MUDDY WATERS

A CRITICAL ASSESSMENT OF THE BENEFITS OF THE SARDAR SAROVAR PROJECT

Rahul N. Ram

KALPAVRIKSH

New Delhi, October 1993

Second Edition

ABOUT KALPAVRIKSH

Kalpavriksh is an environmental action group based in Delhi, working on aspects of education, research, campaigning, litigation, and networking with regard to environment and development issues. It was the first to highlight the potential negative impacts of the Narmada Valley Development Project, after a extensive field trip through the valley in 1983. Since then, it has remained involved in the issue through awareness work, research, publications, and participation in the Narmada Bachao Andolan.

The author, Dr. Rahul Ram, is an environmental toxicologist by training, and has been involved with research, documentation, and campaigning on the Sardar Sarovar Project since 1990. He is on the editorial team of *Narmada: A Campaign Newsletter*, brought out by Kalpavriksh.

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ANALYSIS OF SSP BENEFITS : HIGHLIGHTS

CLAIMS

Drinking water for 40 million people
Irrigation to 1.8 million hectares
1450 MW power production

REALITY

The Narmada river has 17% less water than assumed by project planners.

DRINKING WATER

No drinking water plan exists even today.

Cost of supplying drinking water is "several thousand crores". This cost has not been included in project costs.

Urban areas are to receive 80% of the drinking water.

Number of beneficiaries not based on any detailed study.

IRRIGATION

Non-completion of upstream dams reduce SSP irrigation benefits by 17-30%.

Canal efficiency is much lower than assumed: Water available for irrigation further reduced by 23.3%.

Total irrigable area likely to be only 44-52% of the area claimed by project planners.

Over half the area proposed for irrigation is susceptible to waterlogging and salinization.

Irrigation benefits are likely to be monopolized by rich farmers in Central Gujarat to grow cash crops such as sugarcane.

POWER

SSP will provide only 439 MW firm power in the initial stages. Final firm power production is only 50 MW out of an installed capacity of 1450 MW.

Non-completion of Narmada Sagar Dam upstream will reduce power benefits by at least 28%.

SSP will consume more power than it will produce for Gujarat.

FINANCIAL

True cost of SSP is likely to be over RS. 20,000 crores and may rise to over RS. 25,000 crores.

Cost figures quoted by the Government list only the base cost of the project and ignore contingency costs.

All hopes for foreign bilateral funding for SSP have disappeared.

The SSP consumes 80% of Gujarat's irrigation budget.

Only about 10% of total project costs have been spent so far.

SSP spending is 53-63% behind schedule.

The Government has no money to finance the SSP.

CONCLUSIONS

Benefits from the SSP have been substantially overestimated.

The SSP will not solve Gujarat's drought problem.

Kutch and Saurashtra will get minimal irrigation benefits from SSP. No detailed plan to supply drinking water to Kutch and Saurashtra.

A comprehensive review of the SSP is needed to determine the actual scope for benefits and its financial viability.

BENEFITS OF THE SSP: A CRITICAL ANALYSIS

Introduction

The controversial Sardar Sarovar Project (SSP) is one of the largest and most expensive multipurpose river projects ever to be initiated in India. It is claimed that the project will irrigate 1.8 million ha of land, supply drinking water to 40 million people, and will have an installed capacity of 1450 MW of power over the next 30 years (Raj 1992:11). However, the SSP has been opposed by local people and other groups all over the world who describe it as "the world's largest planned ecological disaster". This assertion is based on several findings arising out of a careful study of the entire project. The major problems are: about 1,000,000 people will be displaced and affected by direct submergence, building of canals, weirs, dykes and the project colony, by catchment area treatment and compensatory afforestation, by expansion of the Shoolpaneshwar Sanctuary, and due to secondary displacement and downstream effects; it is likely that waterlogging and salinisation will occur over large parts of the command area; several basic errors and flawed assumptions mar the project plan; the distribution of benefits completely fails to address issues of social justice and equity; by all indications, the project will not be able to meet a large fraction of its targets.

Recently the people of Kutch and Saurashtra, who are supposed to be the main beneficiaries of the SSP, have also started questioning government claims about the benefits of the project. It has become increasingly clear to them that the SSP will not solve their problem of drought, and indeed, by spending vast quantities of money in their name, the government is denying them the resources to develop alternative methods for dealing with water shortages in their area.

Over the last seven years, the Narmada Bachao Andolan (NBA) has marshalled facts and expertise to critically analyse the SSP. The NBA consists of the people of the Narmada Valley, and their supporters all over India. After carefully studying every aspect of the SSP from displacement to rehabilitation to the planning of the dam structure, the canal system, and its environmental and social impacts, the NBA has decided to oppose the project in its entirety.

Informed and compelling opposition to the project, the refusal of project authorities to allow questions or admit shortcomings, and divided opinion within its own establishment forced the World Bank to initiate an Independent Review of the SSP. The report of the Independent Review, released in June 1992 (Morse and Berger 1992) shows clearly that the SSP is flawed, perhaps fatally. Though touted as one of the most studied projects by its proponents, the report of the Independent Review demonstrates that the project authorities have failed to collect basic data for most aspects of the SSP. Thus, the stated benefits of the project should be thought of as optimistic assertions based on wishful thinking rather than on scientific appraisal.

As an outcome of the report of the Independent Review, the World Bank started having serious doubts about continuing its funds; when it became clear that it was likely to withdraw, the Indian Government in a face-saving gesture, cancelled the remainder of the World Bank loan. The withdrawal of the World Bank has served to sharpen the suspicion that the critics of the SSP are right. In light of these developments, it is imperative that a comprehensive review of the entire project be carried out.

THE STATED BENEFITS

The SSP is often described as "Gujarat's lifeline". For forty years, the project had the stature of a sacred cow as people believed the claim that it would "drought-proof" Gujarat. To this end the project authorities claim that they will provide drinking water to 40 million people. In addition the project is supposed to irrigate 1.8 million ha of land spread over 12 districts in Gujarat (see Table 1, Map 1). The SSP is planned to have an installed capacity of 1450 MW of power. Several other minor benefits are touted for the project, including flood control, employment generation, "environmental enhancement", tourism, recreational facilities and improved fisheries. Irrigation is to lead to increased production of foodgrains and oilseeds, reducing the need for imports.

We will examine each of the main benefits (drinking water, irrigation and power) separately. However, any discussion about project benefits must begin by establishing one basic fact: How much water is available for use in the Narmada?

MAP 1

Command Area of Sardar Sarovar Project in Gujarat

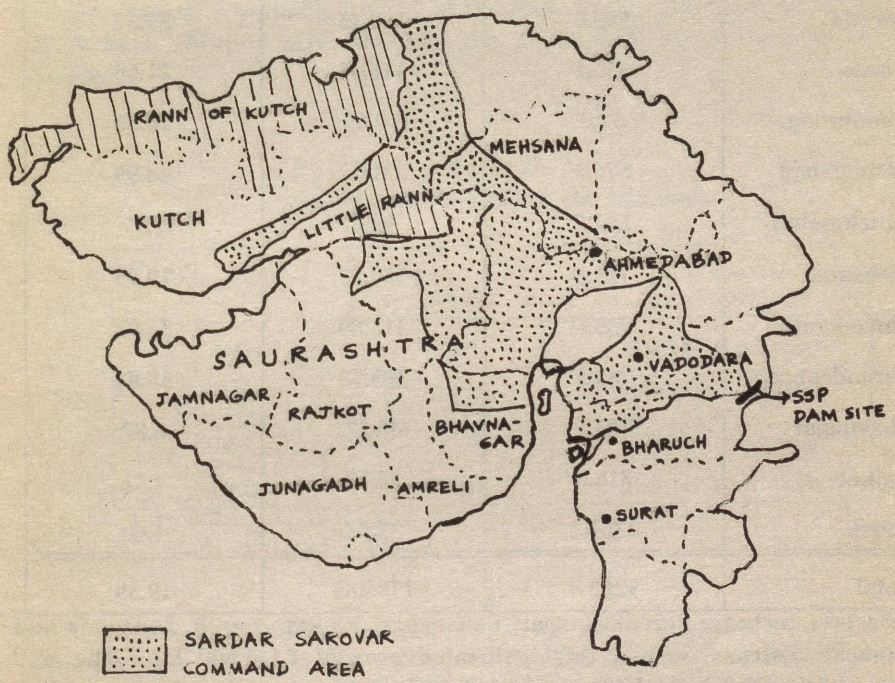


TABLE 1
Area Planned to be Irrigated by Sardar Sarovar Project

District	Cultivable Area ('000 ha)	Area Under SSP ('000 ha)	% Cultivable Area Under SSP
Bharuch	507.8	97.95	19.28
Baroda	593.0	340.15	57.37
Kheda	536.1	116.01	21.63
Gandhinagar	51.9	10.65	20.52
Ahmedabad	676.2	331.27	48.99
Panchmahal	547.8	9.68	1.77
Mehsana	753.3	150.19	19.95
Banaskantha	925.6	313.89	33.91
Surendranagar	782.5	303.73	38.81
Bhavnagar	703.1	48.27	6.87
Rajkot	810.0	34.12	4.21
Kutch	2363.1	37.85	1.60
Total	9250.4	1793.85	19.39

Saurashtra includes Surendranagar, Bhavnagar, Rajkot, Amreli, Junagadh and Jamnagar districts, with a total cultivated area of 4,176,600 ha. The SSP command area is planned to cover only 9.24% of this area.

