GAP

Republic of Turkey
Prime Ministry
GAP Regional Development Administration

INTERNATIONAL WORKSHOP ON WATER BASED DEVELOPMENT PROJECTS EXPERIENCES IN THE WORLD

ŞANLIURFA
November 8, 1999

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BACKGROUND AND JUSTIFICATION

In trying to get a better understanding of the complex world we live in, it is important to exchange the experience and information that is created or gained. It is one way of viewing and understanding this complex world. The development of less developed regions is a policy objective of both developed and developing countries.

Experiences from all over the world have mirrored varying approaches for development with a common point of being water related regardless of the scale of the implemented projects. Needless to say defining, refining, financing and operating the regional development policy of the future will revolve around the gained experiences of yesterday and today only if they are shared and exhanged again and again.

Among the other regional development projects, the experience Turkey has gained in the Southeastern Anatolia Project with its holistic approach in development and the special emphasis given to sustainable human development plays a special role. GAP is well known as a project integrating many of the principles of Agenda 21 long before the Rio Meeting. GAP, with its priority aim of human wealth and well being provides a good example for regional development projects. GAP Regional Development Administration (GAP RDA) is well aware of the fact that development projects can only have a multiplier effect if the experiences gained through the implementation can find a platform to be changed. The GAP RDA is willing to share the experiences of different countries in regional development as well as disseminating its own experiences.

OBJECTIVES

The main objective of the Workshop is to provide a platform where the various approaches of different water based development projects could be shared and the experiences that have been gained through the implementation process of such projects could be disseminated.

The lessons learned from the combined experiences of all the regional development projects shared at the Workshop will also prove to be most useful for planning and implementing similar new projects elsewhere.

WORKSHOP ON WATER BASED DEVELOPMENT PROJECTS : EXPERIENCES IN THE WORLD

November 8, 1999 Şanlıurfa - Turkey

November 8, 1999 Monday (1st Day)

08:00 Registration - Harran Hotel

09:00 Welcome Breakfast at the Hotel Harran
"Welcome Remarks
by I.H. Olcay ÜNVER Ph.D./President

10:00 Departure for Atatürk Dam

11:00 Arrival to Atatürk Dam
Briefing-State Hydraulic Works (DSİ)
(16th Regional Directorate of DSİ)

12:00 Departure for Şanlıurfa

13:00 Lunch - State Guest House

14:00 Opening Ceremony of Workshop on Water Based Development Projects: Experiences in the World.
(Conference Hall, 15th Regional Directorate of DSİ)

- Prof. Asit BISWAS
- Ahmet BAHÇIVAN
  Mayor of Şanlıurfa
- Dr. İ.H.Olcay ÜNVER, Ph.D.
  President-GAP-RDA
- Şahabettin HARPUT
  Governor of Şanlıurfa

SESSION I.

CHAIRMAN **Prof. Asit BISWAS**

15:00 Opening Speech by Prof. Asit BISWAS
"Water-driven Regional Development: Global Experiences"

16:00 **1st Presentation**
- "Southeastern Anatolia Project"
İ.H.Olcay ÜNVER, PH.D.
President, GAP-RDA
TURKEY

16:40 Discussion

17:00 Coffee Break

17:15 **2nd Presentation**
- "Present Situation and the Vision on Water and River Management in Japan"
Prof. Yutaka TAKAHASHI
JAPAN

17:55 Discussion

18:15 Closing

SESSION II.

CHAIRMAN **Benedito BRAGA**

13:30 3st Presentation
- "The History, Planning and Development of the YANGTZE Three Gorges Dam Project."
Prof. Fang ZIYUAN
CHINA

14:10 Discussion

14:30 **4th Presentation**
- "The Sardar Sarovar Project: A Lifeline, Not a Disaster."
Prof. B.G.VERGHESE
INDIA

15:10 Discussion

15:30 Coffee Break

15:40 **5th Presentation**
- "Enviromental, Social & Economic Impacts in the Atatürk Dam."
Cecilia. TORTAJADA
TURKEY

16:20 Discussion

16:40 **6th Presentation**
-"California Experience on Water Based Development"
Naser James BATENİ
USA

17:20 Discussion

SESSION III.

CHAIRMAN **İ.H. Olcay ÜNVER Ph.D**
President GAP-RDA

14:00 **7th Presentation**
"Divert the Waters of the Sao Francisco River to the Semiarid NE Region of Brasil." Prof. Benedito BRAGA
BRASIL

14:10 Discussion

14:30 **8th Presentation (Special Presentation)**
Claude SALVETTI - French Water Academy
FRANCE

15:30 Discussion

15:45 **9th Presentation (Special Presentation)**
M. Mohammed N. SALEM - North Sinai Development Project
EGYPT

16:15 Discussion

16:30 **10th Presentation (Special Presentation)**
Faik TURAN - State Hydraulic Works
TURKEY

17:20 Discussion

17:15 Conclusion and Recomendations

20:00 Farewell Dinner (Harran Hotel)

* Remarks by İ.H. Olcay ÜNVER, Ph.D.

Participants of "Water Based Development Projects" Workshop.

From Left : Prof. G. Verghese, Prof. F. Ziyuan, Prof. Y. Takahashi, M. C. Salvetti, Prof. B. Braga, Mr. N.J. Bateni, Ms. C. Tortajada, Dr. O. Ünver, Mr. M. Salem, Prof. A. Biswas, Mr. F. Turan

OPENING REMARKS

Prof. Dr. Asit Biswas

Ladies and Gentlemen, I have the privilege to chair the first session, and since we are running a little bit late, what I'll try to do is try to set the scene for the workshop, but try to do it in a much shorter time so we can catch up with some of the lost time.

Let me start with the statement I made during the opening session. And that is, the world is changing very fast and with it, the water profession must also change very fast. Since the boundary conditions of water management are changing fast, that means many of our past held ideas and concepts need to be reexamined very carefully. So I would like to start with a very profound statement made by Mustafa Kemal Atatürk, and I think this could probably be one of the watchwords for the water profession in the twenty-first century. He said "I am leaving no sermon nor dogma, nor am I leaving as my legacy any commandment that is frozen in time and cast in stone. What I leave behind is reverence for scientific knowledge and decent judgement." And for the water profession, if it has to meet the challenges of the twenty-first century, we must consider the fact that none of the ideas and the concepts of the past are cast in stone, and that everything that happens in the future must be based on scientific knowledge and decent judgment. It is not going to be easy because we all are, irrespective of what we say, extremely conservative in nature. I am no exception, most people are no exceptions. We have our mindsets that are not easy to change.

At the end of the twentieth century there is no question, globally water development is under tremendous attack. You will be listening during this workshop to experiences from two major dams, with two major water development projects which are under tremendous attack, not only in their own countries, but also elsewhere : the Three Gorges, and the Sardar Sarovar.

We will hear from Egypt, the Northern Sinai Development Project. But again the water of that comes from the Aswan Dam, which is one of the most villified dams of the world.

So now that we have met together here to look into the concept of water based development, let me share with you some of the work, the detective work we have been doing for the past twenty years to put together the story, the story as to why dams like the Aswan dam have been villified in the press, in the media, in the technical literature. Ninety percent of what I'm going to share are based on facts, ten percent on conjecture or extrapolation. And I'll share with you what is conjecture and what is fact, and how, I think for the first time, I would like to share with you, how all this started. And these are based with interviews of some of the personalities who fortunately are still alive, which made some of this controversy now feasible. Historically, of course, water development has always been a

major aspect of mankind. We are in the Tigris - Euphrates valley, which is one of the earliest civilizations of humankind, as is the Nile, or the Indus, the Huang He, all these, all the major developments, developed on the banks of some of these major rivers.

As times passed, in addition to water for agriculture, mankind knew how to control water, to control floods, to produce energy, and some of the developments of the fifties and sixties and seventies can be directly related to major water development projects which help to generate the economies of the region. I might suggest the Tennessee Valley Authority, the Hoover Dam, many of these revitalized the areas of the country.

Till about the 1970s, early 1970s, water development was considered to be a good thing, but things started to change. And it started to change, probably the first one that came under attack was the Aswan Dam, and it is instructive to see why this happened. It is interesting that all this happened not because water development is good, or water development is bad, or neutral, whatever you wish to say, but the sheer fact water development, especially in the context of the Aswan, got caught in politics. And it was politics that made all this situation, the way it is at present. In early 1960's, late 1950's, let me take you back to history, and some of my colleagues here know this history better than I do. There were three presidents in the world, from the Third World, who put together what they called the non-alignment movement. One was Prime Minister Nehru of India, the second was Presidente Nasser of Egypt, third was President Sukarno of Indonesia. These are the three who started the non-alignment movement. The idea was, in addition to the two superpowers one does not have to be with one superpower or the other, but that there could be a third way. And the non-alignment movement was this third way, that these countries are not aligned to any of the super powers.

Nasser was looking for something to do for Egypt, a symbol which would propel Egypt after its indepence to a new era which people could be proud of. And in consultation with Nehru of India, who was the strong supporter of water development, in fact it was Nehru, who said the large dams of India are the modern temples of India. In consultation with Nehru Nasser decided he was going to build a major dam, the Aswan dam. When he decided to do that at that time, the Secretary of State in USA was Dulles, and Dulles offered to finance the Aswan high dam, both with money and expertise.

But there was a condition. John Foster Dulles had a very simple philosophy. He said in this world there's nothing called non-alignment. Either you are with us, if you are not with us you can't be neutral, that means you are against us. So if you are against us, we won't be able to help you very much. So there was a tremendous pressure on Nasser to accept both the financing for the Aswan dam and at the same time to give up the non-alignment movement and join the western camp.

Simultaneously howewer, USA was not very happy with Nasser because he was not exactly dancing to the USA's tunes. He was too independent for the liking of Foster Dulles, and he wanted, Dulles wanted, basically Nasser to go and be replaced with a more acceptable president of Egypt. Accordingly, Egypt was very dependent

at that time to appeal for availability, especially in terms of provision of wheat. And at that time approximately %70 to %80 of wheat that is used in Egypt, it was the staple food of the people, was received from grants from the United States. And once in the early 60's when the grant was about to be done out in three months, Nasser asked his ambassador in the USA to discuss with John Foster Dulles that the food aid, the PL 480 would be continued after that agreement expired.

Dulles assured the Egyptian ambassador that this should be possible and there are some bureaucratic hurdles, it would take six weeks, but within six weeks, they will formally approve the next grant of PL 480 for food grains. Six weeks passed, nothing happened. So Nasser again asked his ambassador to check with Dulles, and Dulles said, "Well, there are a few boottlenecks, but nothing very serious. When do you really need the food?" He said, "We have six weeks of reserve. The ship must be in Alexandria, and we need two days after that to distribute the wheat. So we need a minimum of one week for the shipping time and the distribution time." And Dulles said, "Well, we have six weeks, I assure you it will be there."

Three weeks passed, no news, Nasser got very nervous. He said, "Where is the wheat?" So he called Dulles himself and John Foster Dulles said again, "There are slight problems but do not worry, my friend. The food will be in Alexandria well before your deadline runs out." Ten days before no news. Nasser called Dulles again. He said, "In 48 hours the food will be dispatched." Forty-eight hours later Dulles called Nasser. He said "I am sorry, my friend, the broker said the risk he would take was too much. We will not able to send you the food to Egypt as promised within the time limit. You will have to do best you can, because I don't know when the US will be able to ship the food."

Nasser by then of course found out what was going on, because it was quite clear the strategy was if there is no wheat, there will be food riots in Egypt, and the direct casuality of that is going to be Nasser, and through these riots a new president will be elected. So Nasser in deperation called Kruschev. He said, "Mr. Kruschev, I am in trouble. In seven days I need wheat, otherwise, all hell will break lose in my country. Can you help?" Kruschev said, and these are true stories which we can now verify with the person involved in the negotiations. Kruschev said, "Yes, give me a few hours, let me see what is possible. I will do the best." the same evening, Kruschev called back and says, "My dear friend, there are two ships in the high seas which are taking wheat to Cuba." We have talked with President Castro and he is not in a hurry to have the wheat. We have time to send the wheat to Cuba, but he is already instructed, the wheat to be redirected to Alexandria, and the ships have already turned around and heading for Alexandria. And by the way," Kruschev said, "President Nasser, if the Americans do not wish to finance the Aswan dam, the Soviet Union would be delighted to step in and provide the funds and expertise to help you build the Aswan Dam." By that time Nasser knew what was the score, and he accepted the Aswan Dam help from the Soviets. What happened after that is also very interesting.

When the Aswan Dam was completed, the Soviet ambassador in Egypt got in touch with

Nasser's right hand man, a very distinguished journalist, Mohammed H--?, and said, "President Kruschev would like an invitation, for the opening of the Aswan Dam. And of course Nasser extended the invitation to Kruschev, and Kruschev came to the opening of the Aswan Dam, and read an extremely strong political attack against the US. "Aswan Dam is the first major project of the Soviets in Africa, in the whole continent of Africa." And in his opening speech, Kruschev said that this project is the beginning of the burial of capitalism in Africa, and the Soviet Union is to follow which upset the Americans even more.

As all this was happening, suddenly in the American press, primarily in the Christian Science Monitor, a whole series of articles started to appear saying how bad is the Aswan Dam, based on a few facts, but with a lot of conjecture, and a lot of outright lies. And that series of articles were very famous at that time. Well known journalist C--? Sterling, and this is the part where there is a great deal of conjecture, plus a few articles in the New York Times. Many of my colleagues in USA and Japan feel those were planted because the Soviets were involved in the construction of the dam, and because of Kruschev's strong statement of supporting the dam, and supporting Communism. And what came out in the beginning, late 1960's and beginning of 70's set the scene for what happened to Aswan, that it is the worst dam that man has ever built.

On the contrary, if you look at Aswan, and my Egyptian colleagues could tell you better than I, if you ask me, to be one of the most successful dams in the world, in terms of cost effectiveness, in terms of its overall environmental impact, its social impact, and the impact of the dam on the national development, you would be hard pressed to find a dam which is more effective, more efficient, than the Aswan. And here again, whatever you have read in the books, whatever you read in the documents of the Aswan, most of it is not based on facts. Most of this in incorrect; the best place for it is the waste paper basket. Through the support of the Canadian International Development Agency some 30 million dollars have now been spent to study Aswan. We know everything, almost everything there is to know about the Aswan Dam for 30 years of its operation. The facts and the figures completely challenges the accepted wisdom, that Aswam is a bad dam.

But that was the beginning of the process. What now it appears started the superpower rivalry and the political effort started the ball rolling in the beginning of the seventies. There was the beginning of an environmental movement. And the environmental movement, if you look in the early 70s, and the books like **Limits to Growth** came out, the P--? brothers' book on famine came out, or Paul Ehrlich's **Population Bomb** came out, all in the period of say 1968-1972, the world was convinced that civilization as we know it is heading for disaster and by 1990 the world be in a mess. By 1990, we would run out of oil, the population would explode, the environment would be depleated, and there will be big problems.

And the environmentalists became very aware and they were looking for, in my analysis,

the lightning rod through which their anger could be channeled. And what better would be the lightning rod than the most major infrastructures of the world, and that is the water development structure. The massive dams, which have a positice effect, and the negative effects, they became the lightning rod of the environmentalists' wrath. That has continued ever since. Some for good reasons, because prior to the 1970s the world was not so environmentally conscious, so when you did the desing of the dam, or the design of the airport, or any major infrastructure, we did not give so much emphasis to the social and the environmental factors that we do at present. The world has changed, we have learned more, but that has also meant that for reasons, whatever reasons, the environmentalists' picked up on water, water development, as one of the worst developments of the twentieth century.

In the 1980s, we saw it even more. George Verghese is going to speak about Sardar Sarovar, Prof. Fang is going to talk about the Three Gorges, so I am not going to discuss this, these two issues, just to say that in 1980s the education against the dams intensified and in the 1990s it intensified even harder.

One of the major problems of regional development to water structures is the Sardar Sarovar Project in India, and those of you who know the histroy, know that the World Bank set up an independent commision to review the Sardar Sarovar project. And a little bit of personal histroy may be appropriate here. Two facts are very interesting: when the Bank announced an independent commission to examine Sardar Sarovar, nobody in the Bank knew that this is going to be the situation until the president announced it. His Vice President for legal affairs, the legal counsel talked with him, he said he hadn't a clue until he saw the announcement. His Vice President knew nothing about it until the Bank produced an announcement.

But in any case, when the World Bank announced the independent commision, I was an adviser at that time to the head of the United Nations Environment Programme, a brilliant Egyptian by the name of Mustafa --?. He was, and I happened to be in Nairobi when the announcement of the bank is and he was extremely upset. He was very upset for a very simple reason. He said that if the World Bank had set up a commision unilaterally for a major country like India, and interfere in the internal work of India, then as a precedent, next time it will be for Egypt, one after, or it could be for another country, and they would say, "Well, a big country like India accepted an independent commision, so why can't you?"

So he asked me to visit the goverment of India and put forward an alternative proposal, which I did. And that was, if the goverment of India so requested, the United Nations Environment Programme, in consultation with the goverment of India, will set up a task force of world experts on water and environment, to review the Sardar Sarovar case, and the terms of referance for the start for the task force would be prepared in consultation and agreement with the goverment of India. The members of this task force would be, again, to agree to consultation with the goverment of India, and the United Nations Environment Programme will finance the whole operation.

I passed this message to the secretary of water resources of the goverment of India. Regrettably, the reaction from India was extremly lukewarm, and their thesis was "Well, the Bank has set a commision, let's go ahead with it, probably nothing much will come out of it, so let's not complicate the matter and farther." So the government of India in its wisdom decided not to proceed with this. The results are well known, and I think George is going to be discussing this more. The loan was about to be cancelled by the executive board of the bank, but the day before India formally withdrew the proposal, that loan, saying they did not need any more, and cancelled the loan.

The rest is history, history in a different sense. There have been problems with Sardar Sarovar, but even more important is what it has done to the attude of the Bank for supporting large water development projects. If you look since the Sardar Sarovar Project, the banks' lending, either the World Bank or most of the regional development banks for major water development structures has come down drastically. A few months ago I was asked to give a keynote speech to the Bank staff on a water seminar within the Bank and my thesis was, in retrospect, perhaps a historian in the twenty-first century is going to say Sardar Sarovar became the Vietnam of the World Bank in the area of water development projects. It will be interesting to see, the Bank is supposed to publish my lecture. I will be very interested to see whether some of my statements will be still there when it is published.

Now, those are some of the things that is history, but here we are talking about water as a focus for regional development bank. Water development is under attack, even though we can now show that water can play and will play a major development role, in terms of fostering regional development.

I think GAP has a major role to play not only in Turkey, of course GAP is an important contribution to the regional development for the Southeastern Anatolian area, but even more important for GAP is to show the rest of the world that using water development as an entry point for regional development works. If your thinking is correct, if your institutions are proper, as it is happening in this country, tremendous changes can be brought into the lifestyle of the people, to the economic prosperity of the region, for a regional development project like GAP. Thus, I would like to urge Dr. Unver and the people associated with GAP to publicize their efforts, not only in Turkey but even more important, outside, so that people see an excellent example of holistic development of integrated development project.

All the world over, we talk about sustainable development. We ask, you ask yourself how many sustainable development projects have you seen, you'd be hard pressed to identify one. I would like to venture, with this examination of GAP, what we have seen is actually one of the few cases of sustainable water development, sustainable development on a major scale on the ground. So I think both GAP and Turkey, has a moral duty to publicize, to inform the people rest of the world, the successes you have had so far, and of course the problems you have run into, problems of large development are complex, they cannot be a bed of roses. You are bound to run into problems, and how you solve them, how some of the problems you are facing to solve them.

