rehabilitation has been in evidence in the other projects in the basin too - Bargi, Indira Sagar, Omkareshwar, Maheshwar, Maan, Upper Beda, Goi, Jobat and Tawa. In these projects too the NBA and its associate organizations have undertaken both mass action and legal action in the High and Supreme Courts against the gross violations by the government and its agencies of the NWDT award for rehabilitation and the minimum environmental standards. The employees of the government agencies have instead indulged in gross irregularities in the disbursal of cash compensation in lieu of land, which is prohibited by the NWDT award. This has adversely affected the

tribals the most because they have in most cases been left without productive assets and forced to make do as best they can with meagre cash compensation in the modern market economy in which they are weak players belying the expectation of the Supreme Court that they will benefit from displacement and rehabilitation. Despite this sordid state of affairs the Supreme Court refuses to review the dam centric water resource management paradigm of the government.

Problems of Large Dam Centric Water Resource Development in the Basin

The problems of large dams are many. Arising from their design and implementation having either ignored outright or grossly underestimated the social and environmental costs. They span the areas of rehabilitation and resettlement, canal system and command area development, compensatory afforestation and catchment area treatment and the sequestration of ecological niches and are described below in detail.

Rehabilitation and Resettlement

Involuntary displacement has been a constant phenomenon in the Indian subcontinent from the time of the British. The major legal instrument used by the British for this purpose was the Land Acquisition Act of 1894 (LAA) which continues to be the law in this regard to this day. This law just compensates the owner of land in cash at the value of land recorded in registered land sales and does not concern itself with other social and environmental losses suffered by the land owners. The legal process too is so complicated that poor people and especially tribals cannot hope to secure justice. The divide and rule policies of the British also led to the occurrence of possibly the single biggest displacement at one go in the world of millions of people at the partition of the Indian subcontinent into Pakistan and India in 1947. A Department for Rehabilitation was set up then to deal with this traumatic experience. However, this department did not concern itself with an equally traumatic process of displacement that began with the acquisition of land for development projects on a large scale after independence and was wound up in 1960. There is yet no law or department specifically dealing with rehabilitation and resettlement even though one has now been tabled in Parliament for enactment. Especially large in number were those displaced owing to the construction of large dams and among them the proportion of tribals is the largest. The colonial LAA was used to compensate the oustees with paltry cash compensation and sometimes not even that. There are no firm estimates but the government records themselves show that 75 per cent of those displaced due to development projects have not been properly rehabilitated and these millions of people have suffered immensely as a consequence.

This was the sorry backdrop for the deliberations of the NWDT with regard to the provisions for resettlement and rehabilitation. The governments of Maharashtra and Madhya Pradesh lobbied hard for good provisions to be made for the people being displaced from their States, as the costs would have to be borne by the government of Gujarat. Ultimately as a result for the first time in India very progressive provisions were made in the NWDT award for the rehabilitation and resettlement of the oustees as follows (Shelat, undated) -

- The main principle of the resettlement policy should be that the project-affected families improve or at least regain their standard of living they were enjoying before displacement.
- The affected people should be relocated as village units, village section or families in accordance with their preference.
- The affected people should be integrated with the host community, village where they have settled.
- The affected people should be provided appropriate compensation, adequate social and physical rehabilitation, infrastructure including community services and facilities.
- There should be active participation of the affected people in planning of their resettlement and rehabilitation.

As mentioned earlier mass mobilization first by the Chhatra Yuva Sangharsh Vahini and then by the NBA ensured that these provisions did not remain just on paper but were actually implemented on the ground by the governments of Gujarat and Maharashtra and the detailed arrangements that have been made are listed below as the best example of rehabilitation and resettlement in this country achieved through mass mobilization -