Data from Census of India (1981) and SSNNL 1989.

HOW MUCH WATER IS AVAILABLE?

The quantity of water available is the most basic figure for any dam project. However, the amount of water actually available for the SSP continues to be debated hotly. Table 2 illustrates the existing controversy over this most basic figure : the amount of water actually available for use.

There is about 17% less water in the river than planned for. The amount of water actually available for use at the dam site at 75% dependability is only 22.69 MAF (Million acre feet) and not 27.22 MAF as assumed by the dam builders.

Table 2
75% Dependable Yield of the Narmada

Year of Study	Official Yield[1] (MAF)	Actual Flow Data[2] (MAF)
1966	27	22.28 (15 Yrs of data)
1978	27.22	22.28 (22 Yrs of data)
1983	27.79	23.16 (33 Yrs of data)
1990	27.22	22.69 (42 Yrs of data)

1. From Patel 1991:60
2. Calculated from CWC 1992.

How did the project authorities fail to accurately measure this most basic quantity? The Narmada Water Disputes Tribunal Award (NWDTA), on the basis of which the SSP was designed, used the amount of water available at the SSP dam site for 3 out of every 4 years (called the 75% dependable yield) to apportion water between the states. When the award was made, actual flow data were available for only 22 years (1948-1969). The government estimated flow in the river using rainfall data from 1891-1947, a procedure known as hindcasting. The resulting combination of hindcasted and actual flow data led to an estimate of 27.22 MAF (Million acre-feet) as the 75% dependable yield (henceforth referred to as the yield).

Today we have actual flow data for 42 years (1948-1989), which is sufficient to calculate yield without hindcasting (CWC, 1992). **The yield from 42 years of actual data is only 22.69 MAF, and not 27.22 MAF.** It is scientifically much more appropriate to use actual data rather than hindcasted data. **Project authorities persist in hindcasting even though the exercise is redundant because the lower yield shown by the actual data would render their project unviable as it stands.**

The use of hindcasted data has led to overestimation of yield in several projects, such as the Gandhi Sagar Project, where the reservoir has completely filled up only once in 32 years of operation, leading to net irrigated area 35% lower than that planned. In the case of the SSP, hindcasting has resulted in mistaken estimates of river flow because it is based on inadequate rainfall data. The Khosla Commission, which was appointed to go into the Narmada water disputes question in the early 1960s, stated that the number of rain gauges available from 1891-1930 was too few to allow accurate estimation of data. The World Bank also stated that the number of rain gauges before 1925 was insufficient to allow hindcasting (WB 1985). Thus, only 18 years of rainfall data (1930-1947) are suitable for hindcasting. In other words, **the Narmada Tribunal was technically wrong when it used hindcasted data from 1891 onwards.**

The decreased water yield changes the entire complexion of the project, and throws doubt on the scope and possibility of the claimed benefits. The NWDTA distributed water from the Narmada in the ratio 65:32 to Madhya Pradesh and Gujarat, with Rajasthan and Maharashtra sharing the remaining 3%. Thus, while under the original estimate of river yield at 27.22 MAF Gujarat would recieve 9 MAF of water, under the revised actual yield of 22.69 MAF, its share would drop to 7.26 MAF. This naturally means less water to go around: less water for irrigation, less water for drinking. The reduced quantum of water is specially significant for those at the tail-end of the SSP system, i.e. Kutch and Saurashtra, since they are the most likely to suffer if there is less water.

As the entire planning for the SSP is based on an assumption of using 9 MAF of water, any decrease in this amount will result in decreased benefits. Indeed, the benefit-cost ratio of the project, which at 1.13 is already at marginal acceptability according to Government of India and World Bank norms, will decrease below acceptable limits if the smaller quantum of assured water is taken into account.

DRINKING WATER

The provision of drinking water is one of the main moral and political justifications for the SSP in Gujarat where acute water scarcity has been a crippling problem and an emotionally charged issue. The recent droughts in Gujarat, especially in Kutch and Saurashtra, have highlighted the lack of assured sources of drinking water and the urgent need for water security in this arid land. Under the SSP, drinking water is planned to be supplied to 8215 villages and 135 urban centres in 12 districts, including all villages and cities in Kutch and Saurashtra.

While the moral imperative of supplying drinking water is, in a sense, beyond considerations of cost-benefit analyses, the sheer magnitude of the project justifies a close look at its planning and feasibility.

Official Information on Drinking Water from SSP

Very little detailed information is available about drinking water supply from SSP. Most project literature lists only goals, targets and claims, perhaps in the belief that frequent repetition of an assertion will make it into a fact. For example, it is claimed that 32.5 million people will be supplied drinking water (Raj 1990:11); that the project will permanently solve the water supply problems of all villages in Kutch and Saurashtra (Raj 1990:56); that the supply of drinking water from SSP is economically viable (GOG 1991:132). None of this is backed up by any data.

The SSP authorities appear to be very confused about the number of towns and villages to be supplied drinking water from the SSP, and the number of potential beneficiaries (See Table 4). At the time of the NWDTA, no figures for drinking water beneficiaries were mentioned. Since then, the number has changed several times, and quite drastically too, from 28 million (GWSSB 1983) to 32.5 million (Raj 1989) to 40 million (Raj 1992) and again to 25 million (SSNNL 1993). Similarly, the number of villages that are supposed to benefit has increased from zero in 1979, to 4719 villages in the early eighties, to 7234 villages in 1990, and finally, to 8215 villages in 1991. There has been no concomitant increase in the quantum of water earmarked for drinking water.

The main sources of detailed information on drinking water are a "Study on Water Demand for Non-agricultural Use from Narmada Project" by the Gujarat Water Supply and Sewerage Board (GWSSB 1983), and a recent Narmada Control Authority (NCA) pamphlet on drinking water (NCA 1991). While the former is now quite dated, it is the only detailed source of information available. According to these documents (See Table 3), the total projected water requirement in 2021 for domestic, industrial and thermal power projects is estimated to be 1.37 MAF (Million Acre Feet). 0.48 MAF are available from sources outside the SSP coverage, and 0.14 MAF are available from groundwater sources. The balance requirement of 0.75 MAF is to be provided by SSP, which works out to a gross demand of 1.06 MAF after adding losses in the system (GWSSB 1983).

TABLE 3
Non-agricultural Water Demand in the SSP Command (2021)
(All figures in MAF)

Demand Source	Total Demand	From Local Sources	Recharge Withdrawal	Balance Requirements
Urban	1.01	|		
Rural	0.2	|- 0.48	0.14	0.75
Industrial	0.16	|		
Total	1.37	0.48	0.14	0.75

Source:GOG 1983:3

The NWDTA allocated 1.06 MAF for non-agricultural uses from Gujarat's share of 9 MAF water from the Narmada. Of these 1.06 MAF, 0.853 MAF have been set aside for drinking water purposes and the rest (0.207 MAF) for industrial use.

Several changes have appeared between the two documents. According to the detailed study (GWSSB 1983: 18), drinking water requirements are 227 litres/capita/day (LPCD) for cities with population more than 1 million, 140 LPCD for other urban areas, and 70 LPCD for rural areas. However, in the

same document, **the most needy rural areas of Kutch and Saurashtra are assigned only 55 LPCD**. Again, this document mentions that areas with high cattle populations (large parts of Kutch and Saurashtra) will be assigned 30L/ cattle /day, but then proceeds to completely ignore that statement when actually calculating the amount of water required (GWSSB 1983: Appendix IV-C). The NCA pamphlet fails to mention the higher urban figure of 227 LPCD and asserts that all villages will be provided 70 LPCD. It makes no mention of water for cattle, though the images of cattle trekking miles for water are repeatedly used by the SSP authorities in pressing their claims for the necessity of the project.

The GWSSB study (GWSSB 1983: p.38, 57) estimated the cost of supplying drinking water to be 728 crores (in 1981-82 rupees), which is well over Rs. 1,500 crores in current terms. The NCA document, on the other hand, does not mention any definite figure, but asserts that the cost of the project "**would run to several thousand crores**". It is worth mentioning that the GWSSB study only considered 4719 villages in its cost estimates, whereas the current number of villages is claimed to be 8215. The projected cost of supplying water to villages is 3-4 times that of supplying water to urban areas (GWSSB 1983:57). Thus, the cost of supplying drinking water may more than double with the current targets.

The cost of supplying drinking water has not been included in any cost benefit analysis of the SSP to date. The additional cost of drinking water supply causes will make the financial feasibility of the entire project very questionable.