So to me, it is, GAP is one of the most important one and here I want to share with you a couple of slides, to show why some of us believe projects like GAP are essential for the future of development of the region and the country. You will hear about water development, irrigation development, etc. But let me just share with you some of the expectations of Turkey, and these figures are not coming from the DSI, this is coming from the Energy Ministry, on electricity departments of Egypt, electricity requirement of Egypt, of Turkey in the future. Look at the generating capacities, 1995, 1996, 1997 from 1988 and the requirements by 2010 and 2020. If Turkey has to progress, the electricity requirements are going to increase tremendously, and whether it is Turkey or Brazil, China, or India or Mexico, the electricity, it is immaterial, that the electricity requirements of most of these countries for the next 20 years are going to increase, depending on the country, from %6 to %9 a year increase, compounded. And these are astronomical requirements. These are also important from an environmental viewpoint because... if you are going to increase your energy requirements like this order of magnitude, and do it such a short period of thirteen years or twenty-three years. Use of fossil fuels has some major implication in terms of global warming.

We need to think about what are the alternatives. Nuclear power is not, we are not so fond of nuclear power globally. If you look at actually some countries like Sweden, Switzerland, have definitely decided to phase out nuclear power. There may be new sources of power like renewable energies, solar wind, but solar energies are highly unlikely to make much impact before 2020-2030 because of some technological developments. And one of the major areas still left is hydro. And yet globally, on a percentage basis, hydro has been losing ground not only in Turkey but also in the rest of the world.

So this is one issue, the energy requirements of the future, the electricity requirements for the future of the industrialization for improving the life style of people are going to be enormous, and this cannot be provided by coal and oil alone without some environmental consequences. Water of course has some environmental consequences, but they are of a different nature. In addition, countries like Turkey or Brazil have limited availabilty of petroleum so the question then comes, what of the financial implications of importing large amounts of oil in order to generate electricity. This is something we need to think about.

Now I mentioned the beginning of Aswan Dam. The dam, if you look at it, the dam was completed in 1967, and by 1980 only three drought years and three flood years. If you just take these six years within this thirteen-year period, the three drought years and the three flood years, the money that was saved by the Aswan Dam completely faid its cost. Forget the rest, just the flood and drought. You'd be hard pressed to do that. And let me share with you the simple diagram of what is happening in Egypt. The population of over a hundred year period from 10 millions to now it is largely about 60 million. But when you look at the arable land, very little has been done until Aswan came on stream, and then from about 6 million ha, it is now going to 7 1/2 million hectares.

But if you look at the per capita arable land, Egypt now has the lowest per capita arable land in Afica, and that is even after Aswan. If Aswan wasn't there, there is no question Egypt would have been through major social unrest because of economic depravation, because of famines and droughts. What would have been the cost? The most important issue we have never raised, what would have been the cost to Egypt's economy? What would have been the impact on Egyptian people's lifestyle if Aswan would not have been built? I do not think, it is just not in the -price?-- in our calculation, you can do the calculations in the back of the envelope yourself.

So finally, I would like to conclude with one cartoon from the Wall Street Journal. There are many needs that have been put together, that have been said about the large dams and the use of the dams for the environment. This is from the Wall Street Journal, the business newspaper, and perhaps this is appropriate in the field of water development because there is so much garbage that is written now. So basically in the field of water when you make a lot of noise with a lot of water when you make a lot of noise with a lot of nonsense, the newspapers, the media, a lot of people in the public pick it up.

For in fact I was in Japan, Professor Takahashi mentioned one of the leading economists, Japan's leading economist said the Egyptian government was so fed up with the Aswan Dam, they were seriously considering blowing it up. All I can think of it was, he was probably either smoking hashish or he had no idea what it's about because I have been advising the Egyptian government... this is, I don't know... I haven't gone to as many ministers as Olcay has, but from 1974 to now probably seven or eight ministers I have been advising and a couple of prime ministers of Egypt. I can assure you I have never met a single person in the Eygyptian government who in their wildest dream has ever thought of anything wrong with Aswan.

So what I hope this meeting will do, and this workshop will do, is give us a solid backing with facts, figures, not with hypotheses, what are the benefits and the cost of large development projects which have been triggered through water development projects. And this is why, when Dr. Ünver said if I could assist him with this workshop I not only accepted enthusiastically, but I felt that this is absolutely critical for the development of water and regional area in the future. So, Olcay, I want to thank you to give me this opportunity, to be associated with this. And with this statement let me ask Dr. Ünver to go straight at his presentation to give us some ideas about the GAP project for some of you know, but knowing Olcay, he is going to spring a few surprises on all of us.

GAP : A PIONEERING MODEL FOR WATER-BASED REGIONAL DEVELOPMENT

İ.H.Olcay ÜNVER, Ph. D.
Republic of Turkey Prime Ministry
GAP Regional Development Administration
President

1. SOUTHEASTERN ANATOLIA PROJECT

The Southeastern Anatolia Project (GAP) is a regional development project aiming at the full-fledged socio-economic development of what is called the "Upper Mesopotamia" or the "Fertile Crescent" which had once witnessed one of the earliest civilizations in the world.

GAP is the largest investment for regional development in the history of the Turkish Republic. As an integrated regional development project based upon the concept of sustainability, GAP covers investments in such fields as urban and rural infrastructure, agriculture, transportation, industry, education, health, housing, tourism among others as well as dams, power plants and irrigation schemes on the Euphrates and Tigris rivers. This massive launch for development is given special emphasis and priority for the economic, social and cultural advancement and well being of the whole country in general, and of the people of the region in particular.

The basic objectives of the GAP are : to remove interregional disparities in the country by raising the income levels and living standards in the region; to enhance productivity and employment opportunities in rural areas and; to improve the population absorbing capacity of larger cities.

The water resources development program of GAP includes 13 groups of irrigation and energy projects, seven of which are in the lower Euphrates sub-basin and six in the Tigris sub-basin (Table 1). There are 22 dams, 19 hydropower plants, and irrigation networks to irrigate 1.7 million ha of land. The planned installed capacity is approximately 7.500 megawatts with an annual hydroelectric production of 27 billion kilowatt-hours. The aims and the main features of the integrated project are outlined in the GAP Master Plan (Nippon Koei and Yüksel Proje, 1989).

When the Project is completed, the ratio of irrigated land to the total GAP area will increase from 2.9% to 22.8% while that for rain-fed agriculture will decrease from 34.3% to 10.7%. As a direct result of the introduction of irrigation, agricultural production and crop variety will increase substantially.

As of the end of 1999, the progress has reached a global financial realization rate of 43.3%. Out of the total public investment requirement of $1.5 billion equivalent hydropower project, the Birecik Dam is under construction via build-operate-transfer arrangement by a consortium of European and Turkish firms.

2. POTENTIALS AND THE CONSTRAINTS OF GAP REGION

The total population of the GAP Region in 1997 census was 6.1 million. The average annual growth rate of population for the Region was 2.5%, a figure significantly higher than the national average of 1.5%.

The Region has a very young population with half of the total being in the 0-15 age group whereas working-age group (15-44) constitutes 40%. This has resulted from high birth rates in the Region. Household sizes are large with 39% of households having between 5 and 7 members and 33% of families having 8 or more members.

A comparison of gross regional product (GRP) in 1985 with the GDP of Turkey clearly indicates the level of its underdevelopment. In 1985, the Region accounted for 4% of GNP. Per capita income in the Region, was only 47% of the national average. Agriculture is by far the dominant production sector, accounting for nearly 40% of GRP. It contributes to over 9% of the agricultural value-added of Turkey. Rain-fed agriculture is predominant depending primarily on water availability constraints, crop diversification is limited and productivity is low.

Nearly 70% of the economically active population is engaged in agriculture, but it only generates 44% of total value-added. Similarly the animal stock is large but productivity is low. Traditional production methods still predominate, but agricultural modernization has started.

Only 2% of country's total value-added from the manufacturing industry was produced in the GAP Region during the 1980-85 period. In 1985, 95% of the manufacturing industry employed less than five workers. Industrial employment comprises 5% of the regional labor force as compared to 16% for Turkey. The growth rate of employment reached its peak in 1985, at 19%, which was 4.7 times higher than the national average.

The very original idea of GAP dates back to the early years of the Republic. The founder of the Turkish Republic, Mustafa Kemal ATATÜRK, referred to "developing the Euphrates as a lake of humanity" - that was the earliest reference. The initial studies started in the 1950s. The design of the projects to tap the waters of the Euphrates and the Tigris was initiated in the 1960s. In 1977, the water resources projects that were planned and designed for the lower Euphrates and Tigris were combined in package entitled Southeastern Anatolia Project.

The Southeastern Anatolia Project, in its historical context, was formulated as a package of water and land resources development projects in the 1970s, which was later transformed, in the early 1980s, to a multi-sectoral, socioeconomic regional development program, then into a sustainable human development project in 1990s.

Development Strategy of GAP Master Plan

The GAP Master Plan set the fundamental development strategy on four components :

i. develop and manage the Region's soil and water resources for irrigation, domestic and industrial purposes in an efficient manner

ii. improve land use by encouraging optimal cropping patterns and better agricultural practices

iii. promote private entrepreneur ship with emphasis on the agro-industries and those based on indigenous resources

iv. improve social services, educational facilities and employment opportunities with a view to keep local population away from migrating to big cities as well as attracting qualified workforce to the Region.

The overall senario for the Region's development has been described by the Master Plan as "the transformation of the region into an agro-related export base".

One of the outcomes of the GAP Master Plan Study was for the management of this comprehensive program. The basic principles set for the terms of reference of the entity that would manage the program were as follows;

- Regional perspective,
- Integration of sectors with each other as well as intergration within individual sectors,
- Ability for multi-sectoral planning,
- Flexibility in implementing and funding,
- Hierarchical independence of existing ministries/bodies
- Authority to control land use to ensure operationalization of integration issues, including land-water resources integration,
- Ability to coordinate public entities,
- While still accountable to the government, flexibility to collaborate with private sector, non governmental organization, international organizations, professional societies and local governers.

As no existing organization would be able to undertake these, a new organization, i.e. Southeastern Anatolia Project Regional Development Administration (GAP-RDA), was established under the awspices of the Prime Ministry, in 1989.

The establishment of GAP-RDA brought the much needed integral perspective and also led to the evolution of the sustainable development framework for the socioeconomic development program.

Sustainable Development and Basic Strategies of GAP

Sustainable development was defined by the Brundtland Commision as one that "meets the needs of the present without compromising the ability of future generations to meet their own needs." Under this very broad definition, there are many issues which must be considered: social, economic, cultural, gender, educational, health, physical planning, agricultural, environmental, institutional, among others. At the hub of all these issues is people, either as object, or as the agent, or both. Hence, human development is the core of sustainable development of the GAP Region.

In order to define the scope and composition of sustainability for GAP, a participatory approach was adapted. A seminer was jointly sponsored by United Nations Development Program (UNDP) and GAP RDA in March 1995 attended by a large number of different stakeholders of the development process.

Based upon the results of this seminar and the objectives and targets of the GAP Master Plan, following "sustainability" goals have been adapted for the development process:

1. Increasing investments to the best achievable level which would accelerate the economic conditions;
2. Enhancing healthcare and education services so that they reach national levels;
3. Creating new employment opportunities;
4. Improving the quality of life of the cities and improving urban and social infrastructure so as to create healthier urban environments;
5. Completing the rural infrastructure for optimal irrigation development;
6. Increasing the inter and intra-regional accessibility;
7. Meeting infrastructural needs of existing and new industry;
8. Protecting water, soil and air and the associated ecosystems as a priority consideration; and
9. Enhancing community participation in decision-making and project implementation.

Main components of sustainability for GAP are; social sustainability, physical and spatial sustainability, environmental sustainability, economic, viability and sustainable agriculture & irrigation.

3. OVERVIEW OF PROJECT IMPLEMENTATION

In accordance with the sustainable development approach and strategies of GAP, special programs and projects have been initiated to emphasize the human dimension of development through project implementations concerned with basic social services (education, health, housing), gender equity, urban management, irrigation facilities, agricultural and environmental sustainability, institutional and community capacity-building, and public participation.

Examples from Implementation Projects;

- Regulation of Water in Irrigation Canals and Determination of Water - saving Irrigation Methods,
- Management, Operation and Maintenance of GAP Irrigation System (GAP-MOM)
- Pilot Implementation of Modern Irrigation Technology
- Recycling of Urban Wastewater
- Reuse of Irrigation Return Water
- Development Plans and Infrastructure Projects in the GAP Region
- Environmental Studies in the GAP Region
- GAP Region Environment Study-Tigris Basin
- Agricultural Research and Development Project
- Farmers' Training and Extension Activities
- Agricultural Research and Development Project
- Farmers' Training and Extension Activities
- Agricultural Commodities Marketing Survey and Planning of Crop Pattern
- Employment and Income-generation Projects Geared Towards Non-irrigated Areas

- Consolidation of Agricultural Lands to Improve Efficiency
- Participatory Urban Zoning and Planning
- Participatory Resettlement and Sustainable Redevelopment as a Result of Reservoirs
- The Atatürk Dam Reservoir Sub-regional Development Plan
- Establishment of Multi-purpose Community Centers (ÇATOM) for Women
- GAP Entrepreneur Support and Guidance Centers (GAP-GİDEM)
- Eco-city and Eco-village Planning and Development in Pilot Areas
- GAP Geographic Information System (GIS) Feasibility Study and Pilot Project Implementation

4. WATER AS THE ENGINE FOR SUSTAINABLE DEVELOPMENT

Table 1 shows the basic dimensions and present status of the water resources projects

Some of the larger project components are ready or near completion, such as the Karakaya and Atatürk Dams on Euphrates River, which have produced a combined output of over 20 billion kilowatt-hours (kWh) (47.5% of national hydro production) of hydroelectric energy in 1998 alone and total of 155 billion kWh until now-equivalent to $ 9.3 billion or to 30 billion m^3 natural gas.

Lower Euphrates Project is one of the seven GAP schemes on the Euphrates River and consists of Atatürk Dam and HEPP, Şanlıurfa Tunnels, Şanlıurfa-Harran irrigation, Mardin-Ceylanpınar irrigation, Siverek-Hilvan pumped irrigation and Bozova pumped irrigation in 1990 with a reservoir capacity of 48.5 billion m^3. (See Table 1) Water reaches the Şanlıurfa-Harran plains via Şanlıurfa Tunnels system, which consists of two parallel tunnels each 26.4 km long and 7.62 m in diameter. One of the tunnels was opened in 1995, and irrigation was practiced in a 30 000 ha area in 1995. Şanlıurfa-Harran plain has two main canal systems. Şanlıurfa main irrigation canal will irrigate 43 000 ha of land by gravity and 5 000 ha by pumping. The Harran main irrigation canal will irrigate 98 500 ha by gravity.

1995 has marked the beginning of irrigation in Şanlıurfa-Harran Plains. The initial 30 000 ha irrigation in these plains reached to 107 000 ha by the end of June 1999.

The impacts of irrigation are explained on this 30 000 ha area with 51.3 km of main irrigation canal, 69 km secondary canal, 1 040 km of tertiary canal, 45,5 km main drainage, 2 100 siphons. Land consolidation activities have been completed in 20 000 ha. There are 62 villages, and 8 000 families, having over 26 000 population.

The total production prior to irrigation accounted to $31.5 million with a crop pattern of mainly wheat, barley and some vegetables. The value added was $ 60 per decar. With irrigation, cotton became the main crop with still some wheat and barley, and secondary crops were also introduced by the farmers. The most striking change has been in the land used for cotton, from 21% to 45%.

With irrigation production value rose to $ 121 million and the value-added per decar to

approximately $182, both showing significant improvement in only one year. Value added per decar increased 3 times and the annual per capita income increased from $ 1034 in 1994 $ 3963 in 1995. This area is closely monitored to assess the impact of irrigation on different facets of life and economy.

On the other hand water begins to change the entire socio-cultural life of the people, such as fishing water sports and tourism activities among others (Table 2).

5. CASE STUDIES

a. Management-Operation and Maintenance of Irrigation (MOM) System in the GAP Region

Irrigated agriculture is the foundation for sustained development of the GAP Region. If it fails to perform up to the expectations, this will seriously weaken the economic base of the region and threaten the sustainability of the rapid development that is now taking place.

The continued growth in irrigated area increases the financial burden on the national budget and adds to the complexity of the management role of the state. Furthermore, there is the proven fact that bottom-up management increases efficiency and productivity.

The consequence will inevitably be that limited resources are required to be spread over a wider area, with a consequent fall in the standard of system management, operation and maintenance and the quality of technical support provided to the farmers. This in turn will result in falling levels of service, reduced efficiency of water use, increased salinity and drainage problems and lower crop production. As the farmers' ability to pay for the services reduces, so the quality of the services falls further and the downward spiral continues. This can be reversed only by means of fundamental changes in the institutional structure, aimed at ensuring that the farmers' management ability is fully utilized and resources as a whole are used most efficiently in order to maximize water use efficiency and crop production.

The idea of privatization or management transfer is not new and is adopted in many parts of the worlds. There is a wide range of organizational models in use to fulfil the aim of handing over the irrigation networks, each situtiation requiring its own individual assessment and approach.

The main aim of irrigation projects is to raise the welfare level of farmers. It is necessary to establish an effective training and extension, marketing and input supply systems as well as effective management, operation and maintenance of irrigation. From this point of view, GAP-RDA started a project entitled "Management, Operation and Maintenance of GAP Irrigation System (MOM)" in 1992.

Major objective of the MOM model is to provide an institutional and organizational framework within which proposed management model can be replicated. The management model is required to satisfy the major study objectives :

- to maximize net benefits derived from irrigated agriculture,
- to ensure the financial and physical sustainability of irrigated agriculture.

Moreover it must be a management system that can be implemented in the short term and

which has the flexibility to respond to changing needs and raquirement over time.

There is a range of different tasks that have to be fulfilled during the different stages of implementation. This differentiation is extremly beneficial in forming a working logic and it highlights the crucial interaction between the tasks and processes to be used. The crucial work of formulating the MOM model for the project covered many subjects and disciplines such as :

- Environmental problems and the controls to minimize the negative effects on the water and soil resources and human health.
- Water distribution organisation and management methods for different water supply systems.
- Regulatory and legal aspects related with water supply management, water use, land ownership and establishing farmers' organisations.
- Issues such as social and family structures, variety of work, farming applications, cultural preferences and differences, level of understanding of irrigated agriculture, training needs and character of water uses.
- Technical aspects such as using canal and piped systems, irrigation methods, crop pattern and intensity, soils and topography, drainage needs, evaluation of water resources, operating large drainage and distribution systems.
- Micro economic issues for the irrigation management organisations such as water charge structure and policy, the cost of finance and possible economies of scale and their impact on operation and maintenance costs.

The resulting model is based on a bottom-up, participatory approach. It will provide a framework for water distribution ond water use efficiency leading to sustainable production techniques that ensure the protection of the soil and water resources. It will allow independence in the finances and in the decision making process of the management organization and maximise the responsibility of the individual.

The project has been implemented since 1997 in two pilot areas. Pilot area I has been selected as Fırat Irrigation District in Harran Plain. An advisor team consisting 8 agricultural engineers has been formed to advice, train farmers and form water user groups. 24 on farm demonstrations have been established to test and show different irrigation systems and methods to farmers. Thanks to project activities, 11 % of total irrigation water in this district was saved and cropping intensity has been % 177.5 in demonstration fields thanks to two crops in a year. On-going training courses for technical staff of the Irrigation District and other relted organisations are conducted periodically. Pilot area II is in Kayacık Irrigation Scheme in Gaziantep Province where no irrigation organisation yet exists. Water user group formation activities are under way and intensive farmer training is the major activity in that area. The project covers 900 farmers in both pilot areas.

b. Multi-Purpose Community Centers (ÇATOM) (Pronounced as Cha-tom)

GAP Administration conducted a range of sociological studies and researches to depict the

social conditions in the region; to find out the problems, needs, expectations, behavioral patterns and priorities of the people, and to identify the specific target groups of development schemes.

Upon the completion of these studies, a "GAP Social Research and Action Committee" was formed with the participation of representatives from govermental and non-governmental organizations and universities. This committee developed the GAP Social Action Plan incorporating the principles of participation, equity and sustainability in development. The Multi-Purpose Community Centers (hereafter, ÇATOM) emerged mainly as one of the projects envisaged by this plan in which women are defined as one of the disadvantaged groups who should be integrated to development process.