- Full compensation for the submerging agricultural land as per the provision of the Land Acquisition Act 1894, or land for land as desired by the oustee.
- Full compensation for existing house going under submergence. Dismantled components of the house and household kits to be transported free of cost to the new habitat.
- Each family will get 2 ha of irrigable land whether it is landowner or agricultural landless labourer. Even encroacher on government and forestland will get this benefit.
- Every major son of the landless oustees, agricultural labourers, encroachers, co-sharers who had attained the age of 18 years would be treated as separate families and entitled to get 2 hectares of land.
- Every displaced family will be provided a residential plot of 500 sqm free of cost.
- Facility for temporary sheltered accommodation at new village site.
- For construction of the plinth of houses, grant up to Rs. 10,000 to affected family. The oustee may build the rest of the house.
- Rs. 2,000 for the purchase of new roof tiles instead of transporting the old tiles at new sites.
- A core house of 45 sqm at the cost of Rs. 45,000 in lieu of tin shed, plinth and roof tiles will be provided free of cost.
- Every displaced family is paid subsistence allowance of Rs. 4,500 for the year. The amount is paid in three installments.
- Resettlement grant of Rs. 750 plus escalation in consumer price index at 8 % from January 1980. This is given in bulk after people permanently shift to the new site.
- Rs. 700 grant for purchase of productive assets such as bullocks, cows, sewing machine, trade tools, agricultural implements.
- To make the land fit for cultivation and derive full potential, the land is either ploughed or a grant of maximum Rs.600 is given for ploughing the fields.
- To derive the benefit of 100 per cent electrification, the affected people are given assistance for electrification in their new house and huts in the farms free of cost.
- Appointment of Grievance Redressal Authority for any complaints regarding land, resettlement and rehabilitation.
- Civic amenities such as, primary school, health centre in each new habitat, percolation tank, drinking water well, vocational training centre, approach roads, internal roads, seed store for 500 families, children's playground are to be provided at the new habitat.
- All displaced people are covered by insurance: huts and dwelling for Rs. 5,000; contents including own belonging for Rs. 1,000; death for Rs. 6,000; loss of use of two limbs or two eyes or one limb and one eye for Rs. 6,000; loss of use of one limb or one eye for Rs.3,000; permanent total disablement from injuries other than above for Rs. 6,000.

The implementation of these provisions, which are exemplary and are majorly deficient only in respect of being gender insensitive has been fairly good in Gujarat and Maharashtra. Even so those affected by the canal network and also by the creation of the colony at Kevadia have been given only cash compensation as the Supreme Court decreed that they did not qualify for rehabilitation under the provisions of the NWDT award. The implementation of the NWDT award, however, has meant that the project cost of SSP has shot up tremendously as a consequence. This escalation of project cost that results from providing proper rehabilitation has been the key deciding factor behind the government of Madhya Pradesh not only pushing the oustees of SSP to proceed to Gujarat for rehabilitation but also not providing anything but cash compensation to those who did not do so. Apart from some of the tribal population in Jhabua, Dhar and Badwani districts most oustees from Madhya Pradesh have stayed on there and so have been given cash compensation in total disregard of the NWDT award. Over and above this, there have been gross financial irregularities in the disbursement of the compensation which have continued despite the repeated agitations of the NBA (NBA Website).

Similarly in the ISP, Man and Jobat projects too the Madhya Pradesh government and the implementing agencies - the Narmada Hydroelectric Development Corporation in the first case and the Narmada Valley Development Authority in the latter have tried to ignore legitimate claimants for rehabilitation and give only paltry cash compensation to those identified without any proper provision of support facilities. In

the case of the ISP the dam has been built and the NBA could intervene only after the fact through a writ petition in the Madhya Pradesh High Court. So the most it could do was ensure that proper identification of oustees did take place and that they were given adequate cash compensation. In the case of the oustees of the Man and Jobat projects despite agitations on their part they finally had to settle with only cash compensation.

The battle of the oustees of the Omkareshwar Project, which too has been fully constructed, is still pending in the High Court of Madhya Pradesh. The High Court has stayed the closure of the gates to the Full Reservoir Level till the issues regarding the rehabilitation of the oustees are not fully decided by it. Thus here there is a possibility of the NWDT award being fully implemented once again. The work on the Maheshwar project is totally at a standstill because the implementing agency Sri Maheshwar Hydroelectric Power Company has violated the conditions of the environmental sanction given to the project by not preparing a comprehensive rehabilitation and resettlement plan in accordance with the provisions of the NWDT award. Moreover this private company has also indulged in various financial irregularities for which it has been implicated in court cases by several government agencies. A detailed analysis of the economics of the power to be generated by this project has shown that it is extremely uneconomical.

The plight of the oustees of the projects in the basin which came up before the NWDT award is nothing but pitiful. Thus the oustees of the Barna, Sukta, Bargi and Tawa dams were given paltry cash compensation and left to their own devices. The oustees of the Bargi and Tawa dams later agitated under the aegis of the NBA and the Samajwadi Jan Parishad for the right to form fishing cooperatives and exploit the fishing potential of the reservoirs created by these dams by submerging their lands. But this too is a tenuous concession that is under threat of being revoked by the government all the time. One other aspect of displacement in all the dams in the Narmada basin has been the under-estimation of the backwater effect that arises due to the flowing water being obstructed by the dam as a result of which the submergence area increases over and above that caused by MWL filling. Thus in all the dams the number of project-affected people has tended to be more than that decided on by the government.

Thus there has clearly been a major governance failure with regard to rehabilitation and resettlement of oustees, a substantial proportion of whom are tribals, in the many dam projects in the basin. Only by continuously going to the courts for redressal has the NBA succeeded to some extent in ensuring proper rehabilitation in some cases but the government of Madhya Pradesh in particular has been reluctant on its own to do so. This despite the fact that it has enacted a law for this purpose - Madhya Pradesh Pariyojna ke Karan Visthapit Vyakti (Punasthapan) Adhiniyam, 1985.