As if this was not enough, both the GWSSB (1983) and the NCA (1991) documents assert that studies so far are only preliminary and a detailed project report is yet to be prepared. This was supposed to be complete by 1992, but in January 1993 the GWSSB issued an advertisement in Gujarat newspapers calling for consultants to do a feasibility study on supplying drinking water from the Narmada. **Thus, even after forty years of planning for the "most studied project", there is no detailed project report to date, and it is unlikely that a report will be prepared within the next couple of years!**

In essence, the entire scenario for drinking water supply is in a state of confusion and unpreparedness. Why is a comprehensive plan for supplying drinking water not yet ready? When will the water reach the people? How many people are expected to benefit? Where do the beneficiaries live? What

is the estimated cost of this part of the SSP? How will it be financed? How much energy will be required for the project? Has livestock water demand been considered? How will irrigation and drinking water be prioritized? Have any alternatives been thoroughly considered? Close analysis seems to show that none of these questions can be answered at this point in time, almost 10 years after detailed project plans were drawn up, and a mere 10 years before the project is supposed to be complete.

Scale of Benefits

The Narmada Water Disputes Tribunal Award (NWDTA) (MAI 1979) did not mention any numerical targets for providing drinking water. Subsequently the number of beneficiary villages, urban areas and their population (in the year 2021) has been changing at almost every mention (Table 4). Even within the same document two different figures for number of beneficiaries can be found : 29.5 million vs. 32.5 million (Raj 1990). How the number of beneficiaries can change while the quantum of water allocated for drinking remains unchanged is a mystery that the SSP authorities are unwilling to solve.

TABLE 4
Drinking Water Targets for SSP

Source and Date	Villages	Urban Areas
Narmada Tribunal 1979	0	0
GWSSB 1983	4719	131
SSNNL 1990	7234	131
SSNNL 1991	8215	135

According to the latest official information (NCA, 1992), **948 villages in Kachchh and 4877 villages in Saurashtra will get drinking water.** However, according to the 1981 census, **there are only 887 inhabited villages in Kachchh and 4727 in the 6 Saurashtra districts!** The project authorities have simply listed as a target the total number of villages in all districts of Kachchh and

Saurashtra, ignoring, or simply unaware of the fact that 61 villages in Kachchh and 149 villages in Saurashtra are listed as uninhabited (GOI, 1981, pp.96-99). The planned number of beneficiary villages was apparently the result of a "study" by the Gujarat Water Supply and Sewerage Board (GWSSB) (NCA, 1991). Obviously, this "study" was cursory and slipshod, to say the least, its quality in keeping with the level of other planning seen for the drinking water component of the SSP!

The GWSSB report (GWSSB 1983) displayed a strong urban bias in the supply of drinking water. In an area where the population is approximately 70% rural, 63% of project beneficiaries were to be urban dwellers. Cities were supposed to receive over 80% of the total quantity of drinking water (GWSSB 1983: Appendices IIIA-IVC). **Four major cities: Ahmedabad, Vadodara, Rajkot and Jamnagar accounted for over 40% of the total drinking water to be supplied for the SSP, and Ahmedabad and Vadodara alone accounted for over 25%.** While the GWSSB report is now dated, the absence of any further data leads to the conclusion that the large urban centres in Gujarat are to be the true beneficiaries of drinking water.

A completely neglected aspect of the plan to "drought-proof" Kutch and Saurashtra is the question of livestock. Large parts of the population of Kachchh and Saurashtra are pastoralist. Families maintain large livestock herds, and the animals are an important economic and cultural resource. In every drought, people are forced to migrate with their livestock in search of water. The government has to set up cattle pounds to supply fodder and water.

No mention of actually supplying water to livestock is made anywhere in the drinking water plans, or indeed in all the SSP development plans in spite of the mention that cattle are supposed to be provided 30 LPCD. Cattle consume large quantities of water, and their needs have to be met if any degree of "drought-proofing" is sought.

It is difficult to estimate how many people are supposed to benefit from SSP drinking water in the absence of any plan. However, the bigger question is whether the numbers tossed out are supposed to represent even an approximation to project goals or whether it is merely a facade designed to silence legitimate criticism while diverting water to the politically powerful.

Costs

The cost of supplying drinking water is estimated variously at 728 crores (GWSSB 1983) or, very roughly, at "several thousand crores" (NCA 1991). **This cost has not been factored into any overall cost-estimate of the SSP even though drinking water is a prominently mentioned benefit of the project.** The entire cost-benefit ratio of the project may change if a realistic estimate of this expense is added. Thus the SSP authorities have been deceiving the people of Gujarat by claiming drinking water as a benefit, when they have no idea of the cost, and even less of how they are supposed to find the money. While the SSNNL washes its hands off the question of drinking water and puts the entire burden on the GWSSB, the latter professes to be completely in the dark about where funding is supposed to come from.

The moral imperative of supplying drinking water holds true only if the beneficiaries are in drought-hit areas with no other sources of water, not in cities with assured drinking water sources such as Ahmedabad and Vadodara. Nevertheless, the financial implications of spending an additional "several thousand crores" are very grave, especially in light of the extremely tight fiscal situation of the Gujarat and Central Governments. The SSP has already had to curtail work on the canals because of severe cash constraints, and there is no sign that the situation is likely to improve in the near future.

If the cost of drinking water supply had been included in the original proposal, the SSP may not have received clearance from the Central Government. The late unveiling of this additional cost is an attempt to present the Central government with a *fait accompli;* expenditure already incurred is being cited as a reason for further expenditure. This argument - that "we have already spent so much money, how can we stop now" - is the standard justification used for projects which run into problems due to environmental concerns or even cost/time overruns.

The geographical spread of the beneficiaries (the area of Kutch and Saurashtra alone is 109,630 sq. Km) requires very large pumping capacities, thousands of kilometres of pipeline construction and maintenance, filtering and treatment plants, and setting up or augmenting an extensive bureaucratic and technical infrastructure, all of which are very expensive. The planned 2.5 month annual dewatering of the canal system (NPG 1989) will require the construction or improvement of existing storage facilities, an additional cost (Some recent

SSP documents mention that the canal dewatering will only be for a month, but this is simply a bare assertion unsupported by any data).

Furthermore, the construction schedule of the SSP has been accelerated so that it is supposed to be completed within a period of 12 years (by 2000 A.D.) rather than the 17-22 originally envisaged (Patel 1991:76). This requires an expenditure of over Rs. 1200 crores every year for the next 8 years without accounting for drinking water supply. If the drinking water scheme is to be implemented, from where will the resources for an even higher yearly expenditure come?

The Gujarat and Central governments have completely different views on when the drinking water will reach the needy areas. **While Gujarat claims the entire project is to be finished within the next 8 years, the Central Ministry of Water Resources says that drinking water will reach Kutch by the year 2025! The World Bank Review Mission Report (September 1992) also said that a realistic time-frame for drinking water to reach Kutch is the year 2025, and 2020 for Saurashtra.** The financial problems faced by the SSP, on the other hand, seem to indicate that drinking water from SSP may never reach these areas.

Another aspect of project cost that must be considered is energy. Supplying drinking water will need large pumping facilities due to the widely dispersed locations of the proposed beneficiaries, and topographical variation (especially for Sabarkantha district, the Kathiawar area in Saurashtra, and the areas west and north-west of Bhuj in Kachchh).

The energy required for such a large pumping capacity will not be negligible. It is not possible to obtain even an 'orders-of-magnitude' estimate of the energy demand without a detailed project plan, including geometry and sizing of system, and locations of end-points.

Drinking Water: Conclusions

It becomes clear that the supply of drinking water from SSP is beset with problems and uncertainties. It is unclear how much water will actually be available. It is unclear how many people are expected to benefit from the supply of drinking water. It is unclear how much the project will cost, who will pay for it, and where the money is going to come from. It is unclear when the water is going to reach the people. It would be very useful to compare these uncertainties with the actual plan for the supply of drinking water, but there is no plan!

There is no reasonable explanation for the lack of a comprehensive plan for drinking water. The rhetorical value of "parched throats" and "water for 40 million people" seems to far outweigh actual planning effort put into evolving a workplan. The detailed project report was supposed to be available by the end of 1992 (NCA 1991), but has not put in an appearance so far. There is no way to determine how detailed or feasible the plan will be, if indeed it is ever prepared. The SSP authorities have abdicated responsibility for the plan, its execution and its financing to the Gujarat Water Supply and Sewerage Board, a body whose "study" wants to supply water to uninhabited villages!

Everything seems to indicate that the Ahmedabad-Baroda corridor will get as much water as it needs from the SSP. The GWSSB recently allocated a sizable quantity of SSP water to Baroda in direct contravention of their own directives, using "recalculated figures" to show that more water was available due to high efficiency in transportation (in a hypothetical system which does not even exist on paper!). This was done shortly after the Baroda Municipal Corporation voted to bring SSP waters to the city. Powerful urban centres all over Gujarat are likely to react similarly, and their political clout will ensure that their demands will be met. But for the people of Kutch and Saurashtra the assurance of drinking water appears to be a cruel hoax.