For project development and implementation, the GAP Administration conducted a joint work with UNICEF in the second half of 1994. The project was ready for implementation at the beginning of 1995. And the province of Şanlıurfa was selected as the area for pilot implementation. In November 1995. Actual implementation started in the Sağlık Village and the Yakubiye neighborhood of Şanlıurfa, with UNICEF support, and through cooperation between the GAP Administration and the Governorate of Şanlıurfa. UNICEF involvement in the project continued until the end of 1996 after which the project expanded by the cooperation of the GAP Administration and relevant governorates.

The ÇATOMs are community-based centers where women and young girls are trained and are provided with skills in such areas as general health, maternal and child health, hygiene, nutrition, home ecomomics and income generating activities. However, these centers are not only for such training. Those women who never had a chance to go to school before are taught reading and writing as well. Furthermore, it is at these centers that women get together, share their own experiences with each other, become aware of their common problems, and develop a collective initiative to solve these problems.

The target group of the ÇATOM are women in the age group of 14-50, who are either settled in poor urban neighborhoods (which are emerging as a result of massive migration from rural to urban areas) or live in villiages at central location.

Justification of Project

There are two basic reasons why such a project was developed and put into implementation. The first is the fact that women in the region lag far behind men in terms of human development indicators (i.e., education, health, employment, social security, income, skills, etc.). It is an obstacle in reaching the target of social development when the women, who constitute one half of the population, live in such a weak and disadvanteged position. The other rationale, as exposed by many researche, is that investment made in women will have direct impact on both the childeren and the household welfare as a whole.

Objectives of Project

The objective of the project is to ensure gender-balanced development by empowering women. The empowerment process is realized by providing training programs in a comprehensive and integrated manner to increase the level of

education, social and vocational skills, access to social services of women.

Approach in ÇATOMs

The basic feature of the ÇATOM is their participatory and integrated approach. The content of basic activities carried out and the courses provided at ÇATOM is determined by taking into account the needs and the expectations and/or demands of the target group.

Implementation is also participtory. The programs are identified and implemented by the women and other stakeholders. The ÇATOM aims at the promotion and materialization of a model for participatory community development. In order to realize bottom-up participation and organization, focus group interviews are conducted and meetings are organized at both the ÇATOM and in the villages and neighborhoods where there is a ÇATOM.

Health services, social and income-generating projects are taken up in an integrated manner.

Management and Coordination

At present, the GAP Administration is engaged in ÇATOM activities in cooperation with the Governorates of the region. Within the framework of this cooperation, support is provided by the provincial directorates functioning under governorates (such as National Education, Health, Public Education, Agriculture, Social Services, and Rural Services). The Development Foundation of Turkey (hereafter, TKV) also provides assistance in the management of and training at the ÇATOM. In addition, the Administration cooperates also with various non-governmental organizations, universities and private enterprises. The Mother Culture Cooperative, Turkish Glass & Bootle Industry Inc., Union of Turkish Women, and the Social Services College of Hacettepe University are some of the cooperating organizations and institutions.

Field workers selected from among local educated young women in charge of a ÇATOM unit are responsible for establishing contacts with target groups to identify their basic problems, needs and priorities, as well as ensuring that ÇATOM activities are planned, regularly maintained and monitored with community participation; and for reporting. The field worker reports specific problems (and offers relevant solutions, if any) to the Governorate and its attached units in case such problems are resolvable at the local level. If not, she reports the issue to the Regional Directorate of TKV to be conveyed to the GAP Administration. This mechanism has contributed to human resource development and local capacity building.

Local beneficiaries take part directly in ÇATOM management through their elected representatives. ÇATOM commitees have been set up for this purpose consisting of 3 to 5 members chosen by the participating women. These committees participate in decision-making processes regarding planning, monitoring and evaluation of all ÇATOM activities, and makes regular meeting with field workers and trainers to make decision about the ÇATOM activities. The programs are planned in these meetings.

Programs Implemented in ÇATOMs

A flexible modular programming approach are adopted in ÇATOMs. Main headings of the

programs are social, health and income-generating programs. The content of these programs is determined according to local conditions and demands of beneficiaries.

Under the social programs, literacy courses, training on health, hygiene, maternal-child health, motherhood, home economics, nutrition are given, and social-cultural activities are organized.

Under the health programs, part-time policlinic services and mobile health care services are provided.

Under the income generation programs, training on handicrafts, computer operation, green house etc. are given to the women.

Participants of the ÇATOMs are encouraged to participate in all programs at the same time to ensure full capacity building and for empowerment of women socially and economically.

Coverage and Impacts of ÇATOM

As of 1999, 21 ÇATOMs are in operation in rural and urban settlements of seven provinces in the GAP Region. The number of women that have been reached since 1995 are over 25.000.

It is observed that and women participated in ÇATOM programs affect their families and communities to send their girls to schools, and the rate of female students in primary schools is raised. In addition, most women participated in literacy courses go further and get a primary and secondary school diploma.

ÇATOM services make the families more flexible about women and open women's mind. They start to participate public life, to use public services more such as health care and family planning by the guidance of ÇATOM. Some of them find jobs and get income as a result of their personal development.

According to the results of a social impact assessment conducted in 1998, social status of women participated in ÇATOM programs increases. Self-confidence improves and they start to function as community leaders in their communities by skills they gained in ÇATOM. Their access to public services also improves.

A grass-root participation has started to develop. The projects implemented in ÇATOMs are planned in the local level by joint decision of field workers, trainers and local women themselves. The demand for ÇATOM establishment started to come from local administrations such as municipalities, villages heads and local civil society organizations, and they contribute to meeting the cost of establihment and operation of ÇATOM in their settlements.

c. Story Of Particapatory Resettlement : Halfeti Project

Birecik Dam construction on the Euphrates was started in 1996 by a consortium called Birecik Inc. On the basis of BOT (Build-Operate-Transfer) model. This dam is being built to meet the needs for energy, irrigation and potable water. Its date of holding water and reaching to the maximum water level of 385 m. elevation are December 1999 and October 2000, respectively.

The are affected by the dam reservoir covers a total of 44 villiages and 1 town (Halfeti District

Center) in Şanlıurfa, Gaziantep and Adıyaman Provinces. In terms of settlement areas, 9 villages will be flooded completely, whereas 3 villages and Halfeti will be fooded partially. In 32 villages only the fields will be flooded. The overall population affected by this process is rouhly 30.000 (1997) and the population subject to resettlement are approximately 6.500 inhabitants in 850 households.

The project titled "Assistance For Rual-Urban Integration And Community Development Programs in Halfeti-Şanlıurfa" (1) which was started in 1997 by the GAP-RDA and is undertaken by an interdisciplinary team of experts leaded by an NGO (Sociology Association), with contribution of the United Nations Development Program (UNDP). İt is one of the 29 projects within the umbrella program called "Sustainable Development Program in the GAP Region" (2) co-financed by UNDP. Works related to resttlement are financed from local sources in the project.

Main objective of the project is to assist the people by facilitating their adaptation to their new lives in social, economic and cultural terms. The project is handled in accordance with the sustainable development and participatory planning principles. Therefore, local population is consulted and regularly informed about the works, problems faced and the progress achieved at the project and their participation into the decision making process is sought. A ÇATOM and an Information and Consulting Center are established in Halfeti. An information bulletin is published quarterly with the local initiatives.

Based on the data gathered, a 1/25.000 scale Sub-Regional Development Plan for the area surrounding the Birecik Dam is prepared where the physical, social, economical and environmental data and constraints are incorporated. In line with participatory principles, the draft version of the plan is prepared in concultation with representatives of all the related public institutions and local people in a series of meetings in Ankara, Şanlıurfa and Halfeti. Presenting the best case situation of the study area for the target year 2015, the plan possesses all the necessary land use provisions for the urban and rural settlement, agriculture, afforestation, irrigation and measures against water pollution. Detailed breakdown of the required physical infrastructure and community services for each settlement (existing or new) is also presented in the plan. Furthermore, proposed economic activities end crop patterns for each community (settlement) are presented in the plan. This study also contains an action plan and has been used as a guide to coordinate the works to be conducted by different governmental entities.

In order to achieve the goals, project is implemented in three separete but interrelated components: social, economic, spatial.

- Within the social component, researches are conducted in order to determine the socio economic structures, potential, priotiries and attitude of the people in relation to the dam construction and their resettlement. In this context, a questionnaire is implemented with 1307 households in 13 settlements. Meetings were held with the target groups through village visits in order to convey information about the progress of the project and discuss the alternatives developed (social and

economic guidance). Furthermore, following training activities have conducted to achieve the social, cultural and economic integration and facilitate people's adaptation to new life after the resettlement.

- Driving
  16 participants (4 women),
- Bee Keeping
  80 participants,
- Canned food prep
  16 participants (all women),
- Photography 15 participants
  (4 women),
- Chess 20 participants
  (15 women),
- Music ("saz" - a folk instrument)
  15 participants (4 women),
- Art (painting)
  15 participants (4 women),
- Construction (finishing works) foremansihp
  15 participants (4 women),
- English
  57 participants.

Training programs are designed and periodically offered based on the inputs from village meetings.

- In the economic component, project aims to channelize the exropriation payments to economically productive sectors by providing consultation services to potential entrepreneurs. Project also aims to introduce new crops in order to compensate the existing fertile land and crops to be lost due to the dam reservoir, which requires efforts related to production practice, organization and related infrastructure. A comprehensive program of training, guidance and techical assistance activities es prepared and implemented.

Two workshops seconded by FAO (United Nations Food and Agriculture Organization) were organized to discuss the economic development proposals prepared by the project team with the local people. Following are the works performed under the economic component up to date, which are continuously enriched, expanded and monitored :

- Encouragement of animal husbandry, through technical assistance in obtaining of the cattle with bank credit, keeping them in modern barns under the guidance of a veterinary,
- Establishment of fisheries on the Euphrates. Provision of technical assistance in building the floating cages, obtaining and feeding the fish and marketing,
- Bee keeping,
- Poultry,
- Mushroom raising through provision of free demonstrations and also the necessary infrastructure and inputs on the as-paid basis
- Green house agriculture

In cooperation with relevant public entities and NGO's.

- Within the spatial component, alternatives for resettlement areas are identified based on feedback from the target groups. Existing legislation providesfor two options of resettlement : either housing by the State or village relocation through self-help housing via state assistance.

Among the 6 villages to be resettled and/or relocated; top maps, pre-plan analyses, physical plans, typical house plans of 5 are completed. House constructions are started in one village as goverment housing and 2 villages as self help process. Plan application on the site has been completed in 2 villages as of November 1999.

Whereas, for the Halfeti District Center which loses approximately 2/5 of its settlement area, one of the three alternatives for resettlement was selected based on the preferences of the people. Topo maps and physical planning of this area is handled by the local govermental entities with technical assistance by GAP-RDA. As of November 1999, 220 dwellings, a shopping center of 30 units, a school and a health center are under construction in the area.

Additionally, for the neighborhoods that will remain abovethe reservoir level, detailed geo-technical surverys, drills and tests of soil stability are being made.

The project has been a great experience for the GAP-RDA and a similar implementation has been programmed for another dam on the Tigris River, the Ilısu Dam.

6. CONCLUSION

Turkey is implementing an integrated socio-economic development project based on water resources in "Upper Mesopotamia" which once witnessed one of the earliest civilizations in the world. Sustainability is the philosophy underlining the Southeastern Anatolia Project, which has human wealth and well being as its focus. Having all its details scrupulously planned and implemented, GAP is one of the greatest of the of Turkey Rebuplic.

GAP Regional is the first institution of Turkey entrusted with integrated regional development. In November 1999 it has celebrated its 10th year of experience focusing on sustainable human development and is eager to share the experience gained implementing GAP. With this holistic project, planned to be completed by 2010, The rebirth of "Fertile Crescent" will be possible after thousands of years along the banks the of Euphrates & Tigris.

Table 1:

Euphrates River		*Tigris River*
5 304 MW	Capacity : 7 476 MW	2 172 MW
20 098 GWh	Production : 27 345 GWh	7 247 GWh
1 091 203 Ha	Irrigation Area : 1 693 027 Ha	601 824 Ha
	Number of Dams : 22	
	Number of HEPPs: 19	

Project	Capacity (MW)	Production (GWh)	Irrigation Area (Ha)	Present Stage
I. Karakaya Project	1800	7354		
Karakaya Dam & HEPP	1800	7354		OP
II. Lower Euphrates Projects	2450	9024	706281	
* Atatürk Dam & HEPP	2400	8900		OP
* Şanlıurfa HEPP	50	124		
* Şanlıurfa Irr.Tunnels				OP+U/C
a) Şanlıurfa-Harran Irr.			60000	OP
			90000	U/C
b) Mardin-Ceylanpınar Grav.Irr.			185639	M/P+U/C
c) Mardin-Ceylanpınar Pum.Irr.			149000	M/P
* Siverek-Hilvan Pum.Irr.			160105	Rec.
* Bozova Pumped Irr.			69702	Rec.
III. Border Euphrates Project	852	3168		
* Birecik Dam & HEPP	672	2516		U/C
* Karkamış Dam & HEPP	180	652		U/C
IV. Suruç-Yaylak Project			146500	
* Yaylak Plain Irr.			18322	U/C
* Suruç Plain Irr.			128128	Rec.
V. Adıyaman-Kahta Project	195	509	77824	
* Çamgazi Dam & Irr.			6536	U/C
* Gömikan Dam & Irr.			7762	M/P
* Koçali Dam & HEPP	40	120	21605	M/P
* Sırımtaş Dam & HEPP	28	87		M/P
* Fatopaşa HEPP	22	47		M/P
* Büyükçay Dam,HEPP&Irr.	30	84	12322	M/P
* Kahta Dam & HEPP	75	171		M/P
* Pumped Irr. from Atatürk Reservoir			29599	M/P+U/C
VI. Adıyaman-Göksu	7	43	71598	
* Çataltepe Dam Irr.				M/P
* Erkenek HEPP	7	43		M/P
VII. Gaziantep Project			89000	
* Hancağız Dam & Irr.			7330	OP
* Kayacık Dam & Irr.			13680	U/C
* Kemlin Dam & Irr.			1969	M/P
* Pumped Irr.from Birecik Reservoir			53415	M/P
* Belkıs-Nizip Irr.			11925	U/C
INDIVIDUAL PROJECTS				
OP	14.4	42	60440	
M/P			6353	
Nusaybin Irrigation			7500	OP
Çağ Çağ HEPP	14.4	42		OP
Akçakale Groundwater Irr.			15000	OP
Ceylanpınar Irr.			27000	OP
Hacıhıdır Project			2080	OP
Dumluca Project			1860	OP
Suruç Groundwater			7000	OP
Besni Dam & Irr.			2820	M/P
Ardıl Dam & Irr.			3535	M/P

Project	Capacity (MW)	Production (GWh)	Irrigation Area (Ha)	Present Stage
VIII. Tigris-Kralkızı Project	204	444	126080	
* Kralkızı Dam & HEPP	94	146		U/C
* Tigris Dam & HEPP	110	298		U/C
* Tigris Rights Bank Grav.Irr.			54279	U/C
* Tigris Rights Bank Pum.Irr.			71801	U/C+D/D
IX. Batman Project	198	483	37744	
* Batman Dam & HEPP	198	483		U/C
* Batman Left Bank Irr.			18758	U/C
* Batman Right Bank Grav.Irr.			18758	U/C
X. Batman-Silvan Project	240	964	257000	
* Silvan Dam & HEPP	150	623		Rec.
* Kayser Dam& HEPP	90	341		Rec.
* Tigris Left Bank Grav.Irr			200000	Rec.
* Tigris Left Bank Pum.Irr.			57000	Rec.
XI. Garzan Project	90	315	60000	
* Garzan Dam & HEPP	90	315		Rec.
* Garzan Irrigation			60000	Rec.
XII. Ilısu Project	1200	3833		
* Ilısu Dam & HEPP	1200	3833		Imp.
XIII. Cizre Project	240	1208	121000	
* Cizre Dam & HEPP	240	1208		Imp.
* Nusaybin-Cizre Irr.			89000	Rec.
* Silopi Plain Irr.			32000	Rec.
INDIVIDUAL PROJECT			26312	
Devegeçidi Project			7500	OP
Silvan I & II Irrigation			8790	OP
Nerdüş Irrigation			2740	OP
Çınar-Göksu Project			3582	OP
Garzan-Kozluk Irrigation			3700	OP

Note: Individual project are not included in grand total

Legend: OP – In operation
U/C – Under Construction
D/D – Detailed Design Completed
M/P – Master Plan
Rec. – Reconnaissance
Imp. – On Implementation Program

Source: General Directorate of State Hydraulic Works (DSİ)

Table 2.

	1985	1995
TOTAL POPULATION	4.3 mil	
URBAN/RURAL POPULATION	50 %	
FERTILITY RATE	4.02	
POPULATION GROWTH RATE	2.9 %/yr	
MALE LITERACY	72 %	
FEMALE LITERACY (%)	38 %	
NO. HOSPITALS	45	
NO. DOCSTORS	1182	
NO. PERSONS/DOC	3631	
INFANTMORTALITY	111/1000	
RURAL ELECTRICITY (%)	67 %	
RURAL WATER SUPPLY (%)	36 %	
COTTON PRODUCTION	62,000 t	

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PRESENT SITUATION AND THE FUTURE VISION IN WATER AND RIVER MANAGEMENT IN JAPAN

Yukata Takahasi,
Professor Emeritus, University of Tokyo,
Executive Adviser,
Construction Project Consultant
5-18-7, Todoriki, Setagaya, Tokyo,
JAPAN 158-0082

ABSTRACT

Japanese river engineering and the administration are now entering a turning point. The present situation is introduced presenting several difficult points. An extraordinary story in the river management is explained historically since the end of the 19th century.

Based on the historical considerations and the understanding of the present problems, the future direction of the river projects is proposed toward a sound hydrological cycle.

Finally, a conflict on the Nagara Estuary Barrage is introduced as a typical conflict study. The conflict is arisen between the river administration and the environmental group, whether the project is necessary or not, and which is important, the environmental influence or flood control etc.

1. PRESENT SITUATION OF RIVER AND WATER MANAGEMENT

Japanese river engineering and the administration are now entering a turning point toward environmental policy. Nevertheless, flood control works are always important as the Japanese Archipelago is located in Asian Monsoon Region where it has been suffering from frequent floods owing to severe storm-rainfall. The important point is how to harmonize flood control and water resources development engineering with a new river policy emphasizing environmental issues.

One of the most important problems relating to water management is the integration of several kinds of water administrations. Although the water in rivers in managed by river administration under the River Law, once withdrawn from the river channel, water is managed differently under different laws. Then, so many issues relating to water management are managed by different administrators, such as flood control, hydro-electric development, agricultural and industrial water use, water supply to cities and towns, water quality, sewage and drainage, sediment control such as erosion control works for mountainside and torrential course, forest conservation, prevention from coastal erosion, maintenance of eco-system in rivers and lakes, and river landscape, etc.

Consequently, so many undesirable problems occurred recently in several fields, for example, the prevention of ground subsidence due to overpumping of ground water, flexible and efficient applications of water rights, and the protection of the quality of river water and ground water, etc. cannot be addressed by individual laws or administrators alone. Present problems to be solved now are as follows :

1) Increasing damage potential of floods and sediment against disasters

Active flood control projects and the other measures againist disasters have decreased the number of the flood victims over the years, but the level of safety remains low. In the 10 years from 1986 to 1995, about 90 percent of all municipalities in Japan have suffered a flood or sediment disaster.

Urbanization and industrialization in Japan after the Second World War has taken place mainly on alluvial plains prone to river floods. Since the beginning of this century and in particular during the high-economical growth period around the 60s and 70s, urbanization has concentrated on coastal zones prone to storm-surges. With the progress of urbanization and industrialization, the retention and detention functions of river basins and the wetla and along the rivers and coastal zones were gradually lost, while at the same time flood discharges in river channels have increased, thereby increasing the risks of flood, high-tide damage, and also the destruction of the ecosystem. As hills and mountains have been developed, damage potential of sediment flows including debris flows, landslides, and steep slope failures has increased rapidly.