More importantly since a major proportion of the oustees are tribals residing in scheduled areas notified under the provisions of the Fifth Schedule of the Constitution of India this failure to hold consultations with the tribal oustees by the government is also a violation of their constitutional entitlements. With the enactment of the Panchayat Extension to Scheduled Areas Act 1996 it has now become mandatory to take the permission of the Gram Sabha before implementing any project in a scheduled area. However, this provision has been violated continuously in the case of the tribal oustees of the Man, Indira Sagar and Omkareshwar dams.

Canal System and Command Area Development

The actual realization of the claimed irrigation potential by dam projects depends crucially on the completion of the construction of the canal system and the subsequent development of the command area beyond the canal system so as to prevent waterlogging and salinity, optimize water utilization and maintain water quality. All these objectives require the development of the command area through levelling, grading and provision of sufficient drainage, both surface and sub-surface as well as pollution control measures especially against the fertilizers and pesticides run-off. On-farm development works also have to be detailed and implemented. Thus a command area development plan has to be worked out to fully utilize the irrigation potential. However, this has never been done effectively in all the major and medium projects constructed in the country and so right from the late 1960s several committees and commissions have noted that the claimed irrigation potential of the projects has not been even minimally realized (Upadhyay, 2004). What has happened is that

investments have continually been made in the building of newer and newer dams while funds have been withheld from command area development. Consequently over the period from 1991-2004 despite an investment of Rs 99610 crores in major and medium irrigation projects, the area under canal irrigation actually declined by a massive 3.18 million ha (Thakkar & Chandra, 2007). Similarly while the potential for canal irrigation created in the Narmada basin in Madhya Pradesh is around 318000 ha the actual irrigation was only 55915 ha (MPWRD Website). The SSP itself had reported command area development in only 279,308 ha by 2007 and an irrigation of 1.08 lakh ha (SANDRP, 2007). Thus even though almost 6 bcm of water flows through the canals most of this water is allowed to flow in intervening rivers like Sabarmati and used to fill tanks instead of being used for irrigation. Moreover due to gross mismanagement and financial irregularities the drinking water supply could also be made only intermittently in 2044 villages and 57 towns, less than half the planned number.

The irrigation has not yet begun in ISP, Omkareshwar and Bargi projects because the canal systems are not in place. In Man project only about 15 per cent irrigation is taking place because the main canals are leaking profusely and are incapable of taking the design flow. In the Tawa project there is a serious problem of waterlogging and salinity. The seepage from the canals was much more than had been expected. Thus additional investments had to be made in lining the channels and also in land levelling and drainage works. While the government carried out the former the latter had to be done by the farmers themselves and this they could not do due to lack of funds. Not surprisingly the actual irrigation is much less than the potential that has been created. In all these projects in Madhya Pradesh despite there being a law to this effect no participatory irrigation management is being practised.

The SSP, however, had originally planned to overcome the problems of command area development by participatory irrigation management through the formation of water user associations (WUA) for the mobilisation of farmers to carry out earth levelling, drainage and field channel works beyond the lined minors which would reach every village in the command. This was supposed to be the key to ensuring that problems like waterlogging, salinity and pollution of groundwater did not occur and that the water was equitably distributed among the farmers. However, even though by 2004 as many as 1145 WUAs had been registered none of them had carried out the field distribution and drainage works. So water was being drawn with the use of diesel or electric pumps or siphoning from the minors leading to inequality in the distribution of waters and also in harmful effects on the soil. Consequently instead of supplying water to the first phase command areas in Narmada, Bharuch and Vadodara districts the Gujarat government is now proposing to carry the water to North Gujarat to recharge the depleted ground water aquifers there. The estimated cost of the SSP has now ballooned to well over Rs 50,000 crores. Thus like in other projects earlier, the irrigation projects in the Narmada basin too are not going to be able to actualize the potential for canal irrigation that has been created by damming the rivers at such exorbitant costs. Moreover, there is the question of the unutilization of the storage capacities created because of the lower flow in the river and also the recently established fact that large dam reservoirs are a significant contributor to global warming through generation of methane gas.

Compensatory Afforestation and Catchment Area Treatment

Another two important areas of work in a dam project that are crucial to its sustainability and life are that of compensatory afforestation and catchment area treatment which go together. Unless these activities are done in a planned manner with massive people's participation the amount of soil erosion will continually increase in the catchment leading to a rapid rate of siltation of the dams. Even though on paper compensatory afforestation and catchment area treatment have been completed in reality this has not been effective. For both these activities to be successful the people residing in the catchment have to be involved in the work and the level of investment and planning has to be much higher than actually done.