IRRIGATION

The SSP plans to irrigate 1.8 million ha of land spead over 12 districts in Gujarat (See Table 1) and an additional 75,000 ha in Rajasthan. The command area of the SSP has been divided into thirteen agroclimatic zones (ORG 1982) which form the basis for irrigation planning (Map 2). This irrigation is to occur through a network of 75,000 Km of canals, including a main canal 460 Km in length and 35 branch canals of various lengths. It is planned to supply water to the canals on a volumetric, rotational basis. In addition, it is planned to dewater the canal system beyond the Mahi river for 2.5 months from March 1 to May 15 (SSNNL 1989), though recently the SSNNL has asserted that dewatering will only occur "for a month or so" (NCA 1991).

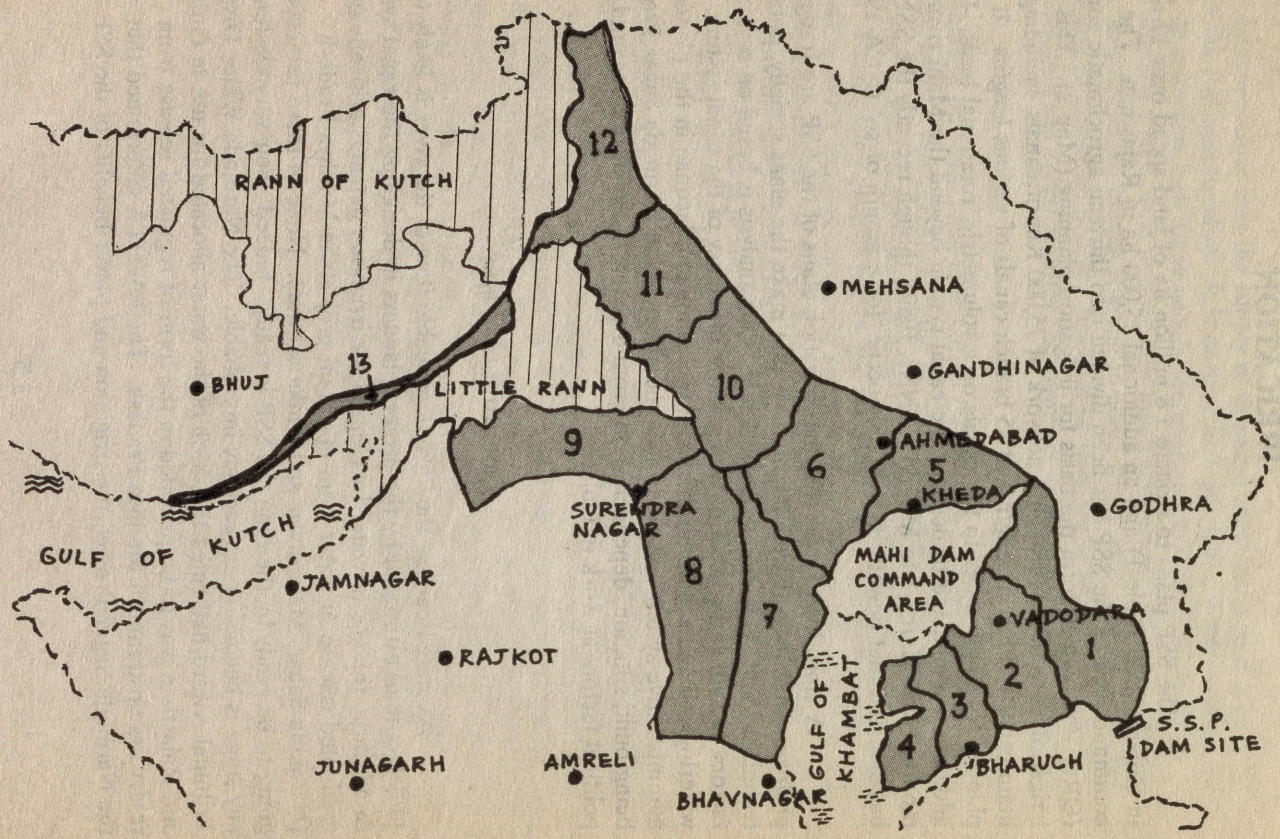
A close look shows that the irrigation plans of the SSP are fraught with problems, based on flawed assumptions that make the plans socially, politically, technically and economically unworkable. Our analysis is based on several factors, including quantum of water, water efficiency of the canal system, waterlogging and salinity problems in the command, lacunae in the planned administrative system for the canals, the effect of the Narmada Sagar Project not being built, siltation, dependence on ground water, financial reasons, and political factors at work in Gujarat.

Quantum of Water

As stated earlier, the 75% dependable flow of the river is likely to be 17% less than estimated by the project planners in designing the canal system. In addition, the use of water by Gujarat for irrigation depends critically on the graduated release of water from upstream projects in Madhya Pradesh (Narmada Sagar, Maheshwar and Omkareshwar). None of these projects is going to be ready by the time the SSP is ready. Indeed, their very existence at any stage is becoming increasingly improbable. The Narmada Water Disputes Tribunal Award had ruled that 85% of the water allocated for use in Gujarat and Rajasthan was to be provided in the form of regulated release from reservoirs upstream in Madhya Pradesh. The NWDTA determined that, without the Narmada Sagar Project, the irrigation and power benefits of the SSP would

MAP 2

The Agroclimatic Zones of the SSP Command



drop by 17% (MAI 1979: VolII:p102). A January 2, 1992 World Bank memorandum stated that irrigated area in the SSP would drop by 30% without the NSP (Morse and Berger 1992: 250).

A 17% lower flow in the Narmada combined with a 17-30% drop in the SSP irrigated area due to the absence of the Narmada Sagar Project could decrease the area irrigable by the SSP to as much as 58-69% of the original estimate, if the two factors are cumulative. But the story doesn't end here.

Canal Efficiency

The area irrigable by the SSP becomes even more uncertain when we examine the efficiency of the canal system. In any canal irrigation system, water is lost due to seepage and evaporation from the main canal, its branches, and from the distribution system and field channels. Water is also lost during field application and in the overall operation of the system. The overall water use efficiency is estimated after accounting for all the losses. The SSP authorities have "deemed feasible" an overall water use efficiency of 60% (NPG 1983:12, SSNNL 1989:360) for irrigation and of 75% for drinking water supply (NPG 1983:4). (Water use efficiency is determined as the ratio of water reaching the target to that released at the source: Thus, if 600ml reach the field for every litre released at the dam, efficiency is deemed to be 60%.) The figure of 60% canal efficiency is based on several very questionable and overly optimistic assumptions (SSNNL 1989: 356).

The project planners have completely neglected evaporative losses in the canal system! Given that large parts of the canal system are to run through the arid parts of Kutch, Saurashtra and North Gujarat where substantial losses through evaporation can be expected, such an assumption seems foolhardy at best and wilful deception at worst.

Other dubious assumptions made by the SSP authorities relate to estimates of seepage rates, field application losses and operational losses. Values assumed by the project planners are shown in Table 5 along with values observed in different systems in India and values used by the World Bank for irrigation projects in India.

TABLE 5
Water Losses: SSP Assumptions and Realistic Values

Source of Water Loss	SSP Assumptions	Observed and Literature Values
Lined Canal Seepage	2 cfs/msft[1]	3 cfs/msft (WB[2]) 2.22-5.93 cfs/msft[3]
Unlined Canal Seepage	5 cfs/msft	8 cfs/msft[4] 5% / 100m canal (WB)
Field Application Loss	20% NIR[5]	20-40% NIR (SSNNL 1989:368)
Operational Losses	5% Total Water Demand	20% NIR (WB)

1. Cubic feet/second/million square feet canal surface area.
2. World Bank report on Irrigation Development in India.
3. Observations on Mahi and Dantiwada Canal Systems (SSNNL 1989:357).
4. Observations on Bhakra system (SSNNL 1989:357).
5. Net Irrigation Requirement at the field.

The SSP authorities have given no concrete reasons for their assumptions. For example, seepage losses in lined canals have been assumed at 2/3 of the value considered appropriate by the World Bank in its report "Irrigation Development in India" (WB 1987). Average losses observed on lined canals in the Mahi and Dantiwada systems (in Gujarat, in similar agro-climatic regions) are double the value assumed for the SSP. Similarly, seepage loss rates in unlined canals are assumed to be 60% of observed loss rates in existing systems. It is completely unclear why this figure is used. A recent Narmada Control Authority publication says that the distribution system will be bricklined (NCA 1991b), resulting in higher seepage than the totally concrete-lined distribution system assumed while carrying out efficiency calculations. Field application and operational losses have also been assumed to be much lower than reasonable, without providing any concrete explanation.