Increased safety from floods etc, has led to further concentration of city functions and housing on floodplains, resulting in higher damage potential. Economic damage due to floods remains. Damage potential of floods and sediment disasters are still increasing.

As the economy and society of Japan rely on intensive urban and industrial activities, it is necessary to minimize the damages due to floods and debris flows that are beyond the control by facilities, especially in large cities and the surrounding areas. With the increase of an aging society, foreigners, and tourists the number of people particularly vulnerable to disaster is expected to grow. It is therefore necessary to take new measures against such a coming dangerous conditions.

2) Increasing frequency of droughts

The conventional approach by constructing dams and other structures in rivers, is expected to become increasingly difficult because of the scarcity of suitable dam sites, considerable cost and time required for relocation, the declining economic efficiency of water resources development projects, and recently growing public concern for the natural environment.

Precipitation has been on the decrease in recent years in Japan, causing frequent droughts. The drought of 1994 in Western Japan, had a far-reaching and serious impact. An oil company went to buy water from Korea, Hong-Kong, and even Viet Nam at that time.

As water use has increased, Japan's social and economic activities have become increasingly vulnerable to water shortage. The establishment of lifestyles dependent on intensive use of water and the growing number of people who are vulnerable to water shortage have made cities particularly susceptible to drought. Major drought may have a serious impact on Japan's social and economic activities and people's lives.

3) Deteriorating river environment

Rapidly changing socio-economic conditions have reduced water and greenery in river basins. It is also an undeniable fact that past flood control and water development projects, which gave priority to early completion with economic efficiency, failed to give adequate consideration to the environment and the riparian landscape. These factors have given, to a number of environmental problems as follows.

Decreasing biodiversity and shrinking habitat, deteriorating water environment such as depletion of springs and decreases in usual stream flow, water pollution in rivers, channels, and lakes.

4) Relationships among communities, people along the rivers, the administration, and the river itself are becoming important

Urbanization, modern river works are making people less and less aware of rivers. On the other hand, the conflicts between administrations and environmentalists are occurring on the new river projects. It is expected to find a new method to obtain a consensus. It is one of the most important topics concerning the present river policy in which it is not so easy to work out a solution to the problem.

2. HISTORICAL REVIEW IN RIVER MANAGEMENT SINCE THE END OF 19TH CENTURY

The old River Law was enacted in 1896 just one year after the end of the Sino-Japanese War. The Imperial Diet has begun in 1890, that meant the beginning of constitutional policy. Based on the law, large scale flood control projects began in several important rivers. As a result of severe flood damage in 1910, these projects enlarged to more than 20 rivers. Almost all the flood control projects were completed around 1930 to 1931.

As a result of the rivers improvement works against floods, continuous embankments were built in areas that could not been protected earlier. River works were designed on the basis of the maximum-recorded flood.

Howewer, for several river such as Tone River, the largest river-basin area in Japan, where flood exceeding the designed flood discharge successively occurred, the plan was revised each time the design flood discharge was exceeded.

In order to meet the growing demand for power generation, municipal water supply, etc., the River Water Control Scheme for flood control and water utilization, which focused on dams and weirs, was initiated in 1937.

The history of Japan after the Second World War is an extraordinary story of a country transcending economic poverty to become a world economic giant. A radical transformation has accomplished this development not only in the socio-economic but also in the water-related fields.

Drastic change mark this era: increase in population, Gross National Product, water demand, flood damage after the Second World War, and the change in industrial structure from agriculture, forestry and fishery to industry and service. To cope with these rapid changes, several measures have been introduced. For example, multipurpose reservoirs, hydrolelectric dams,

saline barriers, and river improvement works have been constructed.

The period over the half century after the War, may be divided into four periods based on socio-economic and related hydrological considerations: (a) the severe flood damage Period from 1945 to 1959; (b) the water shortage Period from 1960 to 1972; (c) Post-high economical growth Period from 1973 to 1989; (d) Environment and Amenity Period from 1990 to date.

Unfortunately, severe and frequent storm-rainfalls were caused by extraordinary strong typhoons and the rainy season from June to July. Especially, the Ise-Bay Typhoon in 1959, which is often compared with the 1953 storm-surge in the Netherlands, lashed mainly at the coast of Ise-Bay, the Pacific side of Middle Japan, killing more than 5100 inhabitants.

Almost all of the important rivers in Japan have experienced breaking of a levee, victimizing more than 1000 people annualy. The river works focused on flood damage repair and flood control during this period from 1945 to 1959. The reasons why such a successive severe flood damages occurred at this period were first, record-breaking severe precipitation, and the change of river regime. Since the end of the last century, continuous levee systems have been built, especially in the middle and downstream reach of important rivers where they flow through large alluvial plains with floodways and cutoffs in several cases, in order to protect rice fields and urbanized areas. As a result of these works, the productivity of farmland has rapidly increased, and the extent of regularly-flooded areas has markedly diminished. On the other hand, flood flows have become concentrated within the river channels between continuous levees on almost all rivers in the country, thereby intensifying peak discharges, raising the level of river stages, and increasing the velocity of flood waves. This implies that the flood regime is decisively influenced by human activities, including the flood control works themselves and economic development in the river basins. This is why the increase in flood discharge for the same amount of storm-rainfall has become one of the most important reasons for the successive severe flood damages. Rapid changes in the factors affecting the condition of river basins are clearly visible in Japan, a country that achieved industrialization in a relatively short time.

Though the Water Resources Development Acceleration Law was formulated in 1961, it was not developed in time to tackle Tokyo's water shortage in 1964, just before the Tokyo Olympic Games. A number of dams were constructed from 1950 to 1970 to meet the increasing demands for municipal and industrial water supply and also for flood control and hydroelectric power. For example, the number of dams higher than 15 m, constructed from 1950 to 1978, is 304 for irrigation purposes, 222 for hydroelectric power, and 226 for multiple purposes emphasizing flood control. As a result, there are now few major rivers without dams, and their appearance at upper river reaches have changed strikingly since the 1950's.

The oil crisis of 1973 deeply influenced not only the Japanese economy but also the water problem. The trend towards increasing water demand by the municipal and industrial sectors slowed down or stopped after the oil crisis. The

cost of dam construction have escalated due to the paucity of suitable dam sites and the increase in compensation costs, including the so-called "social cost" accompanying inhabitants' removal. Then, water became a "precious" and irreplaceable resource.

In 1964, the River Law was overhauled to meet the changing river administration needs, which resulted from the socio-economic progress and administrative reform.

The Special Measures Law concerning Upstream Area Development was enacted in 1973 to stimulate the economy of dam-site areas which are generally less attractive to settlers as compared to urban areas further downstreams. The law means that the social value of water developed in upperstream is recognized, and also it is necessary to find a solution to the conflicting interests between the upstream and the downstream, arising from the dam construction.

Since the latter half of 1970s, citizens began to make new demands for recovering amenity and accessibility to the rivers. At that time, the main topics of interest in water-related sciences and technologies such as hydrology, water resources planning and management, and the like have changed with the socio-economic requirements. The environmental topics related to water pollution, aesthetic design on the river front, and ecological balance gradually became the important issues on the river projects.

In 1980s, the environmental problems occurred in so many fields in each rivers. In 1990, the River Bureau, Ministry of Construction (MOC) initiated a promotion to river restoration project. So-called natural diverse river improvement methods were applied to use natural materials such as stone, rock, and vegetation instead of concrete lining at revetment work on levees, in order to maintain and conserve the eco-system and create sound river environments.

In 1995, the River Council, MOC reported "How River Environment Must Be". Based on the report and others, the River Law was amended towards a new policy in 1997.

3. AMENDMENT OF THE RIVER LAW IN 1997

One of the most important amendments is to add the environmental issue in Article 1, purpose of the River Law, as follows.

"Article 1. The purpose of this Law is to contribute to land conservation and the development of the country, and thereby maintain public security and promote public welfare, by administering rivers comprehensively to prevent occurrence of damage due to floods, high tides, etc, utilize rivers properly, maintain the normal functions of the river water by maintaining and conserving the fluvial environment".

"Maintaining and conserving the fluvial environment" are newly added in "the purpose of the River Law". Before the amendment, the purpose of the River Law, that is, the purpose of river works, were flood control and river water development and the utilization. There were no environmental items in the River Law before 1997.

The next important amendment is the addition to reflect the opinion of the people.

"Article 16-2-3, When river administrators intend to draft a river improvement plan, they shall consider opinions from persons with experience or an academic background when necessary."

"Article 16-2-4, In connection with the previous paragraph, river administrators shall take necessary measures, such as public hearings etc, to reflect the opinion of the people concerned whenever necessary."

"Article 16-2-5, When river administrations intend to establish a river improvement plan, they shall consider opinions from concerned prefectural governors and mayors in advance as provided in the Government Ordinance"

"Article 16-2-6, When river administrators establish a river improvement plan, they shall make a public notification to that effect without delay."

Here, the river improvement plan is a plan setting forth concrete measures to be taken in accordance with the fundamental river management policy, which is authorized by the River Council, MOC. The river improvement plan must be included in matters related to the objective of the river improvement plan, and the execution of the plan, purpose, type, and location of the river works and a description of the functions of the river administration facilities to be provided as a result of the execution of the river works.

Here, the river improvement plan is a plan setting forth concrete measures to be taken in accordance with the fundamental river management policy. If the river improvement plan involving high standard levees, the administrator must promptly provide notice to the governor of the prefecture concerned as provided for in the MOC Ordinance.

The river improvement plan shall set forth the following :

1) Matters related to the objective of the river improvement plan;

2) Matters related to the execution of the river improvement plan;

a) Purpose, type and location of the river works and a brief description of the functions of the river administration facilities to be provided as the result of execution of the river works.

b) Purpose, type and location of river maintenance

The next amendment concerns speedy countermeasures in case of unusual drought. "Article 53, In case of an unusual drought, which makes it difficult to adequately use the river water for the permitted utilization purpose or when such a situation is expected, the persons who have obtained permissions to use the water shall make efforts to consult with one another."

By the amendment, it is expected more efficient and speedy reaction in case of an unusual drought.

Eighty-five percent of water use in Japan depends on river water, and the remaining 15 percent on groundwater. In the event of low precipitation and a drouhgt severer than the design drought, therefore, it is necessary to

conciliate between water uses in different areas and for different purposes. In Japan, just as like the other countries in Asian-Monsoon areas, older water rights have traditionally been deemed superior to recent water rights. As water utilization associated with drinking water supply which is closely connected to everyday life has increased, giving priority to older water rights which consist primarily of irrigation water rights, over drinking water rights cannot necessarily be deemed rational. The River Law stipulates that in the event of a droght, which is usually not so urgent as a flood, the river users concerned first try voluntarily to adjust their water uses. Howewer, in view of the present conditions of river basins, where the expansion of water utilization is in progress and facilities for water resources development such as dam-reservoirs and headraces are becoming increasingly complex, the law seeks to make river administrators to be essentially involved in water use adjustment from the early stages of a drought by requiring river administrators to provide necessary information.

"Unusual drought here refers to a drought that is more severe than a drought whose recurrence interval is used as a basis of water resources development planning and the granting of water rights. In Japan, a recurrence interval of drought of about 10 years is usually used as a basis of the planning. Bu recently the interval have a tendency to being shorter owing to the abnormal climate.

It is also meaningful that "fluvial woods" (trees along levees or reservoirs in a long narrow strip for flood mitigation and/or water conservation purposes designed by the MOC Ordinance) are recognized as the river administration facility as a dam, weir, sluice, levee, revetment, groundsill in Article 3. Here, the river administration facility has the function of increasing public benefits from the water of a river.

Here, these trees must be planted on the following lands.

(a) In the case of a strip of trees located along a levee, land within approximately 20 m from the top of the back slope of the levee:

(b) In the case of a strip of trees along a reservoir, land within approximately 50 m from the water surface-land boundary at the highest level of river water stored in the reservoir.

To add this Article, it was indispensable and important to coordinate two administrative bodies, MOC and Forest Agency.

By the amendment, the engineering method for flood control and water utilization will appear more and more to coexist with nature.

Furthermore, by the amendment of 1997, the river administrator could make the whole or a part of the expenses for river maintenance such as the outbreak of water pollution. Also the measures for unlawful moving of pleasure boats become effective by the law.

Thus, the amendment of the River Law in 1997 focused not only on the environmental matters, but also reflected how to cope with the recent socio-economic change.

4. TOWARD A SOUND HYDRLOGICAL CYCLE WITHIN CATCHMENTS AREAS

Hydrological Cycle Sub-committee (chairman, Yutaka TAKAHASI), River Council, Ministry of Construction, proposed a report to the Minister of Construction in July, 1998 titled "What the hydrological cycle should be within catchments areas". Here I will introduce the result of the report, adding my personal view.

The hydrological cycle plays a vital role as a migration route of various substances. Civilization of our times has been structured by artificially adding on to this primeval hydrological cycle system.

A lack of coopetarion between administrators of rivers, lakes and marshes, agricultural waterways, sewerage systems, municipal water supplies, etc., led to an inability to take comprehensive and systematic measures. This resulted in various side effects on the hydrological cycle. Furthermore, in the use of national land also, observing problems from an overall viewpoint considering the continuity of the hydrological system in administration of cities, forests, and rural communities was insufficient.

Therefore, the framework has to be converted to and oriented towards overall development, conservation, and management of national land from a standpoint which takes up all aspects of the continuing of the hydrological cycle. I will emphasize the importance to assess the effects on the hydrological cycle by all development projects.

We are now changing the framework toward a new flood control and water resources management system for directing a sound hydrological cycle as follows.

Flood control system must be not only river improvement project but also floodplain management including landuse reform. Water resources development and management must be not only river development as dams and weirs, but also water recycle, rainwater harvesting, water right's transition, and desalination.

The sudden and immense change in the social structure in catchment areas has exerted all sorts of influences on the hydrological cycle of each catchment area. Within certain areas new kinds of menaces as the described below have sprung up.

a) Hydrological cycle change in forests and farmland

Japan has developed formerly non-arable land during the 20th century. However, past water retention and retarding functions have dropped due to the development of farmland infrastructure in certain catchment areas. The ways in which agricultural water use has changed have had an ifluence on the hydrological cycle system.

b) Change in the form of floods and increased flood damage potential resulting from expansion of urban districts.

Flood occurs shortly after rainfall in catchment areas which embrace urban districts due to the expansion of impervious areas caused by urbanization and the drop in water retention. The form of flood hydrograph has changed to one which increases peak discharge. Due to such

circumstances, the new type of flood damage occurred first in the western part of Tokyo already in 1958. Then, flood control projects have become subject to review in new-urbanized areas. Flood fighting, maintaining alarm system, evacuation systems, etc. are becoming more urgent and difficult.

In addition, underground spaces are being put to increased use in a number of ways without adequate equipment against inundation. In 1999, two persons died at underground room on the occasion of severe storm-rainfall in Tokyo and Fukuoka respectively. Also due to widespread use of high-tech equipment susceptible to water damage, and the potential for flood damage has increased immensely.

c) Increase in potential for infliction of damage from water shortage

All sorts of damages were brought about in 1994 in Western Japan, as it is already introduced.

d) Drop in normal river discharge

The expansion of impervious areas from urbanization, and development of sewerage systems has decreased infiltration into the subsurface and has diverted the flow of water which used to flow into rivers. The channel type power generation systems makes the discharge which used to flow into rivers bypass them.

These have caused ordinary river flow to decrease and again makes the flow in certain zones less than that in other due to bypassing. This has aggravated the river environment. Rivers are losing original river-like characteristics, not only the channels in big cities but also even the rivers in suburban areas.

e) Water shortage for disaster prevention measures

The Great Hanshin-Awaji Earthquake in 1995 exposed new vulnerable aspects of overpopulated urban communities. They were the occurrence of many fires at the same time. We have learned from this experience that the existence of water in rivers, waterway, ponds nearly overpopulated cities has a great influence on extinguishing fires at an early stage, preventing their spread, and securing water for domestic use. Despite this however, rivers, waterways, etc. are frequently reclaimed or converted to flow through conduits.

f) Water quality pollution

Recently water quality of even underground water which was believed to be good was found to be widely contaminated by chemical substances such as trichloroethylene near hihg-technological factories and laundries. Once contamination takes place, improving water quality is difficult. Underground water contamination by nitrate nitrogen and nitrite nitrogen is also widely observed.

g) Drop in groundwater levels and subsidence

In the eastern part of Tokyo, and other cities where the problem of land subsidence was particularly acute, administrative controls have been placed on pumping up of underground water. However, in regions where control does not exist such as the northern prefectures of from Tokyo, land subsidence and other problems are occurring because of the pumping up of excessive amounts of underground water whenever a time of water shortage.

h) Heat Island phenomena

The increase in reclaimed land, the development of closed sewerage system conduits, and urban activities have caused the so-called "Heat Island" phenomenon in which temperatures rise in cities.

i) Change in the ecosystem

Environmental changes taking place in the hydrological cycle system not only in the river course but also from catchment areas have all contributed to change in the ecosystem.

j) Loss of water-related culture

In ancient times, Japan was called a land of "purple hills and crystal streams" and a culture which could never be detached from water was formed. However, as the change in the hydrological cycle has expanded the livelihood domain in which the natural hydrological cycle cannot be recognized, transmission and nurturing of "water culture" is doubtful and it is further feared that this could lead to the loss of Japan's identity.

5. THE NAGARA RIVER ESTUARY BARRAGE PROJECT

Severe conflict has arisen between the river administration and environments concerning the Nagara River Estuary Barrage Project in 1990 s.

The barrage was completed in 1995 after the heated discussions in politics, journalism etc. The objectives of the barrage are flood control and water resources development. The barrage is located 5.4 km from the estuary near Nagoya City in central Japan. With a total length of 661 m., it consists of 10 main gates and two types of fishways. The construction started in March 1988 and was completed in 1995.

The Nobi Plain, the largest plain lower than the sea water level in the southern part of Japan, has been suffering from so many floods from the Nagara River during its long history. The Ise Bay Typhoon that hit the region in 1959 left over 5.000 people dead and the big flood in 1976 heavily damaged about 3.500 houses. It must be recognized that the degree of safety against floods in the area is still not enough and more flood protection measure have to be implemented.

The downstream area along the Nagara River is so densely populated that it is practically impossible to expand the river width, and then the dredging the river channel must be the optimum flood control measures to expand the cross-sectional area. Rising of levees is perilous because it would increase the flood damage potential in such low-lying areas.

However, riverbed dredging will allow seawater to flow into the river channel. This will make the river water saline and it will be difficult to take in fresh water for agriculture and industry from the existing intake facilities. Without any preventive measure, salinization of ground water and soil along the river cannot be avoided and agricultural activities will be seriously damaged. To prevent intrusion of saline water, the Nagara River Estuary Barrage is required. The gates of the barrage will be kept closed during normal periods to block saline water, but they may be opened during flood time to allow the flood to flow safely into the sea.

The administrators say as follows, a stable water supply is also required to assure the uninterrupted social and economic activities at an abnormal drought time, then the barrage is also the facility for water resources development.

MOC, which is responsible for the project says, a comprehensive study on environmental impacts due to the barrage construction had been executed, prior to the planning stage of the project and also during the construction of the barrage in close consultation with the Environment Agency, regarding items such as the effects on anadromous fishes, the aquatic, terrestrial fauna and flora, and water quality.

On the other hand, so many environmental bodies are strongly opposed to the construction of the Barrage for the following reasons, as reported by the Fish Protection Association in Japan, to The London Times on May 22, 1992.

1) The water resources development for the areas is not necessary, because the existing water supply is quite sufficient. The plan is based on the socio-economic condition in 1968 during the high economical growth era. Though the economical state has changed remarkably, the Ministry does not change the plan once decided.

2) The MOC stresses the importance of the Barrage in flood prevention, but the barrage would exacerbate damage once severe flooding will occur.

3) The quality of water in the upper area of the Barrage would be extremely worse due to stagnation. The natural influx of seawater into the estuary has had a purifying effect on the river water. This would cease with the damming of the estuary.