Good catchment area treatment and compensatory afforestation require the prior demarcation of critically degraded areas on the basis of aerial photgraphs, satellite imagery and ground checks. Creation of a chain of nurseries of suitable species for biological treatment of the area is another important

requirement. Finally a phased action programme for biological and engineering treatment of the degraded catchment area with informed participation of the residents of the area is a must. Only such a thorough exercise can both reduce silt load and maintain ecological balance in the catchment area of dams. The interpretation of the aerial photographs and satellite imagery followed by ground truth checks, detailed land and soil surveys and geo-morphological studies to suggest the engineering and biological treatment for the eroded areas have never been undertaken. Moreover the poor rehabilitation of the oustees has not only forced them to encroach on forest and revenue lands near the reservoirs of the dams for their livelihoods but also made them engage in draw down agriculture in the reservoir itself in the summer months.

The net result of all this is that the soil erosion rate is not controlled and so siltation is a major problem that is reducing the life of all the dams much faster than expected. Over and above this there is continuous land use change in the catchment area which leads to more runoff. There are neither any ongoing studies of these landuse changes nor any plans to reverse them.

Creation of Ecological Niches

Finally there is the problem of creating ecological niches where the wildlife displaced from the reservoirs will be accommodated. This involves further displacement of people, adivasis in most cases, once again without proper rehabilitation and resettlement under the provisions of the Indian Wildlife Act 1972. There are more than ten such new sanctuaries and national parks planned in the Narmada basin.

The most tragic plight in this regard, however, is that of the oustees of the Tawa Dam which displaced the tribals of 44 villages. They were paid a paltry compensation of Rs 100 to 500 per hectare at the time of their first displacement in the 1970s. They settled on forest and government lands near the reservoir. They were then evicted once again as a proof range meant for the purpose of testing military weapons was set up there. They then once again settled in the forests and had to bear the continuous harassment of the forest department, which intensified when the Satpura National Park was set up in 1981. Finally, the people organized themselves and founded Kisan Adivasi Sangathan in 1985. Since then people have raised their voice and have protested through rallies, demonstrations, dharnas, foot marches and road blockades. Following this the government finally decided to hand over the contract for fishing in the Tawa reservoir to a cooperative federation of the displaced people and this has run successfully since then.

However, later the government combined three protected areas for wildlife conservation in the vicinity of the Tawa reservoir - Satpura National Park, Bori Wildlife Sanctuary, and Pachmarhi Wildlife Sanctuary and formed the Satpura Tiger Reserve, to be managed under the Project Tiger. These protected areas are not only home to the tiger but several villages are also located inside these forests. There are 8 villages in the Satpura National Park, 17 inside the Bori Wildlife Sanctuary, and another 50 villages within the boundaries of Pachmarhi Wildlife Sanctuary. In addition to these 75 villages, there are 50 villages located close to the boundaries of these protected areas where people regularly make use of these forests. In recent years the use of the forest by these villagers has been severely restricted and local people are not allowed to work for their subsistence by harvesting and selling products such as honey, broom, ropes made with bhabhar grass, tendu leaves, mahua seeds and flowers, and other forest produce. Grazing of cattle in the forest and harvesting of fodder and fuel-wood has been banned in these forest areas. This has led to a severe crisis of hunger and starvation.

The Tawa reservoir has also been included within the boundaries of the Satpura Tiger Reserve. People displaced during the construction of the Tawa dam had resettled themselves along the banks of the Tawa reservoir and now earn their livelihoods by catching fish in the reservoir and doing draw-down cultivation in the submergence area after the reservoir waters recede. However Satpura Tiger Reserve authorities are trying to ban even these subsistence activities, which means that tribals of these 50 villages may be displaced again and their lives and livelihoods may be devastated once again.

Elitist Water Governance

The World Bank, which has been a major funder of dams worldwide, was forced by public criticism arising from the fiasco of its funding of the Sardar Sarovar Dam to constitute a World Commission on Dams to

review the performance of big dams, which submitted a comprehensive report (WCD, 2000). The report highlights the fact that the benefits in terms of irrigation and power gained from big dam construction have gone to the larger farmers or agricultural corporations generally and that the small and landless farmers have been left literally high and dry. Specifically throughout the Narmada basin the lack of command area and canal system development in the many dam projects that have been implemented has meant that farmers with motors situated near the canals have cornered all the benefits.