The irrigation efficiency for the SSP was calculated using more realistic and observed estimates (As shown in the second column of Table 5). The results are shown in Table 6, along with the SSP calculations for comparison. **The irrigation efficiency of the SSP is likely to be only 46% (ignoring evaporative losses) and not 60% as claimed.** The water available for irrigation

would be 23.3% less than what is assumed. Our figure for irrigation efficiency is almost identical to a World Bank estimate (WB 1985b: 143) made for the SSP using a somewhat different method. The World Bank estimated that only 46% of the water released from the SSP reservoir would reach the fields. It is interesting to note that the Bank did not see fit to mention the implication of this reduced irrigation efficiency anywhere in its documents.

It seems that the World Bank Irrigation Sector Review (1991) must have had the SSP in mind when it made the uncannily apposite observation that: "Most design problems stem from inadequate data and unrealistic assumptions about water availability and irrigation efficiency...More realism concerning the availability of water and feasible efficiency of water usage is in order. Irrigation efficiency in India has often been assumed to be 60% ...Most irrigation commands in India probably have an irrigation efficiency of 20 to 35%. If assumed efficiency is 60% and actual efficiency is 30%, actual water availability will be half the assumption at design."

Adding evaporative losses would further reduce the efficiency of the canal system. A lower efficiency implies that less water would reach the fields or that the area to be irrigated would have to be reduced. However, the project authorities have already minimized the amount of water they would deliver per unit area (in order to raise the total area irrigable). Thus, the area to be irrigated will drop by an additional 23.3%.

Combining a 17% lower flow in the Narmada, a drop in irrigation benefits by 17-30% in the absence of the Narmada Sagar Dam, and a realistic irrigation efficiency, the irrigation benefits of the SSP are likely to be only 44-53% of what is claimed.

How will the SSP deal with this lowered quantum of irrigation water and irrigable area? The most probable answer, both politically and logistically, is that the tail end of the canal system will be deprived of water. In Gujarat, Saurashtra, Kutch, and North Gujarat (Banaskantha and Sabarkantha) are at the end reaches of the canal system. 43% of the area to be irrigated by the SSP lies in these drought-prone districts and will, in all probability, be deprived of irrigation. Thus, it is clear that the claim of irrigating the most needy and drought-hit areas of Kutch, Saurashtra and North Gujarat is a mirage in the desert. So too, of course, is the claim of irrigating a part of Southern Rajasthan.

Waterlogging and Salinisation

About half the proposed command area of the SSP is prone to waterlogging and salinisation. A preliminary study called "Regionalisation of Narmada Command" (ORG 1982) divided the command area of the SSP into 13 agroclimatic zones, and classified them into irrigability classes as shown in Map 3. The Soil Survey Manual of the Indian Agricultural Research Institute recognizes six irrigability classes:

I: Few limitations for sustained use under irrigation
II: Moderate limitations
III: Severe limitations
IV: Marginal for sustained use under irrigation
V: Temporarily classified as not suitable pending further investigations
VI: Not suitable for sustained use

However, the ORG (1982) report used somewhat different nomenclature. Class II areas are called "suitable for rice", Class IV areas are called Class IVA ("partly suitable for rice"), Class VI areas are called Class IVB ("partly unsuitable for rice"), and Class V areas are called "unclassified". The inventiveness of calling an area that is marginal for irrigation as "partly suitable for rice" is impressive!

It is clear that areas classified as Class III are moderately prone to waterlogging, whereas Class IV-VI have severe waterlogging problems under sustained irrigation. It is possible to calculate the areas under different irrigability classifications from Map 3. The results are shown in Table 7 and 8.

Less than half the command area can be called "suitable" for irrigation. 25.61% of the command area has severe limitations for sustained irrigation (Class III), and 26.5% of the command area is not suitable for sustained irrigation at all. **In other words, 52% of the command area faces high to very high probability of waterlogging and salinisation if the SSP is completed.** (It should be reemphasized here that the preliminary land classification done by ORG (1982) is for the gross command area, and not the culturable command area.)

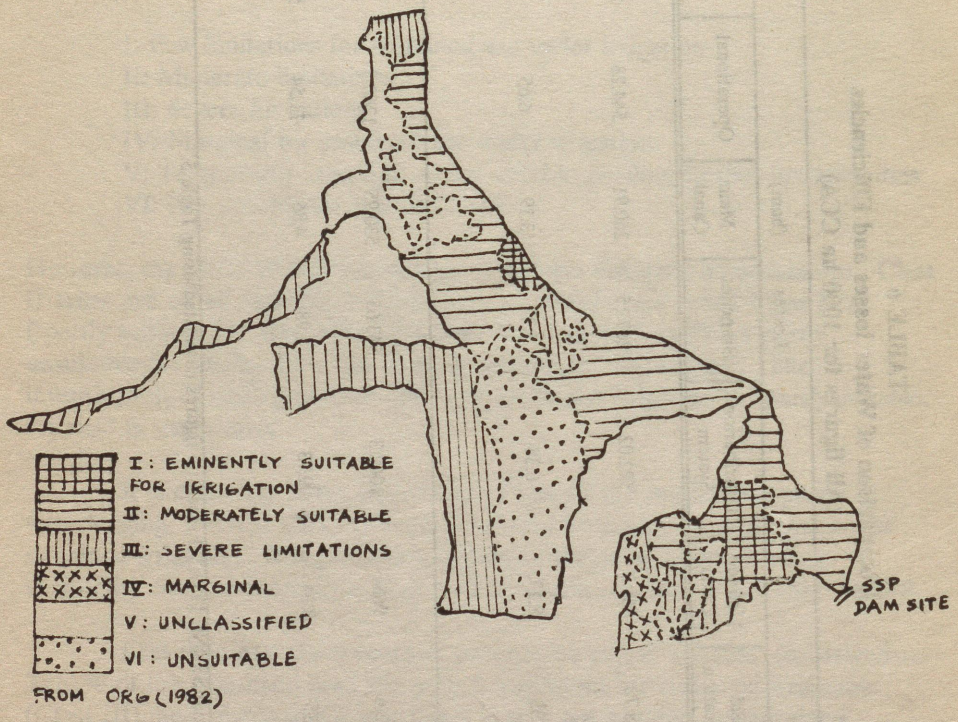
TABLE 6
Comparison of Water losses and Efficiencies
(All figures for 1000 ha CCA)

	NIR (ham)	Losses (ham)							Water Demand	Efficiency
		Field Application	Unlined Canal	Distribution System	Branches	Main Canal	Operational	Total		
SSP Volume (ham)	5042.08	1008.72	668.2	522.02	267.15	260.91	544.28	3135.9	8177.98	
SSP % loss to Main Canal Releases		12.33	8.17	6.38	3.27	3.19	6.65	40		60
Realistic Volume	5042.08	1512.6	965	1062.3	543.65	530.95	1260.5	5875	10917.8	
Realistic % loss to Main Canal Releases		13.85	8.84	9.73	4.98	4.86	11.54	53.81		46.19

All SSP figures are from SSNNL 1989:371, realistic figures calculated using Table 5.

MAP 3

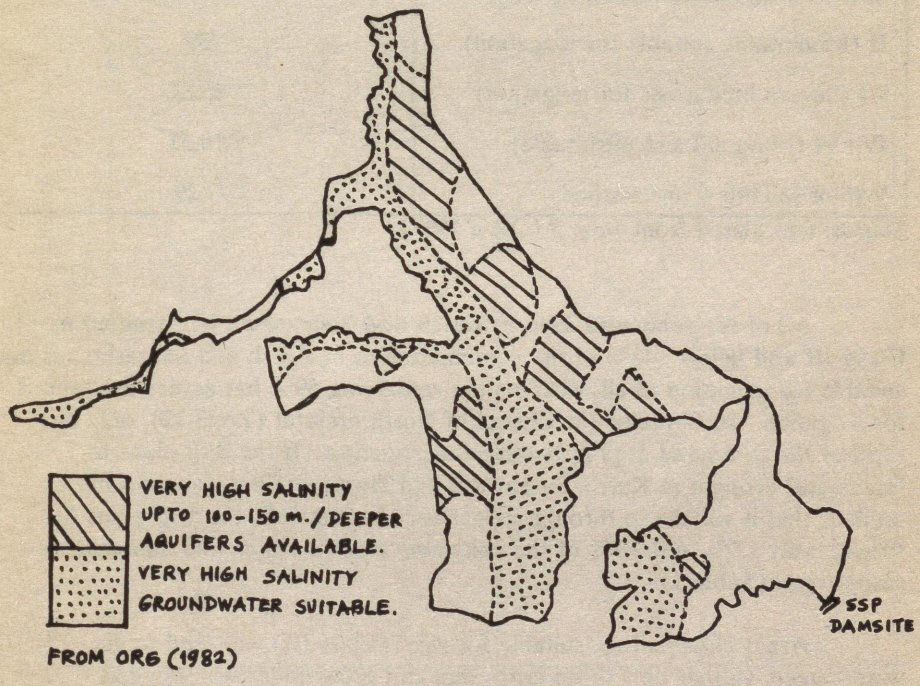
Land Irrigability Classification of the SSP Command



FROM ORG (1982)

MAP 4

Groundwater Suitability and Availability in the SSP Command



FROM ORG (1982)

TABLE 7
Land Irrigability of Narmada Command

Land Irrigability Class	Percentage of SSP Command Area
I (Eminently suitable for irrigation)	8.75
II (Moderately suitable for irrigation)	39
III (Severe limitations for irrigation)	25.61
IV+VI (Marginal and unsuitable)	19.31
V (Not suitable - unclassified)	7.29

Source: Calculated from Map 3 (ORG 1982)

All of the command area in Kutch and Saurashtra is classified as Class III and below. 41% of the command area in Kutch and Saurashtra is not suitable for irrigation at all, whereas the remaining 59% has severe limitations for irrigation. In Banaskantha district of North Gujarat (Zone 12), only one-third of the command area is suitable for irrigation. If the SSP plans to "eliminate" drought in Kutch, Saurashtra and North Gujarat, it seems highly unlikely that it will do so through irrigation. As it stands, the SSP plans to irrigate only 1.6% and 9.3% of the cultivable area of Kutch and Saurashtra, respectively (Table 1).