4) The MOC claims that the Estuary Barrage would prevent salt-water contamination of agricultural fields. Although low- lying fields were damaged in this way on one occasion in the past, advances in irrigation make a recurrence of salt-water damage most likely.

5) The MOC plans to construct special fishways to assist the Satsukimasu Salmon in travelling from the sea into the Barrage. Howewer, even if the fish could successfully negotiate the fishways, it is extremely doubtful whether they would survive the long trek through the heavily stagnated 25 km barrage-reservoir to the river beyond. Once in the river itself, the Satsukimasu Salmon and many other species of fish would find survival in the poor quality water almost impossible.

The Freshwater Fish Protection Association emphasizes to save Satsukimasu Salmon, indigenous to Japan, migration between the sea to the south of the Japanese archipelago and the Nagara River on Japan's west coast. They say, this of salmon is in damage of extinction by the Barrage.

Among the supporters to save the Nagara River are the Ecological Society of Japan, the Ichthyological Society of Japan, the Japanese Society of Limnology, the World Wildlife Fund of Japan, the Nature Conservation Society of Japan, and the Wild Birds Society of Japan etc.

Almost all forms of journalism, including influential newspapers, TV broadcastings and

various magazines supported the environmental group's insistence. They asked the MOC to stop the construction at least once until more detailed survey on the impact on several environmental items by the barrage was completed. But MOC continued and completed the Barrage in 1955, with the support of every assembly of cities and towns in the Nagara River Basin.

After the completion of the Barrage, the discussion is still continuing on the survey on the environmental impact. Both the environmental groups and the engineers of the MOC are taking on the same table and exchanging the data. I hope the relation between the MOC and the environmental group will lead to a consensus toward better river improvement works harmonizing with the eco-system. The way to assess to the consensus is not so easy, but after the severe dispute the situation is becoming better little by little, I believe.

As the lesson on the conflict of Nagara River Estuary Barrage, Aqua Restoration Research Center (ARRC) by the MOC was opened on the Kisa River area in November 1998. The objective of the ARRC is to analyze the basic phenomena such as the relation between the change of the discharge and the biological habitat, to establish and disseminate the method for natural environmental conservation and restoration. The research facility consists of three experimental rivers, each 800 m-long straight channel with revetment, and two biotope channels.

Table 1. History of river management

1986	First River Law was enacted
1910	A large scale flood control works started at many rivers
1923	Kanto Great Earthquake
1930	Almost all flood control work accomplished
1945	The end of Second World War
From 1945 to 1959, Big Flood Damage Period owing to severe storm-rainfall in almost every year.	
1959	Ise-Bay Typhoon. The largest flood and storm-surge damage in the 20th century
From 1960 to 1972, Water Shortage Period owing to rapid increase in water demand by urbanization and industrialization	
1961	Water Resources Development Acceleration Law was formulated
1964	A severe water shortage in Tokyo
	(c) New River Law was enacted
From 1973 to 1989, Post-high economical growth Period	
1973	The Special Measures Law concerning Upstream Area Development was enacted
1977	New policies for comprehensive Flood control measures in urbanized river basins
From 1990 to date, Environment and Amenity Period	
1991	Promotion to river restoration project. The beginning of Natural Diverse Improvement Method.
1994	Estuary barrage at Nagara river accomplished after the severe opposition movement and the heat discussion
1995	The River Council's report "How River Environment Must Be"
1997	Amendment of River Law

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THE HISTORY, PLANNING AND DEVELOPMENT OF THE YANGTZE THREE GORGES DAM PROJECT

Fang Ziyun, CHINA

ABSTRACT

The history of investigation of the Project could be subdivided into three main stages which covered altogether about 80 years. For each stage the main purpose of the Project was quite different. Now its multi-purpose are flood control, power generation, navigation, etc. With flood control as its main one.

The superior topographical and geological conditions of the dam site make it possible to provide a wide range for comparative selection of NPL, since the 1950s, 128-260m (above Sea Level) have been studied. Through successive justification and comprehensive planning nine aspects (Flood control, power generation, navigation, sedimentation problem, Ecology and Environment, Inundation and Resettlement, Arrangement of the upper cascades, Dealing of military attack and Economic analysis) have been considered in detail one by one and as a result NPL of 175 m with an initial operating level 156 m was finally selected and approved.

The schedule of development for the Project is 17 years, namely:

1. Preparation period and 1st Phase construction 5 years (1993-1997).

Completing the river diversion channel, temporary shiplock and enclosure of the main channel of the Yangtze.

2. The 2nd phase construction 6 years (1998-2003).

The first two turbine generator sets start yielding of electricity, 3rd stage diversion.

3. The 3rd phase construction 6 years (2004-2009).

26 Sets of turbines and generators into operation.

1. HISTORY OF THE PROJECT

The history of investigation of the Project could be subdivided into three main stages which covered altogether about 80 years. For each stage the main purpose of the Project was quite different.

1.1 In 1919, Dr. Sun Yat-sen first proposed "Store water with gates to enable shipes to navigate and to exploit the water resource (for power generation)".

1.2 In 1944, US expert J.L. Savage was invited. Compiled a preliminary report, For power generation also controlling floods and improving irrigation and navigation.

1.3 Since 1949, the new government has paid great concern to the Project, with flood control as its main purpose.

In 1992, The National People's Congress of China adopted the Resolution on the Construction of the Yangtze River Three Gorges Project.

In 1994, Premier Li Peng announced the official Commencement of Construction.

2. WHY FLOOD CONTROL SHOULD BE THE MAIN PURPOSE OF THE PROJECT

Now the multi-purpose of the Project are flood control, power generation and navigation, but its main goal is flood control.

Because the flood level is higher than the elevation of the plain and the cities along the river in the middle and lower reaches from several meters to more than ten meters. The highest levee in Jingjiang reach is more than 16 m in height. The floods of 1931 and 1935 caused more than 140 thousand people to die.

3. MAIN BENEFITS OF THE PROJECT

Flood control----from protecting against the present 10-year flood raising to 100-year flood, for 1000 year flood or the max. Flood of 1870 using diversion projects, the Jingjiang area could be protected against catastrophic disaster.

Power generation----Annual energy output of 84.7 billion kW-h, installed capacity of 18.200 MW.

Navigation----(1) Creating 660 km deep navigable channel in the reservoir, total of 10.000 ton fleets (with 3 cargoes) can reach Chongqing six months per year;

(2) Increasing annual one-way navigable capacity from present 10 millions tons to 50 millions tons;

(3) Decreasing navigable cost 35 % to 37 %

(4) Below the dam increasing flow discharge more than 3.000 c.m/s. during low water period.

4. SOME TECHNICAL PROBLEMS

4.1 Planning of the Project

4.1.1 Normal pool level of TGP studied

- Its selection is not only directly correlated with the magnitude and benefits of the project, bu also restricted by the difficulties of resettlement and sedimentation, etc.

  It depends also on the various sectors of the national economy (such as flood control and navigation) and districts above and below the dam.

- The superior topographical and geological conditions of the dam site at Sandouping make it possible to provide a wide range for comparative selection of NPL, since the 1950s, 128 m-260 m have studied.

- Due to the difficulties of handing reservoir inundation, plans above 200 m were ruled out early, until the beginning of 1980s the plans studied tended to be 190-200 m, and at the beginning of 1980s, 150 m plan was once much favoured and even its feasibility study report was approved by the State Council.

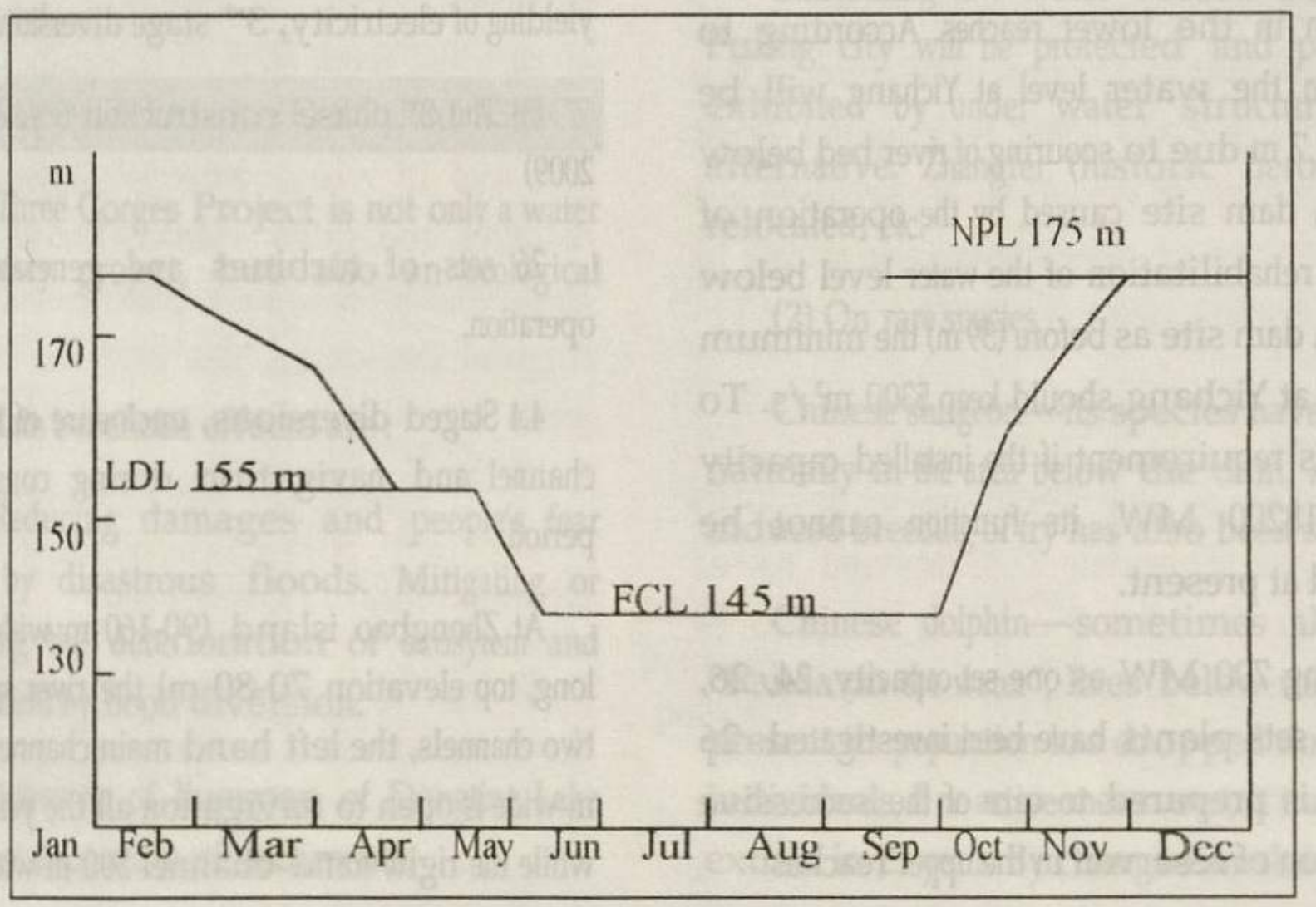
- Because 150 m plan is too low to fulfill the requirements of the project, the State Council decided to re-examine the justification of the TGP design, starting from 1986.

Table for comprehensive consideration in project planning

Problem considered	Plan preferred (m)					
	150	160	170	175	180	Remarks
Flood control				•	•	
Power generation			•	•	•	
Navigation			•	•	•	
Sedimentation problem				•		
Ecology and environment				Below •		
Inundation and resettlement				Below •		
Arrangement of the upper cascades				•		
Dealing of military attack				Below •		
Economic analysis				•		

Operation plan of project

Fig. Operation Chart for Three Gorges reservoir



- A plan of 175 m, with an initial operating level 156 m, was finally selected and approved.

4.1.2 Selection of the installed capacity of turbines and generators

The characteristics of the Three Gorges Power station :

1. Its location is suitable as a giant component for forming the national electric net. Its reservoir has a certain extent of regulation ability for discharge and following the successive construction of upper cascades the regulated discharge will be increased continuously in the dry period.

Thus the installed capacity of turbines and generators could be properly arranged greater.

2. The regulated ability for electric peak of the Three Gorges Power station is limited, because the regulating pool of Gezhouba reservoir is not so big, meanwhile it should satisfy the requirement of minimum discharge for navigation in the lower reaches. According to calculation the water level at Yichang will be lowered 1.7 m due to scouring of river bed below Gezhouba dam site caused by the operation of TGP. For rehabilitation of the water level below Gezhouba dam site as before (39 m) the minimum discharge at Yichang should keep 5300 m^3/s. To satisfy this requirement if the installed capacity exceeds 18200 MW, its function cannot be developed at present.

3. Using 700 MW as one set capacity, 24, 26, 28, 30, 32 sets plants have been investigated. 26 sets plan is prepared to care of the successive construction of reservoir in the upper reaches.

4.2 Layout of the project

The project is composed of a dam, two power plants and the navigation facilities.

From the left to the right bank of the river the project includes the following components 2 lines of 5 steps shiplocks, a vertical shiplift, a temporary navigation lock during construction stage, the power plant embracing 14 units of turbine-generator set on the left bank, the dam spillway and the power plant having 12 units of turbine-generator set on the right bank.

4.3 The schedule of construction area 15.28 sq. km.

(1) Preparation period and 1st phase construction 5 years (1993-1997) Completing the river diversion channel, temporary shiplock and enclosure of the main channel of the Yangtze.

(2) The 2nd phase construction 6 years (1998-2003)

The first two turbine generator units start yielding of electricity, 3rd stage diversion.

(3) The 3rd phase construction 6 years (2004-2009)

26 sets of turbines and generators into operation.

4.4 Staged diversions, enclosure of the main channel and navigation during construction period.

At Zhongbao island (90-160 m wide, 500 m long, top elevation 70-80 m) the river splits into two channels, the left hand main channel 700-900 m wide is open to navigation all the year round, while the right hand channel 300 m wide is dry

during low water period. Wide valley and the river channel is suitable for a staged flow diversion. 3 diversion stages are used.

(1) Right hand bank enclosed first, with the natural branch widened for an open diversion channel (360 m wide and 340 m long with max. Water depth 25 m), facilitating flood diversion at stage II and navigation for river discharge below 20.000 c.m/s for nine months (medium and low water period) every year.

(2) In the second stage of diversion, for higher flood discharge, the temporary shiplock (24 m wide, 240 m long) situated on the left side is used.

(3) In The third stage of diversion, the diversion channel would be enclosed, ships sail through 2 lines of 5 steps shiplocks.

(4) Standard :

A 1 in 100 flood event as the standard for river diversion. It equates to a mean daily discharge of 83.700 c.m./s, the world's largest diversion desing flood.

5. ENVIRONMENTAL AND SOCIAL ASPECT

The Three Gorges Project is not only a water conservancy project, but also an ecological project.

5.1 Main beneficial effects are :

(1) Reducing damages and people's fear caused by disastrous floods. Mitigating or preventing the deterioration of ecosytem and environment by flood diversion.

(2) Extension of livespan of Dongting Lake due to less deposition of sediments.

(3) Helping to control and treat snail fever (oncomelania), improving public health.

(4) Providing huge quantity of clear energy, without air pollution.

(5) Improving effectively the navigation condition in the reservoir area (from Yichang city to Chongqing city) and the reaches below the dam.

(6) Improving the local climate, enhancing the water supply and water quantity below the dam during dry season, resisting the salt water intrusion in river month region, increasing water area for aquaculture in the reservoir.

5.2 Main adverse effects on environment and their mitigation measures (1) On landscape and culturel heritage----no significant impact. The mountains of Qutang Gorges are more than 1.000 m above sea level. The landmark peak of Kuimen stands at 350 m high, where reservoir water level rises only 40 m.

Baiheliang low water record tablets near Fuling city will be protected and plan to be exhibited by under water structures as an alternative. Zhangfei (historic hero) Temple relocated, etc.

(2) On rare species

Chinese sturgeon----its species have spawned naturally in the area below the dam. Artificially induced breeding of fry has also been successful.

Chinese dolphin----sometimes also called "Panda on the water", lives below the dam. At present its population has dropped down to 100 individuals, if no active measures, it may become extinct in 25 years. By changes in sluicing flows

and consequuent channel erosion may have a little bit effects of their habitat.

Protected by strict management and by establishing nature preserves.

Siberian cranes will not be affected.

(3) On water quality in the reservoir reach

The total wastewater discharged into the reservoir reach amounts to more than 1 billion ton annually. Now the water quality of Yangtze, however, remains good in general due to huge quantity of stream flow, except for pollution belts along the banks near cities. After impoundment the slower flow velocity and higher water level causing by the TGP will aggravate shoreline pollution. Therefore, it would be necessary to strictly control the discharge of waste water from surrounding factories, mines, towns and cities, and to be mitigated further by better wastewater treatment measures.

As to water tempature, the most unfavorable result obtained from different methods of prediction is that the thermal stratification of the reservoir water body would begin around April and end in May. It would take 20 more days for the temperature of downstream water to rise to the spawning temperature of 18 °C.

(4) Inundation and Resettlement

According to the 1992's survey, the TGP reservoir will inundate 27.82 thousand ha of farmland (and orchard) and 844.1 thousand of residents living in the inundated area. Taking into consideration of population growth and secondly relocation during the construction period, the total population resettled would be over 1 million. Improper arrangement of such a large number of resettlement would cause serious problems of environment and ecological system. In order to avoid or mitigate the adverse impacts as far as possible, a preferential policy and practical resettlement plan have been carefully formulated after long term research.

The government of China defines that the development-oriented resettlement policy should be adopted for TGP.

The favorable conditions for resettlement include that the relocatees are living along the reservoir shores of 2.000 km long and that 58 % of them live in township. The 364 thousand of rural population is most difficult to be resettled because they will lose means of living due to inundation of farmland, which needs to be carefully arranged.

The remote sensing interpretation and field verification : indicate that about 45.000 ha of unused land existing in resettlement area can be developed. The resettlement programme arranges that about 60% of rural population will continue for agricultural production and other 40% need to create new job opportunity in industries and third estates. Considering the characteristics of spare land resource, it is suggested that citrus, tea trees and other cash plants be suitable to grow. So there are about 120 to 150 thousand tons of grain shortage for this area each year which should be allotted from other regions by the goverment.

During the construction period, the Government invests in the region quite heavily and gives them preferential policy. Besides, after completion of TGP, a portion of profits from

power generation will be allocated as development funds for the region to promote local economy.

In order to protect the environment, the industries and third estates newly established should be carefully selected. Only those of no or less pollution would be allowed to be built in the region.

5.3 Conclusions

The project would benefit not only the local economy but also have a favorable effect on the environment. It would be the vital project for relieving the life damages from floods and benefiting all the races of people in China. It would not give impact to the global environment, global water and global atmosphere and on the contrary for satisfaction of energy demand in China's development. TGP's clear energy supply would help to reduce the pollution of global environment by coal fired power plant. The beneficial effects of the project on environment would be mainly concentrated in the river's middle reaches, while its adverse effect would be mainly concentrated in the revervoir area.

The project's negative consequences will not be so significant and can be avoided or minimized if appropriate measure will be taken.

The Indexes of the TGP Main Features

item	unit	indexes initial stage	final stage
1. Reservoir			
Normal pool level (NPL)	m	156	175
Flood control leveel	m	135	145
Dry season drawdown level	m	140	155
Normal pool level (NPL)	m	156	175
Flood level of 1000-year	m	170	175
Total storage capacity (below NPL)	$10^9 m^3$	23.5	39.3
Flood control storage (NPL)	$10^9 m^3$	11.1	22.15
Active storage	$10^9 m^3$	8.9	16.50
Refulated discharge during dry season	m^3/s	5130	5860
Improvement of navigation channel	km	500-570	570-650
2. Reservoir Inundations			
farmland	hectares	23.793	
Citrus land	hectares	74.960	
Population of the inundated area (the index of late 1985)	person	725.500	
Planned population resettlement (by 2008)	person	1.131.800	

SARDAR SAROVAR PROJECT : LIFELINE TO MILLIONS

by B.G. Verghese

Few large dams have aroused as much controversy or attracted as bitter a hate campaign as has the Sardar Sarovar Project (SSP) on the River Narmada in Gujarat. The echoes of this have reverberated not only in India but throughout the world. It has been likened in destructivenes to a nuclear weapon and has at other times been labelled an environmental disaster. Its impact on the tribal population that lives in some of the submergence areas has been termed genocidal while its projected benefits and economics have been decried as fanciful if not downright dishonest.