The more harmful aspect from the point of view of water governance is that the rationale of water resource management has moved away from water per se to the building of large dams and the tremendous benefits that such gigantic construction works convey to the industrial elites at the expense of the common tax payer. The proper way to go about managing the surface and sub-surface water flows in a river basin is to start from the ridges of the topmost micro-watersheds that constitute the catchment of the river and then work down to the river itself. It is economically much cheaper and environmentally much safer to do this and big dams should only be built to service the needs that cannot be met through in situ water conservation and extraction. However, since this decentralized water management requires very simple technology that has been around for thousands of years from the time of the ancient Harappan civilization (Agrawal & Narain, 1997) it does not appeal to the planners, engineers and politicians. So there is little consultation with the people either in the command areas or in the catchment areas of dams before they are designed. There has thus been a lack of equity in both the distribution of benefits and costs of large dam construction with the poor having lost out on both counts.

Alternatives

The areas in the Narmada basin with less than 5 per cent slope which are eminently suitable for extensive canal irrigation from major or medium dams cover only about 20 per cent of the total cultivable land. Indeed the Man and Jobat dams have been built in areas whose commands are highly unsuitable for canal irrigation due to the terrain and the soil structure. In the case of the SSP, which envisages inter-basin transfer also, the command is situated in plains areas as it is in the case of the ISP. Thus the substantial upper watershed regions having greater slope will always remain without irrigation if nothing other than large and medium sized dam-based irrigation projects are implemented. Thus even if the tremendous problems associated with dam-centered water resource development detailed above are ignored even theoretically such development cannot address the water needs of the more numerous population residing in the upper watersheds of the basin. Apart from this there is the problem of the collapse of external input flood irrigation-based agriculture that has been mentioned earlier. Thus there is a need to invest more on techniques for conserving soil moisture and for augmenting the groundwater aquifers which are natural reservoirs available free of cost. Some of the alternatives that have been implemented in the basin are described below.

Watershed Development

Centralized planning for the agricultural sector after independence and especially since the decade of the 1960s in the Narmada basin based on subsidized supply of inputs like water, power, hybrid seeds and chemical fertilizers has not only been environmentally harmful but has also led to the near total neglect of the tribal dominated dry land areas that constitute most of the basin (Shah et al. 1998). This led to the initiation at the beginning of the decade of the 1990s of watershed development through the "ridge to valley" approach as opposed to the treatment of land in isolated areas with the active involvement of the beneficiaries in planning, implementation and post-project maintenance of the created structures as an ameliorative measure (Shah, 1993, GOI, 1994). The Government of Madhya Pradesh initiated the ambitious Rajiv Gandhi Watershed Development Mission (RGWM) in 1994 incorporating these new ideas by pooling all the funds being made available to it by the Government of India for poverty alleviation and treatment of drought-prone areas under various schemes. This increased stress on watershed development arose because most of the terrain was undulating and due to the underlying basaltic rock structure water storage in the natural system was low. Apart from the government many NGOs too began to implement watershed development programmes along these lines. The obvious positive impact of the

RGWM on the water availability in the upper watershed villages in the districts of the basin in which it has been implemented can be gauged from the chart below :