Areas classified as "suitable for rice" (Class III) will tend to get waterlogged, so that only those crops that can grow under waterlogged conditions (i.e. rice) will survive. Interestingly, the existing cropping patterns in the zones labelled as "suitable for rice" (Z_{8-9}, Z_{13}) show that almost no rice is grown there at present. Rice is 0% of cropped area in Z_9 and Z_{13} and only 0.06% of cropped area in Z_8 (SSNNL 1989: 192). Further, the proposed cropping patterns for these zones under SSP irrigation do not describe rice as the predominant crop, with only 3.9, 5.4, and 0% paddy proposed for Z_8, Z_9 and Z_{13} respectively (GOG 1983). This somewhat contradictory position remains unexplained.

TABLE 8
Zonewise Land Irrigability

Zone	Area ('000 ha)	LIC (% Area)		
		I + II	III	IV + V + VI
1	253	100		
2	273.05	100		
3	153	65	35	
4	111.3			100
5	295.7	100		
6	181.7	55	17	28
7	476			100
8	294		100	
9	268.4		100	
10	344.6	79	14	7
11	191.7	100		
12	462.8	33	13	54
13	122.9		100	
Total	3422.9	47.75	25.61	26.6

Source: Calculated from Map 3 (ORG 1982)

Further problems exist. The SSP plans to augment Narmada waters with groundwater, since the surface waters will not be sufficient to irrigate the command to the level decided. Unfortunately, as shown by Map 4, groundwater is highly saline in Z_4, Z_7 and substantial parts of Z_{2-3}, Z_6 and Z_{9-13}, and is unsuitable for use in irrigation. Aquifers suitable for use in irrigation in parts of Z_6, Z_8 and Z_{10-12} are very deep (>150m) and it would require very high energy inputs to tap them. From Map 4 (ORG 1982) it can be seen that about 35% of

the command area has groundwater that is completely unfit for irrigation, while an additional 25% of the command area only has very deep aquifers (>100-150 m depth), from which would be very costly to pump water.

An additional factor is that the main soils in Z_{7-9} are medium deep black soils, while Z_{2-4} have substantial areas of black soils (ORG 1982:15). Black soils are known to be unsuitable for canal irrigation in a sustained fashion due to their propensity to get waterlogged. The experience with the Ukai dam, just south of the proposed SSP system, is illustrative: The Ukai command had substantial areas of black cotton soils. Before canal irrigation, less than 0.5% of the command reported waterlogging, but after 15 years, 17-35% of the command area reports waterlogging (Mukhopadhyay and D'Souza 1992). Similarly, Tawa Dam in a similar soil zone in Madhya Pradesh has had 20% of the command area taken out of production partially or completely due to waterlogging, just 10 years after irrigation was started.

Taking irrigability classifications and areas of black soils and saline aquifers into account, about 55% of the command area appears to be in danger of waterlogging and salinisation, an environmental disaster of epic proportions in the making.

Detailed studies appear to indicate that the actual potential for waterlogging and salinisation is even worse than what was indicated by the preliminary study. A study of Zones 1-4 of the SSP command (Table 9) conducted by Core Consultants (1982) concluded that 54% of Z_2, 64% of Z_3 and 100% of Z_4 is liable to be affected by waterlogging and salinity. The report said "..increased recharge will cause water tables to rise by 1-2 m/year. Over much of the study area the water table will rise and within a few years encroach on the crop root zone causing waterlogging and salinisation, resulting in the decrease or complete loss of soil production". Comparison of Tables 9 and 10 shows that while the preliminary study indicates 20.9% of Zones 1-4 as prone to waterlogging and salinisation, the detailed report puts that figure at 45.5%, almost double the original. Even if we exclude the problematic Zone 4, the relative area prone to waterlogging and salinisation increases from 8% to 36.5%!

TABLE 9
Detailed Study of Zones 1-4
Percentage Area in Land Irrigability Classes

Zone	Irrigability Class		
	I + II	III	IV-VI
1	74	19	7
2	70	27	3
3	15	70	3
4	2	39	59
Total	52.65	33.26	12.22

All data from Core Consultants (1982).

A study done on Zone 7 reports that 74% of the area is severely problematic for irrigation (ORG 1981). The study concludes that since the area suitable for irrigation in zone 7 is such a small fraction of the total area of the zone, it is questionable whether this should be brought into the SSP command. The report suggests that a change in cropping patterns under the existing regime may be more fruitful.

Incredibly, detailed studies have so far been completed for only 5 out of 13 agroclimatic zones! Studies are supposed to be under way for the rest of the command area, and it is quite likely that they will bear out the gloomy prognosis of the preliminary study undertaken by ORG earlier (ORG 1982).

The project authorities claim to have a "foolproof system" to deal with any problems. They assert that not a single hectare will get waterlogged or salinised. Let's look at this foolproof system.

The SSP authorities plan to have groundwater sensors placed along every 100 Km^2 of the 18,000 Km^2 command area. These will be linked to a central computer, which will analyse the data and send out commands to the canal heads to stop the flow of water into areas showing signs of waterlogging. In addition, a mix of irrigation-only, drainage-only and irrigation-cum-drainage

tubewells shall be sunk, and operated on the command of this central computer. It would truly be a technological miracle if such a system could be installed and operated. Unfortunately, there is not even a pilot project using this system anywhere in the country. We have no idea how such a highly centralised and complex information and engineering system will work under field conditions. Given the track record of irrigation systems in India, it is unwarranted optimism to hope that such a system will work in a "foolproof" fashion.

Canal Operation Policy

If the SSP were to be built, the first areas to receive irrigation would be Bharuch, Khera and Baroda districts. Already economically strong and politically powerful, their regional clout would increase tremendously with irrigation. According to the World Bank Staff Appraisal Report (WB 1985), the earlier reaches will initially be given more water since the canal system will not be ready to carry the water beyond the Mahi (This is a common practice in all irrigation systems). Is it politically feasible to reduce this quantity later on? Once farmers get water in large quantities, they tend to switch to water intensive cash crops like sugarcane as has happened over the entire Ukai command. When water begins to be diverted to those at the further reaches of the canal system, those close to the canal head "apply for canal water to 'save' the standing crop and sanctions are given 'on humanitarian grounds' and 'in order to prevent wastage of national wealth'" (Dhamdhere 1986: 167). The economic and political clout that comes from growing sugarcane makes it very difficult for the government to then give less water to these farmers.

It is indeed no coincidence that seven large sugar factories are coming up in the initial reaches of the SSP command area. That they are doing so despite the fact that almost no sugarcane is grown there at present (0.05-0.67% of gross cropped area in 1981-82: SSNNL 1989:194), is a clear indication that those in positions of power in Gujarat are confident of a large source of sugarcane in the locality in the near future. In the Ukai project in Gujarat, sugarcane now accounts for over 75% of the command area, though the planners had originally decreed that only 30% of the command area shall grow sugarcane. History, rather predictably, appears to be repeating itself.

The official canal operation policy of the SSP needs to be examined in the light of this political reality. The policy specifies that a limited quantity of

water will be provided to farmers. An induced scarcity will be maintained by supplying water volumetrically on a rotational basis, so that extensive use of irrigation is made and profligacy minimized. The authorities fondly hope that farmers will be persuaded to grow "...crops...which consume less water, but are comparatively more remunerative." (Patel 1991:76) What is much more likely is that farmers will grow cash crops that require a lot of water, and resist efforts to enforce cropping patterns by centralized regulation of canal flow. This could upset the estimates of water demand which are based on projected cropping patterns, and lead to decreased availability in the tail-end reaches of the system.