The World Bank "stepped back" from the Project in 1992, virtually terminating the $ 180 m balance of a $ 450 m loan it had earlier approved. This followed the report of an Independent Review Mission commissioned by the President of the World Bank. The Japanese Government followed suit, halting disbursement of promised assistance for the power component of the Project. These decisions were hailed by some but strongly criticised by others, including the Indian Government and Project authorities, as mistaken and biassed.

The Project nevertheless moved forward with Indian financing. The bulk of this was provided by the state of Gujarat through budgetary allocations and borrowings, inclusive of proceeds from the sale of Narmada bonds. These have been oversubscribed by investors who perceive the SSP as essentially sound and absoslutely necessary. Those living in the arid, drought prone areas of North Gujarat, Saurashtra and Kutch see it as their lifeline.

The Narmada is one of India's larger rivers with a total basin area of 97.410 sq km. Flowing within a somewhat confined valley with an average rainfall of 112 cms per annum, it traverses 1312 kms through Madhya Pradesh, Maharashtra and Gujarat in tribal-inhabited middle India to empty into the Arabian sea. Limited arable land within the basin and the existence of large tracts of heavy vertisols (or black cotton soil as locally known) which become a gluey mass with the application of water explains why the river was never harnessed for large scale irrigation down the centuries. Water disputes among the riparian states and their reorganisation with the absorption of numerous princely fiefdoms within new boundaries after Independence are among further reasons for the delayed start to water resource development.

Narmada Tribunal Award

Rival provincial proposals proved irreconcilable, resulting in reference of the matter to a statutory inter-state Narmada Waters Dispute Tribunal (NWDT) in 1969. The Tribunal's first task was to establish the hydrology of the river, apportion inter se priorities between irrigation and power uses, and define the legitimate claimants to benefits. In view of the fact that

actual flow data was only available for the relatively short period from 1948 onwards, resort was had to hindcasting on the basis of internationally accepted rainfall-to-runoff figures based on the Indian Meteorological Department's carefully maintained records. This gave an average annual yield of 27.22 million acre feet (maf) of water at 75 per cent dependability, that is, in three out of every four. Taking account of certain additional flows below the terminal Sardar Sarovar dam site at Navagam in Gujarat, the quantum of utilisable water was estimated at 28 maf.

The Tribunal's final Award was announced in 1979. The claims of Rajasthan, a non-basin desert state, to a share in Narmada waters were politically accepted on the gound that there are no alternative sources that the state can tap. The available waters were thereafter allocated in the ratio of 18.25 maf to Madhya Pradesh, 9 maf to Gujarat, 0.50 maf to Rajasthan and 0.25 maf to Maharashtra. Through a process of optimisation, the sites and capacities/heights of four key dams on the main stem were determined at Indira Sagar, Omkareshwar and Maheshwar in Madhya Pradesh and Sardar Sarovar in Gujarat. Hydro production was sought to be maximised on the basis of prefixed irrigation priorities, with 57 per cent of the power going to Madhya Pradesh, 27 per cent to Maharashtra (since some of its proposed dam sites will be submerged under the waters of Sardar Sarovar) and 16 per cent to Gujarat.

The height of the terminal Sardar Sarovar Dam (SSP) was fixed at 455 feet (138.68 metres), entailing submergence of 37.000 ha in a linear stretch of 214 kms and displacing a population of 40.727 families from 245 wholly or partially affected villages, 19 in Gujarat, 33 in Maharashtra and 193 in Madhya Pradesh. Submegence at full reservoir level is expected to affect 11.279 ha of agricultural land, 13.542 ha of forest land and 12.869 ha of riverine and waste land.

The Tribunal worked out an elaborate and generous resettlement and rehabilitation (R&R) package for Project Affected Persons (PAPs), comprising both individual and community benefits. Alongside, it mandated a comprehensive series of measures to mitigate or obviate a variety of environmental impacts. These included catchment area treatment, compensatory afforestation, dam safety and flood precuations, health, fishery and archaelogical concerns, floral and faunal protection, and eco-tourism.

The Award further approved details of the large multipurpose Indira Sagar dam on the Naramada some 400 kms upstream of the SSP together with two dams at Omkareshwar and Maheswar to store 11.2 maf of water in Madhya Pradesh, (9.9 maf in Indira Sagar alone) and regulate supplies to Sardar Sarovar. These four dams will constitute a single cascade with each reservoir backing up to the toe of the preceding dam. Together with 26 other major dams, 130 medium dams and 3000 minor dams, the integrated Narmada Valley development programme is calculated to irrigate 2.75 m ha and generate 2600 MW in Madhya Praseh, with Sardar Sarovar irrigating an additional 1.8 m ha in Gujarat and 75.000 ha in southern Rajasthan and generating 1450 MW of power. A further major benefit envisaged is the provision of municipal, domestic and industrial water, all of them vital needs.

The Tribunal set up a Narmada Control Authority to oversee the implementation of the entire Narmada complex over a 45 year period up to 2025 after which it might be reviewed. The four participant states and the Central Government are represented on the NCA.

Madhya Pradesh has set up a Narmada Valley Development Authority for the implementation of its projects. Four major dams (one on the main stem and three on tributaries) have been completed and four others are in an advanced stage of construction within the state. Work on the main Indira Sagar dam is in progress while further construction of the Maheshwar project (400 MW) has been entrusted to a private entrepreneur.

While controversy has enveloped some of the other dams, Indira Sagar and Maheshwar among them, the brunt of national and international criticism has fallen on Sardar Sarovar.

Salient Features

The SSP is a giant project. Its 458 km main canal, with an initial capacity of 40.000 cusecs and 66.000 kms of distributaries, will irrigate 1.8 m ha in the arid north of Gujarat and another 75.000 ha in Rajasthan. This makes it the largest single irrigation project anywhere, entailing massive aquaducts and siphons and other complex engineering works as it traverses nine subsidiary river basins. It must probably also rank among the foremost drinking water schemes anywhere, delivering 0.86 maf of water catering to over 30 million people by 2011.

The distribution and management of the drinking water programme will be a separate major undertaking. The SSP canal system will itself, howewer, replenish all village ponds en route, thus providing supplies for community use and livestock both directly as well as by recharging rural groundwater sources. The water supply project is to cover 8215 villages and 135 towns at the rate of 70 and 100-140 litres per capita per day respectively. Many of these villages have no local water source at present; existing supplies in a large number of places are affected by fluorides, nitrates and salinity which pose health hazards. With over-pumping, the water table is falling rapidly. Water availability is limited and has to be supplemented with expensive ad hoc imports through road tankers. In years of poor rainfall, which occur in a regular cycle, there is considerable distress migration evidenced by the many deserted village that dot the barren countryside.

A huge fishery will be created in the reservoir which will more than compensate for the loss in estuarine fisheries consequent on the steadily increasing diversion of water into the main canal over a twenty year period when the complete irrigation system will be fully operational. The dam will provide flood protection to the lower Narmada. Heritage sites will be excavated and artefacts housed in museums or relocated on higher ground. Degraded forests are being afforested and compenstory afforestry undertaken elsewhere. Ten trees are being planted by the project authorities for every tree lost, inclusive of canal bank and road side plantations. Taken with the trees likely to be planted by farmers around their fields and homesteads, the ratio is expected to approximate 100:1.

The burden on women of fetching water from distant sources is enormous and tells on their health, education and creativity. Girls and women spend a lifetime walking to fetch water, fuel and fodder. Sardar Sarovar offers deliverance from this eternal drudgery and will have a positive impact on health and hygiene with safeguards to control water borne disease.

Five game and marine sanctuaries are being created in the SSP command for black buck, wild ass, migrant birds and the Great Indian Bustard.

South Gujarat enjoys adequate to good rainall which diminishes as one moves northward. North Gujarat, Saurashtra and Kutch are arid regions and water short. Water harvesting and conservation through watershed management and micro and mini storages is being encouraged and must be promoted. Likewise, reliance on sprinkler and drip irrigation, mulching and appropriate cropping patterns. With all that, howewer, the hydrological cycle prediates two lean years in every five with severe drought at least once every decade. The uncertainty, impoverishment and distress migration this entails is endemic. Millions of hapless victims are compelled to seek temporary relief when disaster strikes and yearn for permanent insurance against the cyclic disruption of their lives. For them Sardar Sarovar offers a lifeline.

R&R Package

Coming to the aid of the vast numbers living in this extended command does entail displacing people living in the catchment area above the dam. Displacement of long-settled farming populations is undoubtedly traumatic, especially if simple tribal people ensconced in traditional habitats with their distinctive social and cultural networks, are among those affected. It is therefore necessary to ensure that, following rehabilitation, they are better off at the end of the day, or at least no worse off than before.

All through the 1950s, 1960s and even into the 1970s there was limited awareness of environmental issues. Displacement, seen as an inevitable concomitant of development, was regarded as a routine to be dealt with underexisting laws and regulations such as the land aquisition act which provided for cash compensation. But in the back of beyond and among people unaccustomed to a monetised economy these procedures led to paternalism and distress. Even if compensation was fairly assessed, the money would be soon squandered or siphoned away without proper or even any kind of rehabilitation. There was no dedicated agency for R&R which was left to the project engineers as a supplementary charge. The system was unsatisfactory and it is true that the record was patchy and often poor.

It was only after the World Environment Conference in Stockholm in 1972 that the social, economic and environmental impacts of large dams (or development projects more generally) came into focus. India has since then been on a learning curve, with steady improvements in the conceptualisation and implementation of R&R. Thus it was that the Narmada Water Disputes Tribunal in 1979 wetnt beyond current practice and earlier tribunal awards to incorporate more stringent and generous standards, borrowing from international experience. This process was further reinforced following the World Bank's entry as a donor and its lending conditionalities

related to adherence to certain norms which were themselves constantly refined and upgraded.

The Narmada Tribunal's R&R package was far in advance of anything conceived of earlier. It made land rather than money the basic unit of compensation, prescribed an elaborate implementing agency in each of the three affected states, recognised the special needs and sensitivities of tribal communities, specified stringent environmental standars and required the establishment of a Narmada Control Authority to monitor all aspects of Narmada valley development, with particular reference to Sardar Sarovar, Improvements followed and continue to this day.

The basic R&R package provides that any person losing more than 25 per cent of his land shall be treated as a Project Affected Person (PAP) and shall be entitled to a minimum of two hectares of irrigable land subject to any ceiling on land holdings applicable in the concerned state. Further, every co-parcener, major, son, and agricultural labourer and encroacher within the submergence area shall also be entitled to a minimum of two ha each. Each of these beneficiary families shall be entitled to a 500 square metre homestead plot, transport to move household effects and any building materials that might be salvaged from the original dwelling, and a transitional allowance.

PAPs from each village are being relocated in clusters so as to preserve existing social networks as far as possible. Further, civic amenities like a primary school, dispensary, water points, electricity, panchayat ghars, grain storages, children's playgrounds, places of worship, an approach road an so on are being provided on given scales per 500 population.

Since the SSP primarily benefits Gujarat whereas most of the subnergence is in Madhya Pradesh and Maharashtra, Gujara is enjoined to relocate all PAPs in its territory if they so desire. Those from Madhy Pradesh and Gujarat desirous of relocation in their home state are given that option, with all R&R costs being borne by Gujarat.

Selection of land has been left to the PAPs. Representatives from affected villages are bussed around potential sites where sufficent land might be available. Having made their choice, Land Purchase Committees on which they are represented negotiate the sale price and oversee all other formalities. Homestead plots are marked out and developed and the PAPs are required to relocate six months before the due date of submergence. However, they are permitted to cultivate the new site while remaining in their villages of origin until this movement takes place. Many PAPs exercise this choice and are provided temporary sheds with a regular plinth where they can live until they relocate and build their permanent home.

A subsequent stipulation was made by the World Bank that canal-affected PAPs should also be compensated. This too has been conceded, though compensation in such cases will largely be in terms of money or other assistance as the productivity of their remaining lands will be considerably enhanced with irrigation. Why then is the SSP being so vociferously opposed?

Issues in Contention

The opposition to the dam is manifold. It has been described as environmentally unsound in terms of forest, bio-diversity, fishery and cultural loss, the likelihood of waterlogging and salinity,

and its negative health impacts. Economic viability and dam safety have been questioned, the latter in relation to seismicity. The charge is that costs have been questioned, the latter in relation to seismicity. The charge is that costs have been minimised and benefits exaggerated, and the irrigation efficiency assumed is excessive. Approvals have been secured on the basis of incomplete and inadequate long term environmental impact studies. Doubts have been expressed with regard to irrigation supplies ever reaching the more distant drought prone and backward regions of North Gujarat, Saurashtra and Kutch on the ground that rich Central Gujarat farmers with political clout will divert a disproportionate share of water by growing sugarcane and other water-intensive cash crops in disregard of the proposed cropping pattern. Likewise, industry will claim much of the remaining water as well as the available power.

In consequence, little or no drinking water will reach the arid northern districts. In fact, it is alleged that this allaged benefit was introduced as an afterthought merely in order to facilitate project approval, which is proven by the fact that the SSP project allocations do not include any separate budget heading for the water supply programme. Moreover, a number of uninhabited villages are listed among the habitations to be served. In sum, the argument runs, the Project is biassed against the small and marginal farmer and the more backward regions of the state. More important, recent hydrological measurements suggest that the annual runoff of the river is no more than 23 maf as against the 28 maf assumed by the Tribunal. This being so, the inter-state allocations need to be proportionately reduced, and if this is done Gujarat will not need such a high Sardar Sarovar dam. A lower height will reduce submergence appreciably and this in turn will entail far less displacement and forest and farm loss in Madhya Pradesh.

Despite the submergence it suffers, Madhya Pradesh gets no irrigatrion benefit from Sardar Sarovar though it does receive the lion's share of hydro-electric generation from the 1450 MW power installation. It has sought lowering of the dam height to 436 feet (as against the projected 455 feet) as this will save 113 partialy affected villages and a population of some 40.000 persons from submergence without basically affecting whatever irrigation is planned in Gujarat. As against this, it is prepared to compensate Gujarat for the loss of power consequent on a 19 feet lowering of the dam. Gujarat, Maharashtra and Rajasthan disagree and wish to hold Madhya Pradesh to the Tribunal's Award which only comes up for review in 2025.

Judicial Appeal

The issues of hydrology and the "impossibility" of rehabilitation were taken to the Supreme Court of India by Madhya Pradesh in 1994. Critics of Sardar Sarovar latched on to this under the banner of the Narmada Bachao Andolan (Save the Narmada) led by Ms Medha Patkar - a member of the World Bank-IUCN sponsored World Commission on Dams - who has been a staunch opponent of the project almost from the start. In 1995, the Court ordered a freeze on further construction of the dam, though not on other project works. Although 80 per cent of the dam was complete, the construction, described an irregular "U" with the dam height being 80.3 m at its lowest point as against the stipulated height of 138.68 m (reservoir level 455 feet) and initial

benefits of irrigation and power beginning to flow at a height of 110.64 m (363 feet).

The height-rehabilitation issue is what is primarily to be addressed. The environmental and other objections are incorrect or grossly exaggerated. Gujarat pleaded its case for domestic and industrial water before the Tribunal which made an allocation of 1.06 maf under these heads, 0.86 maf of this specifically for drinking purposes. The SSP's main canal and distributaries will convey these supplies to designated offteke points within the command to connect with a separate network of pipelines or other vonveyance structures. The task of constructing and managing this latter enterprise is being entrusted to the Gujarat State Drinking Water Infrastructure Corporation. That uninhabited villages have been included in the list of beneficiaries is explained by the fact that the severity and duration of past droughts have led to a large number of villages being deserted for years on end. They will be reoccupied as soon as water is available.

Irrigation has been planned on the basis of careful soil-irrigabilty classifications on the basis of which cropping patterns have been prescribed. Automated canal systems are to regulate water releases accordingly. The water table is to be monitored through a battery of observation wells which will regulate groundwater pumping and signal a corresponding reduction in canal releases so as to maintain the requisite water balance. Water users associations are to be established to encourage participatory water management and maintenance with volumetric charging to ensure conseration, water use efficiency and cost-effectiveness. All these systems have been designed after considerable study and evaluation, with sprinkler and drip methods being designated for the more arid regions. As a result, a 60 percent water use efficiency has been assumed. This is higher than current all-India averages but is consistent with the best results already observed in Gujarat even in less sophisticated systems. There is certainly a real challenge here. But to discard it as no more than wishful thinking is to foreclose innovation and progress.

With further raising of the dam in abeyance under court orders, the Goverment of India and Supreme Court awaited the outcome of reviews and recommendations by expert committees and of inter-state negotiations. These proved infructuous while the burden on the project kept mounting with overheads and interest charges adding to the cost.

Following a four year freeze on construction of the dam, Gujarat approached the Court with the plea that all the R&R due up to the existing height of 80.3 m had been completed by it and that land and other arrangements to cope with displacement up to a height of 90 m were in hand so that resettlement up to this contour level of submergence should be allowed. It appointed a former Chief Justice of the Gujarat High Court as a Grievance Redressal Authority (GRA) whereupon the Court required that this mechanism be used to certify satisfactory completion of R&R or arrangements therefor up to this level.

After hearing the concerned parties, the Supreme Court in February 1999 directed that Gujarat be permitted to raise the height of the dam to 90 m. At the end of the last working season on the eve of the 1999 monsoon, the dam

had reached a height of approximately 88 m with appropriate certification from the GRA. Even while the matter is before the Court for further directions, the NBA and its associates, national and international, have launched yet another virulent campaign against the dam.

Misplaced Criticism

Given staged clearances on the basis of certification by the GRA, it should be possible to raise the dam to 110 m within the next 20 months and commence storage with the monsoon of 2001 and begin delivering irrigation and power benefits. Once this happens, the whole picture is likely to undergo transformation. Perceptions will change with the "impossible" beginning to unfold in a stream of benefits that impacts on people's lives and well being.

The opposition is of two kinds, political and emotional, tinged with an ideological romanticism. Madhya Pradesh fears that the burden of R&R on account of Sardar Sarovar could pose political problems as it has to find sufficient land for resettling displaced persons from its own Narmda Valley projects. Hence its interest in lowering of the height of the Sardar Sarova dam. Madhya Pradesh, located in the heart of India, cradles the headwaters of several rivers that flow into other states in every direction. Large water resource projects therefore tend to confort it with submergence and displacement, with most of the benefits going to lower riparians. This is so in the case of Sardar Sarovar, though the remaining Narmada Valley projects will be to its exclusive benefit.

The very generous land policy adopted by the Narmada Tribunal in 1979 was postulated on resettlement being permitted on degraded forest land, some of which is bereft of tree cover. However, following deep concern over the consequences of years of deforestation, the Government of India passed a Forest Conservation Act that barred further diversion of any forest land whatsoever. This directive rendered the Tribunal's land-for-land policy exceedingly onerous. The situation was not made any easier with incremental improvements in the resettlement package with the two hectare norm being extended to co-parceners, major sons, landless labourers and encroachers. This has raised the land exchange ratio as between catchment (displacement) and command (resettlement) anywhere from 1:2 to I:4 or more.

In a situation of burgeoning population (which has tripled since Indepence in 1947) where is all this land to come from? The current mean holding in much of Gujarat is one hectare, while urbanisation and infrastructure development is adding to pressures on the land-man ratio all over the country. Land for land is a policy that should only be selectively applied. For the rest, other than grant of a homestead plot, the alternative lies in providing or assisting gainful employment through a process of education, training/skill formation, infrastructure and other development or cash compensation.