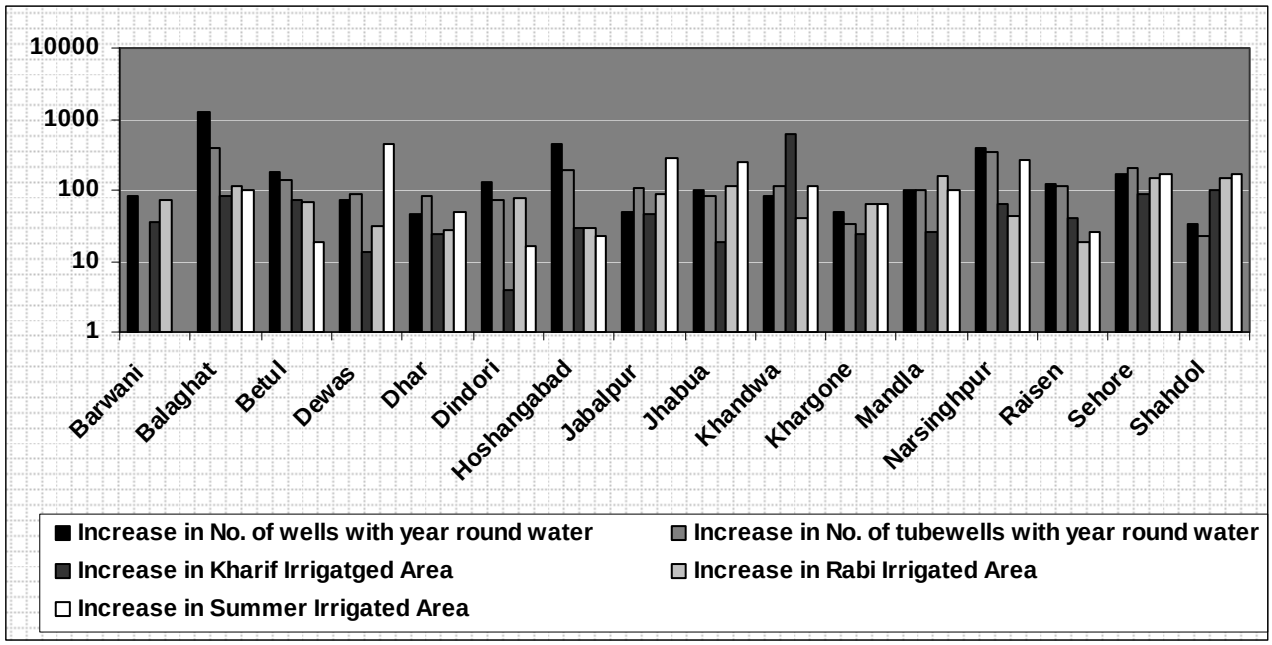

Figure 3: Changes in Water Availability due to Watershed Development (%)
Source: *RGWM Website*

Similarly in Gujarat too in 2005-06 the irrigation achieved through small water conservation programmes was 3.5 lakh ha as compared to only 1.08 lakh ha by the SSP. The increased return flow in streams and rivers from the recharged groundwater aquifers can then be used through a combination of check dams and lift irrigation. Consequently given the increasing importance of local area conservation and harvesting of water resources the World Commission on Dams in its report has recommended that in future people's participation in processes of water resource governance should be made mandatory so that more effective and less harmful solutions to the problems of water resource management can be worked out. After all the investment required in comprehensive watershed development is only around Rs 12,000 per ha as opposed to the lakhs of rupees required for large dam construction and the benefits are immense as detailed below -

- Recharge of the natural storage provided by the groundwater aquifers.
- Conservation of soils and soil moisture.
- Conservation of forest, common land and agricultural biodiversity.
- Greater irrigation coverage.
- Generation of energy through biomass production.
- Mitigation of climate change effects through greater forest cover.
- The greater flow that results in the hilly streams can be harnessed for micro-hydel power generation for cheap distribution in remote rural areas.

Unfortunately the fatal fascination with big dams means that most of the investments are directed towards their construction and very little for watershed development.

Combination of Endogenous and Exogenous Water

Arid and semi-arid areas may not always be able to fulfill their water needs from the maximum utilization of the water available endogenously because it is insufficient. In such cases introduction of water exogenously from another basin may be necessary. This has been the practice in Tamil Nadu where rainfed

tanks are replenished with canal waters once they run dry. This principle along with the conjunctive use of surface and groundwater has been relied on to devise an alternative plan for the harnessing of the waters of the Narmada for the benefit of Gujarat which would ensure full utilization of the 11 bcm of water allocated to Gujarat with much greater irrigation and environmental benefits at much lower economic, environmental and social costs through the use of local dispersed surface storage and the storage in groundwater aquifers instead of one large storage at the dam (Joy & Paranjape, 2006). In addition there are provisions for local participation in biomass generation through equitable distribution of water both upstream and downstream thus ensuring sustainability and equity in resource use. The comparison of the actual and alternative plans under this design for SSP are given in the table below –

Item	Alternative Plan	Current Plan
MWL at SS dam	107 m	140 m
Total submergence	10,800 ha	36,000 ha
Displacement	Drastic reduction in displacement	1.5 lakh people displaced
Rehabilitation	Within the same area with assured share of Narmada water	Uprooted, rehabilitation in
Upstream service area	More than 1 lakh ha	Nil
Total Gujarat service area	41 lakh ha	18 lakh ha
Saurashtra	13.1 lakh ha (32%)	3.9 lakh ha (22%)
Kutch	4.0 lakh ha (10 %)	0.4 lakh ha (2%)
North Gujarat	14.7 lakh ha (36 %)	3.1 lakh ha (17 %)
Rest of Gujarat	8.9 lakh ha (22 %)	10.6 lakh ha (59 %)
New Power Generation	850 MW	1,400 MW
New Energy Generation	2,600 MU	3,600 MU
Energy Consumed in the project	1,646 MU	1,138 MU
Peak load capacity	1,200 MW	1,400 MW
Gas-solar hybrid generation	200 MW (1750 MU)	Nil
Surplus energy	At least 4,410 MU (26.3 MT produced as biomass)	Nil
Equitable water distribution	Basic issue	Not planned
Total cost (Rs crore)	12,920	13,000
Expenses on local employment and services (Rs crore)	3,620	Negligible
Loss of Forest	3,000 ha by submergence and 10,000 ha low grade forest for rehabilitation	13,700 ha substantial prime quality forest
Cost recovery	Based on distinction between basic	No such plan
Gujarat's total share of Narmada water	11 bcm	11 bcm
Permanent vegetative cover in service area	11 lakh ha (23,000 ha in upstream contiguous to forest area)	No provision

Table 7: Comparison of Alternative Plan with the Current Plan of SSP
Source: *Joy & Paranjape, 2006.*

This alternative plan is in consonance with the provisions of the Helsinki Rules for "reasonable and equitable" utilization of the waters in a basin and also their sustainable and conjunctive use. This plan also conforms to the provisions of the UN Convention on Non-navigable Uses of International Watercourses. Such plans can also be developed for the other major dams in the basin leading to a much better participatory regime of water governance.