In addition, the SSP plans to supply water to farmers' irrigation cooperatives instead of individuals, on a volumetric basis, for which farmers will pay per litre. These irrigation cooperatives will arrange for rate payment, will line canals beyond the minors, will carry out groundwater pumping when required, will maintain the drainage systems at the micro level. However, the decision to supply water to them will still be taken by a central authority. This "revolutionary" system is exactly what irrigation experts have been recommending. Unfortunately, no such irrigation control system is in place in India, even on a pilot scale: How is it supposed to work over 1.8 million ha? And, regrettably, the entire success of the project is dependent on these blithe assumptions that defy ground realities.

Work on Indian irrigation by Chambers, Wade and others has shown that decentralised systems are much more efficient. While the SSP commendably seeks to decentralize the irrigation system, there has been absolutely no degree of participation of the beneficiaries in plan formulation. The government has not bothered to ask the potential users of irrigation to ascertain whether this cooperative structure is at all feasible. Besides, there has been no thought given to the administrative, logistical and financial costs of setting up and running thousands of irrigation cooperatives, ensuring that elections are held regularly and conducted fairly, proper accounts are maintained, that the rich and powerful do not grab all the water: a nightmare for any person who has ever worked as an irrigation specialist at the micro level. Besides, cooperatives cannot be formed 'on demand'. While the government can force cooperatives to be formed, it cannot force people to cooperate.

Under such conditions, how politically feasible would it be to supply water on a rotational basis and on the basis of land holding, without giving in to popular demands? Once the farmers of central Gujarat receive the surplus

water that would be available before the further reaches of the canal were built, how will it be taken away from them?

Irrigation: Conclusions

It is clear that the irrigation benefits of the SSP have been vastly exaggerated. The project will not only be unable to irrigate 1.8 million ha, it may have water to reach only 44-52% of that area. Large parts of the command are unsuitable for irrigation, and waterlogging and salinisation are bound to occur. Prospects of failure loom large, magnified by the absence of the Narmada Sagar Project. Rich and powerful central Gujarat will definitely benefit in the short run, before waterlogging and salinisation lays waste its fields forever, but the drought-hit will be left high and dry.

POWER

The SSP has a planned installed capacity of 1450 MW, of which 1200 MW will be generated by turbines installed in the river bed power house (RBPH) and 250 MW from the canal head power house (CHPH). However, installed capacity is not equal to actually produced power. **Power will never be actually produced at 1450 MW.** As the SSP planning documents show (Table 10), the amount of power that will be generated on a reliable basis (i.e. firm power), drops from 415 MW to 0 MW for the RBPH, and increases from 24 MW to 50 MW in the CHPH! **Thus, the final firm power from the entire SSP is only 50 MW, while at its highest, the firm power from SSP is 439 MW.**

TABLE 10
Firm Power Generation From the SSP

Source	Installed Capacity (MW)	Firm Power (MW)	
		Initial Phase	Final Phase
River Bed Power House	1200	415	0
Canal Head Power House	250	24	50
Total	1250	439	50

The reason for this is very clear. As the dam impounds water in the beginning, water can be sent to the large turbines in the RBPH to generate power. However, this can be done only when there is enough water in the river. As the canals for the SSP are completed, water abstraction for irrigation will decrease water diverted to the RBPH turbines. The riverbed powerhouse will then stay idle except for periods of high "excess" flow and for periods of pumpback/generation from the Garudeshwar weir to meet peak demands for electricity. The final firm power generated by the RBPH is zero. The CHPH, on the other hand, will increase its generation to 50 MW as more water flows through the canals.

The SSP is expected to generate a large amount of peaking power (i.e. power provided for a few hours every day to meet peak demand). This will be generated by a combination of direct generation and pumpback generation from the Garudeshwar weir. The weir stores water downstream of the dam, and this water is then pumped back up the dam, after which the water is again sent down the dam (through the turbines) to generate power. Pumping water up the dam consumes more energy than is generated by the same amount of water flowing "down" the dam. So, pumpback generation ends up **consuming more energy than it produces!** The only reason pumpback generation is done is to provide energy during peak hours even though it means the consumption of a larger amount of energy during non-peak hours. In the final phase of the project, as water gets diverted for irrigation, most of the peaking power will be produced by pumpback generation rather than directly. Thus, the peaking power "generated" by the SSP will actually end up consuming more power than it can generate!

Even the highest firm power production of 439 MW, as well as peaking power production by the SSP is open to question. It must be kept in mind that production of electricity by SSP in the early stages of the project contributes substantially to the net present benefits of the project, as evident from the cost-benefit calculations (TEC 1982). However, the graduated release of water from the Narmada Sagar Project upstream is essential for this power generation to occur to the extent planned. This is because most of the flow would occur in monsoon months, and the SSP, its reservoir and turbine intake tunnels quickly filled to capacity, would let the water spill over to go to the sea. During the rest of the year the flow is much lower, and the amount of power generated would not be able to reach 439 MW. In the absence of the NSP, the power generated at SSP in the highest stage will drop by 28% (SSNNL 1989:226). The World Bank estimated power releases would be reduced by 50% if the Narmada Sagar project was delayed. Furthermore, losses of firm power in the "no NSP" scenario would be substantially higher than loss of total power (WB 1985B: 117).

Does the SSP Provide Any Net Energy For Gujarat?

It is becoming increasingly clear that the SSP will actually *consume* more energy in Gujarat than will ever be produced for Gujarat by the dam. Power from the SSP is to be divided amongst Madhya Pradesh, Maharashtra and Gujarat in the ratio 51:33:16. Gujarat's share of the highest firm power production is 70.4 MW (16% of 439 MW), which will only be obtained in the

few years the canals are not supposed to be in operation. Once the canals start functioning, however, the SSP will require vast quantities of energy.

The Gujarat State Narmada Minister, Shri Babubhai Patel recently admitted that more than 60 MW will be required for lifting water in the canals in Saurashtra and Kutch (Patel 1992). Thus, the canal system itself will consume most of Gujarat's share of firm power. Furthermore, the SSP plans require 3 MAF of groundwater to be annually pumped into the canals to augment the Narmada waters in the command. SSP plans call for installing thousands of irrigation-only, drainage-only and irrigation and drainage tubewells all over the command. The power required for operating all these tubewells has not been calculated in any project document, but the amount is likely to be quite large.

Supplying drinking water to 8215 villages and 135 towns, as claimed by the authorities, is going to require large expenditure of energy for pumping and maintaining flows in very long pipelines. Again, there is no estimate of the energy likely to be required for this component.

These power costs have not been included in any cost-benefit analysis of the SSP. Power benefits in the initial years contribute very significantly to the overall benefits of the SSP - including the power costs would probably push the cost-benefit ratio for the SSP below the level of acceptability.

Power: Conclusions

Thus, the highest power produced by the SSP is 439 MW, which will drop to only 50 MW at full development of the canal system. Thus capacity utilization will be very low. The power generation is likely to be reduced by as much as 28% since the NSP will not be constructed in time to provide graduated releases for power generation. The SSP will consume more power than it generates for Gujarat, and may even consume more power than will be generated by the project as a whole. The power consumed by the SSP has not been factored into any cost-benefit analysis.

FINANCIAL VIABILITY

The critical analysis of the benefits proposed for the SSP is rounded off by a brief look at the financial viability of the SSP. The total cost of the project is still a much debated figure. The cost of the project was estimated to be Rs. 4,877 crores in 1981 (TECS 1981). This rose to Rs. 6,500 crores in 1985. In 1991, Shri Babubhai Patel, the Narmada Minister of Gujarat, stated that the cost of the project was Rs. 9,000 crores. The Gujarat State budget for 1992-93 states that the cost of the project is Rs. 9,400 crores. All these cost estimates refer only to base cost and not the total project cost. The total cost of any project is the sum of the base cost and physical and price contingencies. The latter may be very roughly described as the effect of inflation over the implementation period of the project. **In 1985 the World Bank estimated the cost of the project to be Rs. 13,640 crores in 1985 (WB 1985).** This included a base cost of Rs. 6,264 crores, price contingencies of Rs. 6,574 crores and physical contingencies of Rs. 803 crores. In other words, the total cost of the project is more than double the base cost. Thus, if we accept that the base cost of the SSP was Rs. 9,400 crores in 1992, **the total cost in 1992 terms should be around Rs. 20,470 crores.**

It is shocking that the government and project planners have consistently chosen to ignore contingency costs when informing the public about the cost of the SSP. As recently as 1993, the Deputy Finance Minister at the Centre informed Parliament that the cost of the SSP was Rs. 6,400 crores. Such blatant disregard for facts is all of a piece with the overall attitude of secrecy and misinformation that seems to obscure the SSP like a miasma.