In Gujarat, a part of the country with an entrepreneurial tradition, landowners, have been willing to sell shrinking farm holdings in order to raise capital for investment in trade, industry or the service sector. This is why the SSP authoritites have been able to purchase land. But this will become more problematic over time and less practicable in other states.

Sufficient land is already in hand to complete the task of SSP resettlement in Gujarat and Maharashtra (where in fact some degraded forest land had ultimately to be released). The problem lies in Madhya Pradesh. But even here, out of the 33.000 affected families in 193 submergence villages, almost 14.000 have indicated their willingness to settle in Gujarat; further, about 18.000 families in as many as 163 of the 193 affected villages face only partial submergence, losing only their houses but not their farmlands. They could be given homestead plots along higher contours in the same villages, thus minimising disruption to their lives. Those losing farmlands could be assisted to buy new or additional land and permitted rights of drawdown cultivation to the extent feasible, or guaranteed off-farm employment.

This is a viable solution or could at least reduce hard core problem to manageable proportions. A proposal was examined by the NCA some years ago to build an embankment joining pieces of higher ground to protect tailend villages from any backwater effect between the 436 and 455 foot contour level. This suggestion came up against certain technical and maintenance objections. Nevertheless, while it may be rejected as a single comprehensive solution, it merits reexamination as a partial solution for the protection of at least some villages so as further to reduce the residual core of the R&R problem.

The Tribal Factor

The NBA and its friends would, however, urge that tribal people in particular should not be touched as their social ethos is fragile and will crumble in the face of displacement as a result of any development onslaught. This special pleading will not wash. Lack of development and consequent environmental degradation causes tribals from this very belt to migrate in droves, first seasonally and then permanently, in search of employment as they are unable to sustain themselves in their present circumstances for more than nine or 10 months even in a good year. For the rest, they have to forage for roots and fruit in the forest and catch what fish they can in the Narmada. This semi-hunter-gatherer status is romanticised and tends to be written about with a tinge of nostalgia. Keeping these simple people in enclaves would seem to deny them the option to modernise even at their own pace and to seek a better quality of life while preserving what is best in their own tradition. The harsher features of much present-day tribal life - poverty, illiteracy, ill health - is ignored.

There is no evidence whatsoever that tribal India - and India has the largest tribal population in the world, some 85 million - does not want progress and change. Certainly, those displaced by any development programme must be rehabilitated with care and compassion. This is being done and should certainly be closely monitored in order to ensure proper implementation on the ground. Beyond this, one cannot ignore the fact that large numbers of tribals and marginalised people will benefit from Sardar Sarovar.

Transforming Effect

The human and economic cost-benefit ratio clearly favours the Sardar Sarovar project on every count. Given a few years, those displaced by the project will assuredly be far better off than they are today. Such evaluation studies as have

been carried out thus far already point in this direction. Lags and points concern have also been pointed out and these are being sought to be corrected. In the end, the Project will transform Gujarat and will be a national asset bringing succour to millions who today have little hope.

Various alternatives keep being proposed. All these are variants of local water harvesting and watershed development. Such programmes are already being implemented and it is their sheer and proven insufficiency or limited application that compels search for more effective and lasting solutions.

The multiplier effect of the SSP will be enormous. A inland navigation component has been given prelimanry consideration. The backwaters from Sardar Sarovar to the tail of the India Sagar reservoir will in time become a step-pond which could be navigated with an appropriate system of cargo transfer or locks built around the dams.

The SSP will repay itself nationally many times over during the its 180-year worst-case life of the dam. This it would do even in terms of negative benefits alone - by averting or mitigating drought, flood and migration. The total cost of the project at 1991-92 prices is estimated at Rs 131.800 million (around $ 3.2 b) of which Rs 880.000 m (about $ 2 b) has been spent up to date. Costs always seem large. They can only be meaningfully evaluated when seen against benefits. The cost of not doing, seldom calculated, is far greater.

Controversies over large versus small dams and groundwater versus surface irrigation are also based on misconceptions. Narmada Valley development posits dams of all sizes and the conjuctive use of surface and groundwater and rainwater harvesting as an integrated whole.

The hydrology issue has been raised. Every river has a hydrological cycle and it would seem that this for the Narmada is about 79 years. While, current readings of annual flows do indicate a slight dip in recent trends, this is not expected to be a permanent feature. However, even if this expectation is belied, a higher dam could store the bounty of good seasons and provide valuable carryover storage. Moreover, preliminary studies by the National Water Development Agency regarding water transfers from surplus to deficit basins within some kind of national water grid, indicate surpluses in certain small west flowing rivers south of the Narmada which can be diverted north in staged phases. So augmentation of Narmada flows is not to be entirely ruled out in the future.

For a Better Tomorrow

Meanwhile, it would make sense to permit the dam to rise up to 110 m in the first instance and secure an early flow of initial benefits and thereafter raise it to 436 feet. This could be done pari passu with commensurate R&R monitored at every five metre raising of the dam height. There could be a fuller evaluation of impacts and prospecets at 436 feet after which gates could be installed on the dam to raise the ultimate reservoir level to 455 feet as planned.

India already faces water shortages over space and time on account of the skewed distribution and marked seasonality of the monsoon. This situation is likely to be accentuated with the passage of time and growing pressures of

population resulting in water stress. With some 1580 to 1600 million people to sustain by 2050, and with the urban population increasing from 30 per cent to 50 per cent during the next half century, there is little alternative to storing and transfering a larger quantum of water during the ensuing decades.

Two thirds of India's grain comes from a third of the available arable land which is irrigated. Gross irrigation, currently approaching 90 m ha, can go up to an ultimate figure of 140 m ha. Be that as it may, grain production, which has just topped 200 m tonnes will have to more than douple to around 450 m tonnes by 2050 to meet estimated requirements, including those of feed, seed and wastage after allowing for improved agricultural technologies. The bulk of the additional production will have to come from irrigated farming.

The Independent Review Mission for Sardar Sarovar, appointed by the President of the World Bank, offered many useful insights. However, it did grave disservice to itself and to the International Bank for Reconstruction and Development by throwing a spanner into the development works through a combination of bias and arrogance. It addressed matters admittedly outside its terms of reference while ignoring its real task, shut its ears to the project authorities and ground realities, turned lobbyist for causes dear to itself, and "stepped back" to declare Sardar Sarovar Mission Impossible. The Report has been critiqued elsewhere. ("Winning the Future", B.G. Verghese, Konark Publishers, Delhi, 1994).

There are others who insist that the day of the large dam is over because dams are being decommissioned in the United States. This is preaching virtue after the event. The US has long built all the dams it needs and has only decommissioned those that are overaged, uneconomic or have otherwise outlived their utility. The example is irrelevant and compares unlikes.

In any large and complex endeavour, there will be problems. These need to be addressed and overcome. Critics like the NBA have unfortunately failed to adopt a problem solving approach and have instead sought to find problems for every solution. If they too have adopted a Mission Impossible stance it is because they are ideologically committed to a different pre-industrial, small-is-beautiful, decentralised, let-the-tribes-alone development path. This being so, the argument tends to be shrilly emotional rather than reasoned.

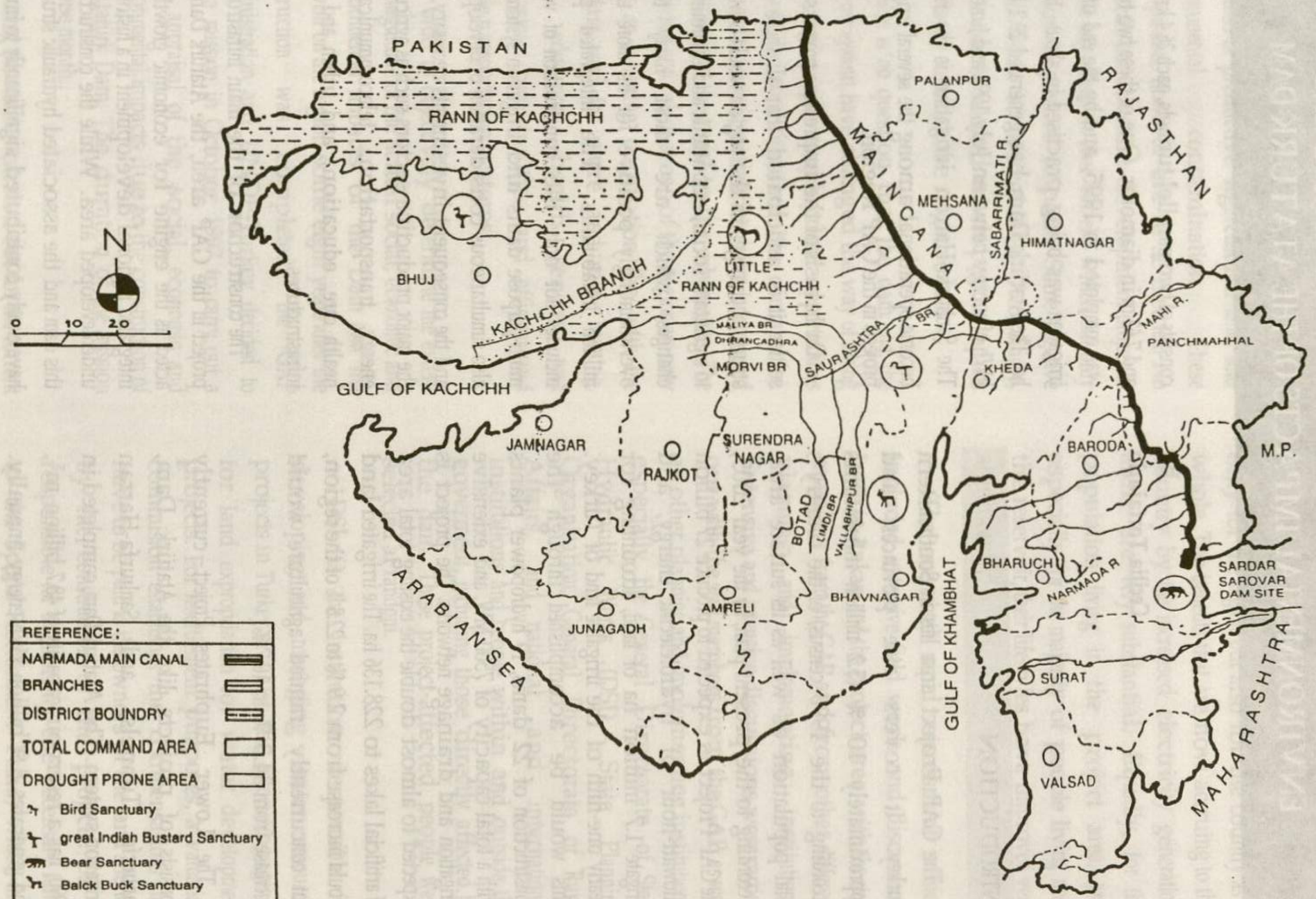
At the end of the day, the people of Gujarat and of India must be provided the wherewithal for a better tomorrow, not in terms of ostentatious consumption for the few, but ensuring equity, social justice and greater opportunity for all. There must be due regard for human rights and sustainability as well. Not all projects necessarily qualify. The Sardar Sarovar Project is one that does.

Centre for Policy Research,

New Delhi.

October 30, 1999.

SARDAR SAROVAR PROJECT



RAPID APPRAISAL OF SOCIAL, ECONOMIC AND ENVIRONMENTAL IMPACTS OF THE ATATURK DAM

by
Cecilia Tortajada

INTRODUCTION

The GAP Project area lies in Southeastern Turkey. It covers nine provinces and approximately 10 % (5.2 million inhabitants according to the 1990 census) of the country's total population as well as its surface area. According to the present plan, by the year 2005, the GAP Project is expected to produce 27 billion kilowatt-hour of hydrolelectric energy, and irrigate 1.7 million ha of land, accounting for nearly one-fifth of the irrigable land of Turkey. This would be accomplished through the construction of 22 dams, 19 hydropower plants with a total capacity of 7500 MW, and extensive irrigation and drainage networks. The project is expected to almost double the existing total area of artificial lakes to 228.136 ha. The irrigated land would increase from 2.9 % to 22.8 % of the region, but concurrently rainfed agriculture would decrease from 34.3 % to 10.7 %.

The Lower Euphrates Project currently consists of projects like the Atatürk Dam, Şanlıurfa Tunnels, and Şanlıurfa-Harran irrigation system. The Atatürk Dam, completed in 1990, has a reservoir capacity of 48.7 billion m^3, and generates 8.9 billion kWh energy annually. Water reaches the Şanlıurfa-Harran plains through the Şanlıurfa Tunnels system, which consists of two parallel tunnels, each 26.4 km long and 7.62 m in diameter. One of these two tunnels was completed in 1995, and by the end of 1997, irrigation was being practised in about 160.000 ha. The Atatürk Dam has generated 29.2 billion kWh of energy between July 1992 and June 1996. The Şanlıurfa-Harran irrigation is the first to become operational among the several irrigation projects in the GAP Region.

On the basis of the impressive progress made so far, it is anticipated that all these major structural changes in the region would contribute to significant social, economic and environmental changes, which are most likely to be overwhelmingly positive for its more than 5 million inhabitants. The integrated project includes not only the construction of various multi-purpose dams and irrigation systems but also simultaneous consideration of development, and the consequent investments necessary, in all the major productive sectors such as agriculture, energy, transportation, telecommunications, health care, education, and urban and rural infrastructures.

The construction of the main infrastructural project in the GAP area, the Atatürk Dam, has acted as the engine for economic growth and integrated regional development in a historically underdeveloped area. While the construction of this dam and the associated hydraulic structures have clearly contributed significantly to improve the lifestyles of the people, they also have had some adverse direct and indirect, social and

environmental impacts as well, e.g. resettlement of large number of people from the inundated area, loss of productive agricultural land, and environmental contamination. These developments, however are to be expected. No large-scale infrastructure development project is possible anywhere in the world which can only contribute to positive impacts. Some negative impacts would be unavoidable. Accordingly, projects must be selected where positive impacts significantly outweigh the negative ones.

There is no question that the dam and the reservoir system have changed the way of living of the local people, employment opportunities and working conditions of the communities. Expanded economic activities have encouraged migration from the rural to the urban areas. The semi-urban and urban areas of the region are now facing an incoming population flux, with the attendant need for more and more housing, water, education, health services, and employment opportunities and efficient and reliable transportation systems.

In order to objectively determine the extent and magnitude of the actual social, economic and environmental impacts of the Dam and the reservoir on the region some eight years after the construction was completed, the GAP Administration and UNDP-Turkey decided to field a mission in October 1997 to carry out a rapid appraisal of the social, economic and environmental impacts due to the construction of the Atatürk Dam. The duration of the mission was one month.

During the studies carried out for the current GAP-UNDP mission, it was evident that the magnitude and extent of the social and economic impacts generated by the Atatürk Dam and its reservoir have been overwhelmingly positive not only for the region but also for the country as a whole. The benefits that are now accruing to the country by the increased electricity generation alone are very substantial. Equally, for the population living in the project area, and especially for the majority of people living near the reservoir, their lifestyles have improved very significantly.

The one-month rapid assessment mission included extensive field work and discussions, both in Ankara and the project area, with the staff members from the GAP and from other different planning and implementing institutions. Extensive and intensive discussions were carried out with the staff members from the GAP, as well as other planning and implementing institutions, especially the General Directorate of State Hydraulic Works (DSİ), State Planning Organisation, General Directorate of Rural Affairs, and national and international institutions and people within and outside the goverment, including those directly affected by the dam. These project-affected people were selected at random.

DSİ is the institution responsible for developing and managing water resources projects in Turkey. It is also the executing agency for land expropriation for water development projects. For resettlement purposes, a valuation commision establishes the compensations that have to be paid to the owners of the land affected by the construction of the projects. DSİ is responsible for transferring the necessary funds to the Special Resettlement Fund, which then becomes the responsibility of the General Directorate of Rural Services, and the Ministry of

Agriculture. DSİ and the Ministry of Agriculture have signed the protocol governing the water products-related activities in reservoirs of the DSİ. Activities related to conservation and aquatic products existing in the reservoirs are carried out both by the Ministry of Agriculture and the Ministry of Finance.

After an initial set of discussions, and considering the serious time constraint, it was decided to focus on issues like employment creation during the construction of the Dam and the associated water projects, new economic activities due to the construction of the Atatürk Dam and the reservoir; farms using pumped irrigation directly from the reservoir, and how their agricultural yields, and thus incomes, may have changed; resettlement problems due to inundation caused by the reservoir; impacts on health and education, and on other facilities available; and overall changes in the quality of life of the population living in the project area.

The construction of the Dam was completed in 1990, and thus it was very difficult to find consistent and reliable data on employment generated during the construction of the Dam. Considerable efforts were needed to stream line the data available.

EMPLOYMENT GENERATION

1. Construction of Atatürk Dam, Hydropower Plant and Deviation Tunnels.

Employment opportunities in the GAP region have been historically limited. With the beginning of the construction of the Atatürk Dam and the associated hydraulic infrastructures, the area became a magnet for people seeking employment, from both within and outside the region. The private sector companies who carried out all the construction suddenly opened a new vista for employment of skilled and non-skilled personnel.

The contractor for the construction of the Atatürk Dam was ATA İnşaat Sanayi ve Ticaret A.Ş. The contract value of the Dam was 102.842.062.500 TL. This amount increased to 171.085.000.000 TL. The contract was signed on October 28,1983, and the construction of the Dam started immediately thereafter, on November 4,1983. Although the duration of the work was initially estimated at 108 months, the construction period had to be extended until December 1997, a period of some 169 months. The payment was 214.293.000.000.000 TL at 1997 prices, including VAT equivalent to ($ 1.916.437.700.000 at Jaunary 1997 exchange rate of $ 1.00 = 111.818.40 TL).

The diversion of water through the tunnels started in June 1986. The filling of the reservoir began in June 1986 and was completed in August 1990. The normal operational level of the reservoir is 526.0 m.

On the basis of information collected by the Mission from the ATA Construction Company, the construction of the Dam started in November 1983 with only 89 workers (Figure 1). The total number of workers employed during the construction of the dam was 16.431, of which 466 were technical staff, and the rest were skilled and unskilled workers (1000 of them were sub-contracted). Between November 1983 and May 1996, there was an average of 3.100 men/month.

The technical and skilled staff came to the region from the other parts of Turkey, since local people neither had the knowledge nor the skill to

construct such a large and complex structure. Most of the skilled workers who migrated to the dam site had gained their knowledge and experience during the construction of other similar structures like the Keban, Karakaya and Altıntaş Dams. Local people represented 95 % of all the workers employed, but all of them were initially recruited as unskilled employees. ATA Construction Co., trained many unskilled personnel, who later worked as drivers, machinery operators (light, medium and heavy), carpenters, turners, metal workers, etc. Following the completion of the training period, the unskilled workers gradually became skilled.

As can be seen from Figure 1, the number of people working on the construction of the Dam steadily increased with time. As noted earlier, the number of employees in November 1983, when the construction started was 89, but a year later, by October 1984, the number had increased to more than 1.000 workers. At the peak of construction, which was reached in October 1988, the number of workers was 7.688. The number started to decline steadily thereafter, and had decreased by half in about two years. By May 1996, the number had reduced to only 281 workers.

The contractor for the construction of the diversion tunnels of the Atatürk Dam was Doğus İnşaat ve Ticaret A.Ş. The construction started in October 1981, when the estimated cost was 9.500.000.000 TL. The original contract value was 5.671.849.025 TL. The final palment was 10.386.000.000.000 TL ($ 92.882.700 at January 1997 exchange rate of $ 1.00 = 111.818.40 TL.)