Traditional Water Harvesting Systems

The Narmada basin has traditionally been home to very wise and ingenious water harvesting systems. The upper basin areas around Jabalpur, Narsinghpur and Hoshangabad had the "haveli" system. In this the fields with deep black soils were bunded and kept immersed in water throughout the monsoons. This led to good recharging of the aquifer and also the rotting of all the weeds. At the end of the monsoons the water was slowly drained and then when the fields had just the right moisture they were sown with indigenous dry land varieties of wheat. This area had the highest productivity of indigenous wheat varieties in the entire country in the 1950s. However, with the introduction of soyabean as a kharif crop this practice died as farmers began to take a kharif crop and then use irrigation with pumped groundwater or water from the Tawa dam for the rabi wheat crop. Consequently the haveli system has become moribund in most areas (Agrawal & Narain, op cit).

In the lower hilly tracts of the basin in Khargone, Barwani, Dhar, Jhabua, Nandurbar and Vadodara districts the Bhil adivasis have a system of water harvesting called the "paat" (Rahul, 1996). In this hilly streams are bunded with rocks, stones and muds to form a weir and then the water is diverted into channels which have a much lower gradient than the stream bed. So after a distance downstream these channels are able to reach the fields on the high banks of the streams and irrigate them. Since maintaining the bunds on the streams and the channels which are over a few kilometres long and have to be carried across intervening gullies requires a lot of labour the paat systems are normally maintained by the communities and are a participatory irrigation system. Since this system requires only labour which is in abundance among the Bhils it is still very popular as irrigation with electric and diesel pumps has become extremely uncertain and expensive these days.

Micro Hydel Systems

The hilly portions of the basin with fast running streams offer considerable scope for micro-hydel power generation. However, even though policies are in place in this regard in all the states of the basin little has been done to actualize this on the ground. The NBA has implemented one such project on a tributary of the Narmada, the Udai river, in Nandurbar district in Maharashtra at Bilgaon village. Designed by the People's School of Energy of Kerala, the hydel project taps the power potential of a natural waterfall. The 15 kW of electricity produced is adequate to light all 12 hamlets that fall within 4 kms of this tribal village. A two-metre high check dam stores 15 lakh litres of water, which is channelled into a smaller tank capable of storing 30,000 litres. Water flows at the rate of 400 litres a second from a height of 8 m to drive a turbine. This, in turn, drives a generator at the rate of 1,500 rotations per minute (rpm) giving Bilgaon its electricity. In the months when the river Udai is in full flow, the village would have electricity round the clock. When there is less water, there are four hours of supply only in the evening (Bavadam, 2003).

Conclusion

This review unequivocally leads to the conclusion that there has been a serious governance failure in the Narmada basin regarding the proper utilization of its water resources. The basic assumption that big dam projects are indispensable for irrigation and power development has led to the ignoring of the tremendous environmental and social costs associated with such projects and a violation of the basic principle of "reasonable and equitable" utilization of water as mandated by international covenants on the use of river waters. The inability to fulfil the need for irrigation through dam projects has on the one hand led to the excessive exploitation of groundwater aquifers and also to a lower recharge of groundwater and leading to reduced surface flow and greater siltation due to a paucity of funds for soil and water conservation measures. The various mass organizations and NGOs led by the Narmada Bachao Andolan have continually agitated for people centred water governance in the basin so far with only partial success. This has led to the development of alternative approaches for better participatory and sustainable water governance in the basin at both the theoretical

and practical levels but they are not being replicated on a large scale. The basic reason is the lack of funds and political will. However with the National Rural Employment Guarantee Act 2006 now to be implemented throughout all the districts of the basin there is an opportunity to prepare a comprehensive basin development plan and implement it also over a period of time. The time is thus ripe for the initiation of such participatory planning processes.

References

Agrawal, A. and Narain, S. (1997): *Dying Wisdom: State of India's Environment a Citizen's Report,* Centre for Science and Environment, New Delhi.

Bavadam, L. (2003): The Bilgaon Model, *Frontline*, Vol 20 Issue 21, October 11 - 24.

Central Groundwater Board Website: http://cgwb.gov.in

CGWB (1995): *Groundwater Resources of India,* Ministry of Water Resources, Government of India, Faridabad.

Central Water Commission Website: http://cwc.nic.in/main/webpages/rm/activities.html

CWC (2006): *Integrated Hydrological Data Book (Non-Classified River Basins),* Information Systems Organization, Central Water Commission, New Delhi.