The true cost of the SSP may be even more than estimated above. The total cost of the power component of the SSP was estimated to be Rs. 1,700 crores by the World Bank (WB 1985). However, the Government of Gujarat announced in April 1993 (after the World Bank withdrawal) that the "Rs. 2,700 crore power component of the SSP will be privatised." In other words, the power component costs 58.8% greater than was assumed. If the total project cost has been similarly affected, **the total cost of the SSP would rise to Rs. 21,700 crores.** It should be kept in mind that the drinking water costs of the SSP are not included in any of these cost estimates. The "several thousand crores" required for this component of the project may raise the total cost well

beyond Rs. 25,000 crores. (As an interesting comparison, the total cost of all the major and medium irrigation projects built in India from Independence till 1985 is only Rs. 15,000 crores.)

According to a press release issued by the Chairman of the Sardar Sarovar Narmada Nigam, the Government had spent about Rs. 2,300 crores on the project till June 1993. This is just about 10% of total costs, and thus the argument that most of the expenditure on the project has already been incurred is hollow and untenable. What needs to be examined is how much more money needs to be spent on the project, and whether it is at all feasible to obtain such finances. The tendency to throw good money after bad must be resisted.

Where does the Government hope to obtain funds for the project? **After the withdrawal of the World Bank from the SSP, all hopes of funding from international donor agencies and foreign governments have disappeared.** This is specially significant in view of the fact that approximately 50% of the amount already spent on the project came from the World Bank. By the withdrawal of the World Bank, the project has lost Rs. 530 crore from the cancelled loan, Rs. 310 crore from the Japanese, and an additional Rs. 1,400 crore in the form of additional funding proposals already submitted to the World Bank, a total of Rs. 2235 crores.

In the wake of the World Bank withdrawal, attention was focussed on the financial aspects of the project. The Government announced plans to obtain funds from NRIs, by floating Narmada Bonds and by obtaining Rs. 1000 per acre from every farmer who is supposed to benefit from the project. The government also wants to privatize the Rs.2,700 crore power component of the project.

The proposal for funding by NRIs is still to get off the ground. An earlier proposal was rejected by the Reserve Bank, and a complete new proposal is yet to be formulated. The Narmada Bonds, or Narmada Vikas Patra that the Gujarat Government was supposed to float, have yet to show results. Currently the authorities are trying to persuade all cooperatives in Gujarat to invest their funds in the SSP, an attempt that seems to have met with very limited success. The ludicrous proposal to raise contributions from farmers who are supposed to be beneficiaries is not even worthy of comment except to point out that such an exercise is politically impossible. The attempt to privatize the power component of the project will depend on the success of ongoing privatization of power

generation in other parts of the country, and its feasibility cannot be assessed at this juncture.

On top of all this , the Gujarat Government has announced that it plans to complete the entire project by 2000. Such an optimistic plan would require Rs. 1000 crore to be spent every year for the next seven years, just to meet base costs. The SSP cannot even meet current spending requirements. Only Rs. 530 crores were spent in 1992-93, out of a requirement of Rs. 820 crores. The SSP is about 53-63% behind schedule in terms of money spent on the project compared to financial schedules drawn up by the Gujarat Government and the World Bank. The Gujarat Government is devoting 80% of its Eighth Plan irrigation budget to the SSP (Gujarat State Budget 1993-94), bypassing the needs of scores of smaller projects in the drought-prone areas of the state. Thus it is not possible for the state to allocate more money for the SSP.

The SSP appears to be totally unviable from the financial standpoint. Currently, the Gujarat Government is unable to show financing for even 25% of the project. Prospects of raising money seem very bleak. A comprehensive review of the costs and financing of the SSP needs to be conducted immediately. A fresh decision on the financial viability of the project must be taken. In light of the reduced benefits of the SSP such an exercise becomes imperative.

CONCLUSIONS

The benefits claimed for the SSP do not stand up to scrutiny. The benefits claimed for the project have been consistently, systematically and deliberately overstated by the project authorities. It is highly unlikely that the project will perform as planned, a view supported by the World Bank Independent Review (Morse and Berger 1992).

At the very outset, the amount of water available in the river has been overestimated by 17%. In addition, it is highly unlikely that the Narmada Sagar Project upstream in Madhya Pradesh will be built, further reducing the amount of water available for use by the SSP to about 58-69% of what was originally assumed and planned for. This reduction distorts the entire project, and will substantially reduce drinking water, irrigation and power benefits. However, the SSP authorities are wilfully ignoring this most basic fact.

The drinking water benefits claimed for the SSP are completely unsubstantiated. There is no detailed plan available to date. The current limited planning effort is careless, incompetent and riddled with inconsistencies. While project authorities claim that the project will be completed by 2000 A.D., the World Bank fells that a realistic schedule is for Saurashtra to get drinking water by 2020 and Kutch by 2025. Rhetorical flourishes are substituted for plans and the lack of careful and realistic studies.

All realistic appraisals indicate that the system will provide much less water than promised, and at a very large cost, which has not been included in the project. **So far, the government has not given any firm estimate of this cost (beyond stating that it will cost "several thousand crores"), nor has it allocated any funds for it.** There is a strong possibility that drinking water from the SSP will be used for the large cities of central Gujarat, and that the drought-hit people of Kachchh and Saurashtra will be left high and dry.

The SSP is likely to irrigate only 44-52% of the 1.8 million ha. claimed by the project authorities as the amount of water available for irrigation is substantially less than planned for. Furthermore, the authorities have made completely unrealistic assumptions about the efficiency of the canal system. The efficiency is likely to be closer to 45% rather than the 60% claimed. This will further reduce water available for irrigation.

Over 55% of the SSP command is prone to waterlogging and salinisation. The plans to prevent this from occurring are based on completely untried methodologies and a very high level of technological sophistication that has not been tested, even on a pilot scale, anywhere in India under realistic field conditions.

The canal operation policy of the SSP is also based on several desirable but completely untried options. The large quantities of water that will be supplied to Baroda, Bharuch and Khera districts in the initial stages of the project will lead to large-scale cultivation of water-intensive crops. As the experience of the Ukai command shows, it will be politically impossible to subsequently reduce the amount of water allocated and expect farmers to switch back to less remunerative crops.

The power benefits of the SSP are vastly exaggerated. Even though the installed capacity is 1450 MW, the highest firm power generation is only 439 MW, dropping to 50 MW once the canals start operating. In the absence of the NSP in the initial stages power benefits will drop by at least 28%. The SSP will consume more power than it produces for Gujarat.

The needy regions of Gujarat - Saurashtra, Kutch and North Gujarat, are unlikely to get any of the overall benefits of this project. The already rich and politically powerful "mainline corridor" of Central Gujarat will certainly benefit, further cementing its dominance in the state. Kutch and Saurashtra will doubly suffer: the SSP already eats up 80% of the 8th 5-year plan allocation for Gujarat, leaving no money for provision of alternative water supply schemes to these needy areas. Several alternate supply schemes available with the state district irrigation boards are languishing for lack of funds.

The SSP appears to be completely unviable from a financial standpoint. Only about 10% of total project costs have been spent to date. Further foreign funding is unlikely to be obtained, and the probability of domestic funding is remote.

The SSP needs to be comprehensively reviewed by an unbiased body to ascertain whether the vast costs of the projects will translate into benefits at the scale claimed by the project authorities. The Government of India owes at least this much to the people of Gujarat and the country.

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ABOUT THE BOOK

The Sardar Sarovar Project (SSP), the largest and most expensive multipurpose river projects ever to be initiated in India, is often described as Gujarat's lifeline. It is claimed that the SSP will drought-proof Gujarat by irrigating 1.8 million ha of land and supplying drinking water to 40 million people, in addition to an installed capacity of 1450 MW of power. These claims have been used to justify expenditure that is likely to exceed Rs 20,000 crores -- more than the total cost of all the major and medium irrigation projects built in India from Independence till 1985. However, none of these claimed benefits have ever been comprehensively and critically scrutinised. This is the task that **Muddy Waters** sets out to do. Using project planning documents and studies commissioned by the Government of Gujarat and the World Bank, **Muddy Waters** shows that the claims made about the SSP ar grossly exaggerated and that the project is highly unlikely to live up to its promises.

The most basic fact, the amount of water available in the Narmada which can be harnessed, has been overestimated by at least 17%. With less water in the river than planned for, the lack of planned upstream dams, and the efficiency of the canal system much lower than assumed, the SSP is likely to irrigate only 44-52% of the 1.8 million ha claimed by the project authorities. Over half the area proposed for irrigation is susceptible to waterlogging and salinisation. Irrigation benefits are likely to be monopolised by rich farmers in central Gujarat. Although providing drinking water to the drought-stricken regions of Gujarat is one of the main justifications of the SSP, even today there is neither a detailed plan nor any financial allocation for doing this. The cities of Central Gujarat are likely to get the bulk of any drinking water. The SSP will consume more power than it will produce for Gujarat. This project has a gargantuan appetite for public funds. Even though only about 10% of total project costs have been spent so far, the government has run out of money to finance the SSP.

The Sardar Sarovar Project is fatally flawed on economic and financial grounds. It is imperative that the project be critically reviewed as soon as possible to prevent further wastage of our nation's wealth.

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