Gujarat HDR (2004): *Gujarat Human Development Report 2004,* Mahatma Gandhi Labour Institute, Ahmedabad.

Howard, A. (1940): *An Agricultural Testament,* Oxford University Press, London.

Joy, K. J. and Paranjape, S. (2006): Alternative Restructuring of the Sardar Sarovar: Breaking the Deadlock, *Economic & Political Weekly*, February 18.

Maharashtra HDR (2002): *Human Development Report Maharashtra 2002,* Government of Maharashtra, Mumbai.

International Law Association Website: http://ila-hq.org

MPHDR (2002): *The Madhya Pradesh Human Development Report: Using the Power of Democracy for Development,* Madhya Pradesh Government, Bhopal.

Madhya Pradesh Forest Department Website: http://www.forest.mp.gov.in

Madhya Pradesh Water Resource Department Website: http://www.mpgovt.nic.in/wrd/default.htm

Morse, B (1992): *Sardar Sarovar: The Report of the Independent Review,* Resource Futures International, Canada.

Mosse, D., Gupta, S., Mehta, M., Shah, V., Rees., J. and KribP Project Team. (2002): Brokered Livelihoods: Debt, Migration and Development in Tribal Western India, *The Journal of Development Studies*, Vol, 38 No.5, London.

Narmada Control Authority Website : http://www.nca.gov.in

Narmada Bachao Andolan Website: http://narmada.org

Paranjpye, V. (1990): *High Dams on the Narmada: A Holistic Analysis of the River Valley Projects,* INTACH, New Delhi.

Patnaik, U (1991): Food Availability and Famine, *Journal of Peasant Studies*, Vol. 19 No. 1.

Rahul (1996): The Unsilenced Valley, *Down To Earth (DTE)*, June 15, 1996.

Rahul and Nellithanam, J. (1998): Return of the Native Seeds, *The Ecologist*, Vol.28 No.1

Rajiv Gandhi Watershed Mission Website: http://www.watermissionmp.com

Ranade, R. (2005): 'Out of Sight, Out of Mind': Absence of Groundwater in Water Allocation

of Narmada Basin*, Economic and Political Weekly*, May 21.

SANDRP (2007): SSP: Mounting Costs Minimum Benefits, *Dams, Rivers & People*, Vol. 5 Issue 10-11, November-December.

Sangvai, S. (2002): *The River and Life: People's Struggle in the Narmada Valley,* Earthcare Books, Kolkata.

Sardar Sarovar Narmada Nigam Limited Website: http://www.sardarsarovardam.org/

Shah, M., Banerji, D., Vijayshankar, P. S. and Ambasta, P. (1998): *India's Drylands: Tribal Societies and Development through Environmental Regeneration*, Oxford University Press, Delhi.

Shah, P. (1993): *Participatory Watershed Management Programmes in India: Reversing Our Roles and Revising Our Theories in Rural People's Knowledge*, Agricultural Research and Extension Practice, IIED Research Series, Vol 1 (3), IIED, London.

Shelat, U. (undated): *Resettlement in Narmada River Basin: Evolution of Resettlement Policy in India,* accessed at http://www.hdm.lth.se/fileadmin/hdm/alumni/papers/ad2000/ad2000-08.pdf.

Thakkar, H. and Chandra, B. (2007): Rs 100000 Crore Spent but No Additional Benefits: No Addition to Canal Irrigated Areas for 12 Years*, Dams, Rivers & People*, Vol. 5 Issues 9-9, September-October.

Upadhyay, H. (2004): Narmada Project: Concerns over Command Area Environment*, Economic and Political Weekly*, May 8.

Vijay Shankar, P S (2005): *Four Decades of Agricultural Development in MP: An Agro-ecological Sub-Regional Approach,* Economic and Political Weekly Vol 40 No 48.

World Bank (1985): *Gujarat Sardar Sarovar Dam Power Project,* Staff Appraisal Report (No. 5107-IN), February 2.

Wessel, J. and Hantman, M. (1983): *Trading the Future: Farm Exports and The Concentration of Economic Power in Our Food System,* Institute for Food and Development Policy, SF.

United Nations Treaty Collection: http://untreaty.un.org

WCD (2000): *Dams and Development: A New Framework for Decision Making,* World Commission on Dams.

Published by **Society for Promotion of Wastelands Development** under a **Sir Dorabji Tata Trust** supported **Water Governance Project**. All views and opinions presented here are solely the author's and in no way reflect opinions of the project.

We look forward to your feedback, do write in to us at wgp_spwd@yahoo.com; Info@watergovernanceindia.org

Printed by: **IDEAS 2 IMAGES;** 3087, 2nd Floor, Sangtrashan, Paharganj, New Delhi – 110055, INDIA