Akpınar Construction Co. was one of the sub-contractors for the construction of the diversion tunnels. According to its records, 66 skilled and unskilled workers were employment directly by the company in January 1985; peak employment of 186 was reached in August 1991, and then it declined to 70 by September 1997. Based on interviews carried out with the Akpınar Construction Co., the payments were based on minimum wages. Unfortunately, the information available at present form this company does not make any distinction between the salaries paid to skilled and unskilled workers; there is just one gross average wage per person per month for the entire staff. Furthermore, the records indicate that employees of the Akpınar Construction Co. were earning only about one-third that of the ATA Construction Co. However, since detailed

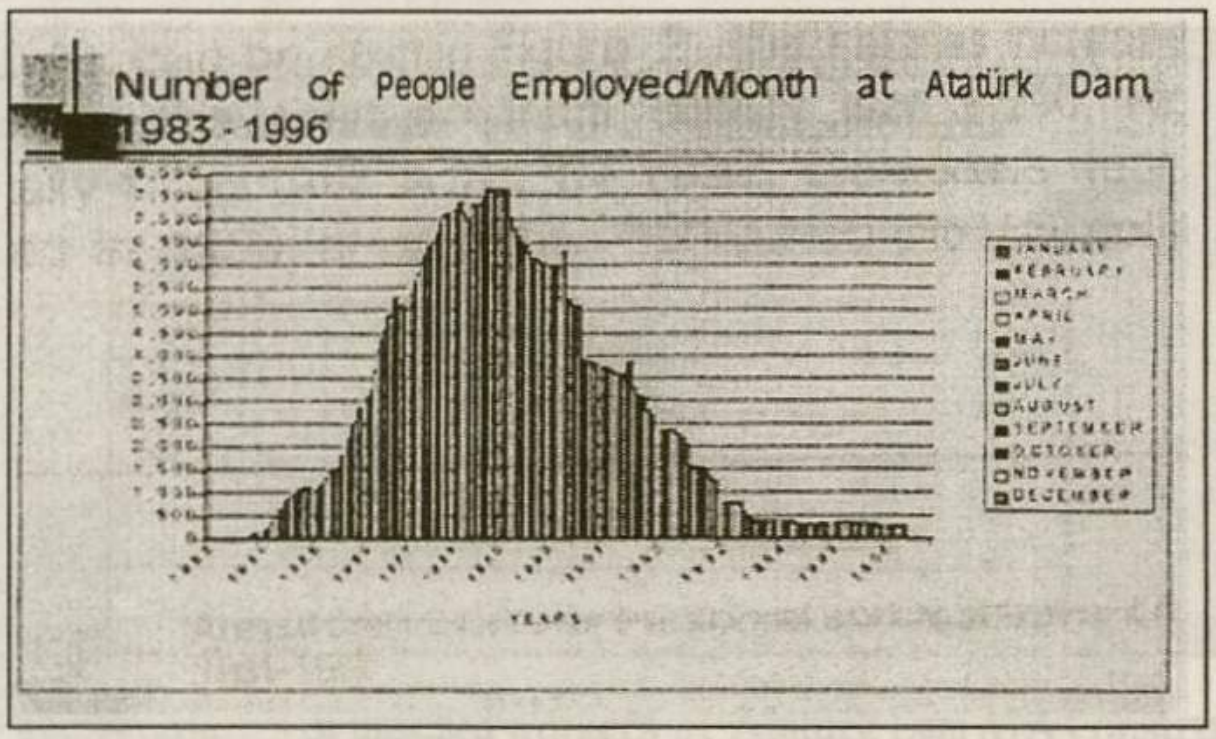


Figure 1. Number of people employed/month at Atatürk Dam, 1983-1998

employment records are no longer available, it was not possible to make any comparison between the salaries paid by the two companies to their skilled and unskilled workers.

The actual salaries of the workers of the Akpınar Construction Co., for technical staff as well as skilled and unskilled workers, varied tremendously over the months, and also over the years. As can be seen in Figure 2, the salaries increased steadily between 1985 and 1992, when the average annual salary was $ 1290. However, the wages decreased dramatically from 1993. In fact, by 1997, the workers were receiving less than what they had earned in 1990, at least whan converted into U.S. dollars at the prevailing exchange rates.

Figure 3 shows the gross salaries paid by ATA Construction Company to unskilled workers. The salaries have been calculated per month, based on 10.5 working hours per day and 30 working days per month. Minimum wages are also shown in this figure. Considering the high inflation rate of the country, the monthly salaries of the unskilled workers increased very little between 1984 and 1987, from $ 113.79 to $ 138.52 in the U.S. dollar terms, However, between 1988 and 1989, there was an increase of almost 170 % (from $ 163.79 to $ 274.69) This increase in the salary was somewhat similar to what was awarded to all the workers in Turkey. However, in the case of the workers of ATA Construction Co., it also resulted from the fact that the coffer dam was completed in 1989. The workers realised that most of the work for the project was completed, and from then on the number of people needed would start to decline radically. In view of the fact that most of the people would lose their jobs, the workers demanded an extra increase in their salaries. Contrary to the expectations, the salaries declined by 10 % in 1998, compared to the preceding year. From 1992 to 1994, the salaries increased again, but during 1995 and 1996, the compensations were similar to what were paid in 1989 in dollar terms.

It should be noted that nearly 100 % of the unskilled workers employed by the different companies during the construction of the Dam and the associated hydraulic structures were recruited from the people living in the GAP Region. The estimated number of people hired during the construction of the Atatürk Dam was

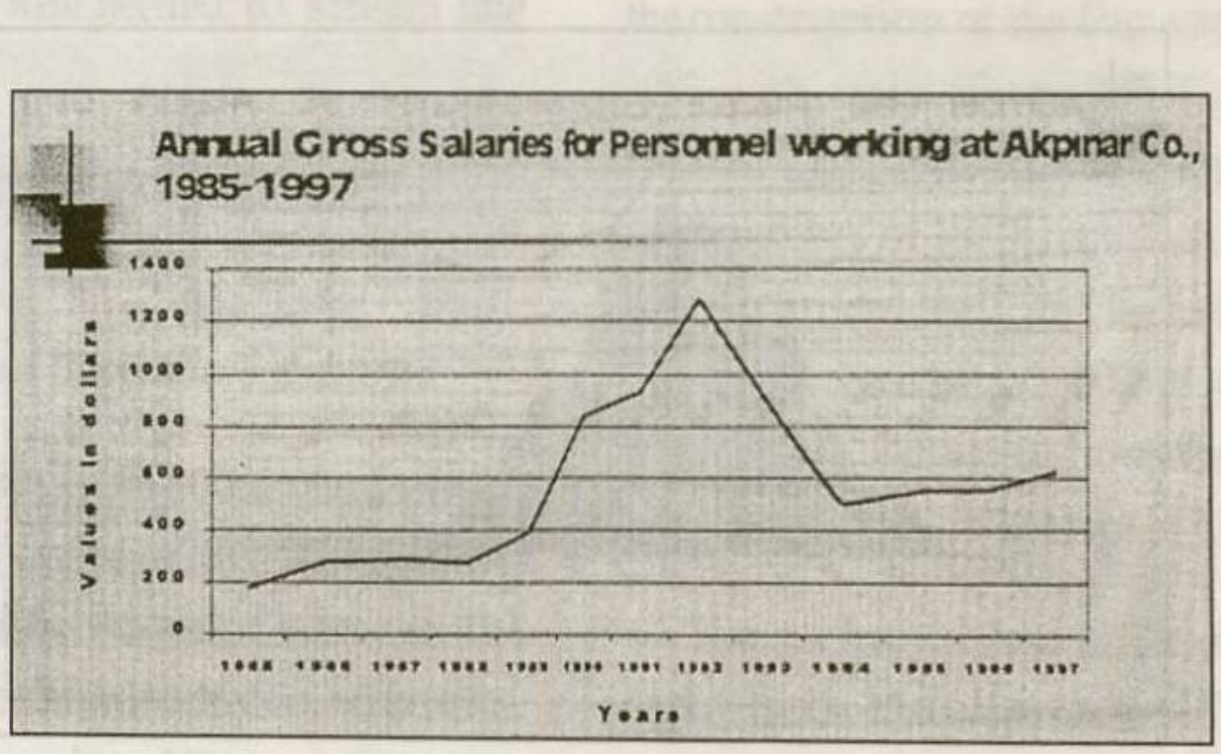


Figure 2. Annual Gross salaries for personnel working at Akpınar Construction Company

about 16.400. If this number is multiplied by a factor of 7 (average number of persons per family in southeast Turkey), some 114.800 people living in the Region were sustained by the income generated due to the employment created during the construction of the Atatürk Dam.

The benefits that accrued to the local people (100 % men) who worked during the construction of the Atatürk Dam, at least in the case of ATA Construction Co., went far beyond the higher salaries paid to them, as compared to by the government.

1. Capacity Building. As noted earlier, thousands of local unskilled workers received training from the company in different activities, thus gaining knowledge, experience and skills in different areas. This training gave many workers who were unskilled and mostly unemployed earlier marketable skills, and thus an opportunity to get both permanent and seasonal jobs in various construction companies after the work on the Atatürk Dam was completed.

The Manager of the ATA Construction Co. estimated during an interview with the Mission that approximately 25 % of the skilled people working in the Atatürk Dam were hired later for other construction projects.

ATA Construction Co. noted out of the hundreds of students that were trained at the Şanlıurfa Vocational School of Industry, many were hired by the company after their graduation.

2. Furthermore, since the construction of the Dam continued over several years, many employees were entitled to retirement pensions.

3. The workers received additional social benefits as well during the time they worked for ATA Construction Co., including social insurance for both the employees and their families, as well as health services.

4. ATA Construction Co. employed 4 doctors, and 5 nurses, and had 4 ambulances to provide health services to the workers and their families, as well as to the local people. These were important social and health benefits which were basically unavailable to the local people before the construction began. Clearly these developments had benefical impacts on the lifestyles of the local population.

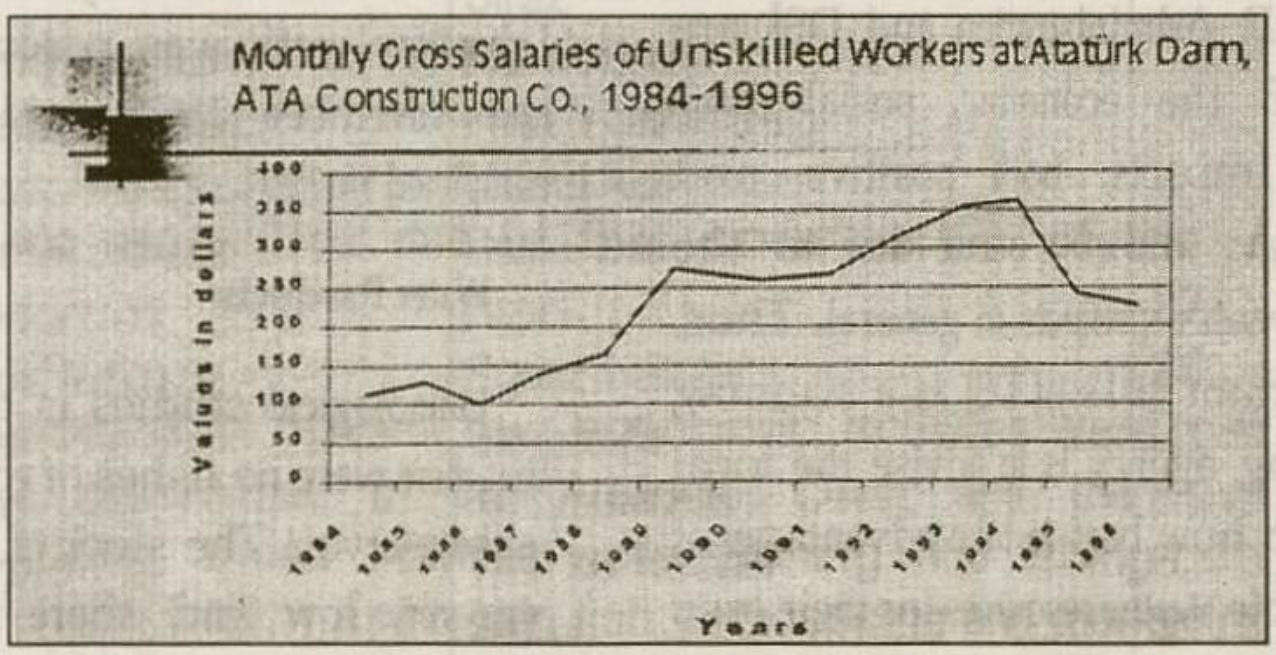


Figure 3. Monthly gross salaries of unskilled workers at Atatürk Dam ATA Construction Company, 1984-1998

2. New economic activities due to the construction of the Atatürk Dam and Reservoir.

It was natural that several new economic activities were generated during the construction and operation of the Atatürk Dam and the associated hydraulic infrastructures. Among these activities were fishing and fishing-related industry (boat building, fish-net construction and repair, fish processing and marketing, etc.); agricultural production through pumped irrigation directly from the reservoir; transportation through ferry boats in the reservoir, tourism (new hotels and restaurants); developments in the agro-industrial and industrial sectors, etc.

A) Fishing and fishing-related industries.

The south-east region of Turkey is arid. Accordingly, most of the agriculture practised is still rain-fed, and fishing-related activities were basically unknown by most people before the construction of the Dam and the Reservoir. The Atatürk Dam Lake is the biggest reservoir in Turkey, and is one of the biggest man-made lakes of the world. With the construction of the Atatürk Dam, some 81.700 ha of land were inundated.

Both the GAP Administration and DSİ are fully aware of the economic, social and environmental impacts, both positive and negative that may directly occur due to the construction of water projects in general. Thus, one of the important tasks of DSİ as a planning and implementing agency is to advise the local populations as to how best to take advantage of the newly available water resources for their own benefits as well as for the benefits of the concerned communities.

These include income-generating activities, use of new varieties of food that were not locally available earlier, improvements in water supply and sanitation facilities, crop diversification ond increase in agricultural yields, promotion of fishery, etc. DSİ is also the institution that is repsonsible for carrying out activities related to water conservation and maximising the economic benefits from the water projects.

The assessment of the impacts of the reservoir included its characterisation, limnological studies, fish production, recreational activities, etc. In the case of the Atatürk Dam, the Department of Operations and Maintenance, Water Products Branch of DSİ, prepared an Assessment of Water Products and Fishing Ground in the Atatürk Dam Lake. Among the main objectives were definition of the characteristics of the lake, study of the flora as well as any structure that would be covered by the water in the reservoir, limnological studies, estimation of the fish production in the revervoir, including stock assessment and feeding requirements, establishment of a Water Products Station, and provision of necessary support to establish a cooperative for fishermen. The field work on which the assessment was based was carried out between May 1992 and March 1993. Laboratory work was conducted between July and November 1993, and the report was completed in 1994.

Water Products

Limnological studies in the Dam concluded that there were no fishes of economic importance in the reservoir. The stock of the existing species was very low and there were considerable problems in terms of hatching. Accordingly, it was decided to introduce large fish populations

(especially carp) in the reservoir, using 5-6 cm fingerlings from the Elazıg-Keban Water Products Centre. In 1991, 200.000 carp fingerlings were released into the lake. The number of fingerlings released increased subsequently to 600.000 in 1992, and then to 2.000.000 each year in 1993 and 1994.

On the basis of data currently available, it appears that the density of fish in the Atatürk Reservoir is less than what have been observed in the Karakaya and the Keban reservoirs. This is to be expected and is primarily due to the fact that the Atatürk reservoir is new and thus the amount of nutrients available for fish production is low. On the basis of investigations carried out by DSİ, the fish stock in the Atatürk Reservoir was about 850 tons/year when the assessment referred to earlier was carried out. This stock comprised of mainly varieties like Bıyıklı, Bızır, in, sis, cultured carp, fresh water scud, and bass (Table 1).

According to the DSİ reports, there are many bays in Adıyaman at present in the Atatürk Reservoir. The report noted that it should be possible to establish successfully cage fishing in these bays. In fact, cage fishing is considered to be an important potential economic activity for people living near the Reservoir. However, this may have some water quality implications which need to be considered carefully.

Fishing activities

The data included in the Assessment of the Stock of Water Products and Fishing Grounds in Atatürk dam Lake is based on discussions the DSİ staff carried out with the fishermen living in the project area well as on a questionnaire survey that was conducted in 1993 in the villages surrounding the Lake. According to this report, there were about 900 fishermen in the districts around the Reservoir, who had 153 fishing boats.

Table 1. Existing Fish Species in the Atatürk Dam

FISH SPECIES	TURKISH NAME	PERCENTAGE
Capoeta sp.	Sıraz	
Chondrostoma regium	Kababurun	
Mastacembelus simack	Fırat Yılanbalığı	
Chalcalburnus mossulensis	Musul kolyozu	
Cyprinion tanuiradius	Bıyıklı balık	
Barbus raganorum	Bızır	27
Carasobarbus luteus	Egrez balığı	26
Vimba vimba	Sis balığı	21
Aspius vorax	Kültür sazanı	8
Cypinius carpio	Tatlı su kefali	8
Tor grypus	Sabut	5
Silirus triostegus	Mezopotamya yayını	3
Alburnus alburnus	In balığı	2

The average fish catch was 2390 kg/day in both Adıyaman and Şanlıurfa (Table 2).

It is not clear from the report whether the people referred to were already fishermen before the Dam was constructed, or who decided to become fishermen because they realised the economic potential of fishing activities. Nor is it possible to determine at present if this fish catch was for a specific year, or that it was an average over several years. Information is also not available as to whether fish was sold, or consumed, and if sold, how much was sold, at which locations, and what were the market prices. Accordingly, on the basis of information available, it is not possible at this stage to estimate the economic potential of fishing-related activities for the local population living near to the Lake in any definitive manner.

A cooperative for the fisherman has already been established to facilitate fishing activities. The General Directorate of Organisation and Support of the Ministry of Agriculture is responsible for assisting the fishermen in establishing the cooperatives, and provide further assistance to its members in terms of its efficient running as and when necessary.

When the Atatürk Dam was constructed, 146 villages (43, 198 ha of land) were expropriated : 84 in Adıyaman, 49 in Şanlıurfa, and 13 in Diyarbakır. Since the reservoir affected 3 different provinces, and 10 administrative districts, it was necessary to divide the reservoir into several fishing grounds so that the cooperatives could be properly established. The fishing grounds so that the cooperatives could be properly established. The fishing grounds were identified by DSİ, General Directorates of Agricultural Production and Development, Conservation and Control, and Organisation and Support of the Ministry of Agriculture, on a combined basis. The fishing grounds were established based on a number of factors, which included their areas in hectares, geographical boundaries, state of expropriation, and studies carried out by DSİ which included fish stocks and ongoing production activities in various locations. The established fishing cooperatives are likely to require some support in the near - to medium - terms if they are to be viable commerical operations.

Table 2. Fishing Activities in Atatürk Reservoir

PROVINCE-DISTRICT	NO. OF FISHERMEN	NO. OF BOATS	AVERAGE FISH YIELD (KG/DAY)
Adıyaman, Kahta	165	23	500
Adıyaman, Gerger	70	13	320
Adıyaman, Centre	333	50	1100
Adıyaman, Samsat	45	6	90
Şanlıurfa, Hilvan	45	14	100
Şanlıurfa	244	47	280
Total	902	153	2390

When the fishing grounds were first established, there were nine of them :

1. Adıyaman, with four fishing grounds (51.200 ha) : Central (15.400 ha), Samsat (16.800 ha), Kahta (15.200 ha) and Gerger (3.800 ha).

2. Şanlıurfa, with three fishing grounds (29.400 ha) : Bozova (15.000 ha), Hilvan (7.500 ha) and Siverek (6.900 ha).

3. Diyarbakır, with two fishing grounds (1.100 ha) : Cermik (800 ha) and Cungus (300 ha). In was agreed by the different parts that the Ministry of Agriulture should train its own staff working in the Dam, as well as the fishermen organised in Cooperatives. The rent that the Cooperatives would pay would be based on the dominance of rural settlements, proverty, employment opportunities, lack of information on fishing activities, local consumption of fish, etc.

In the information gathered by GAP in the project area in 1996, 21 fishing grounds into which the nine original ones were divided, are already considered. GAP reports 290 fishermen in Adıyaman (compared to 613 fishermen mentioned by DSİ in the report written in 1994), and 172 in Şanlıurfa (compared to 285 reported by DSİ).

Both DSİ reports (with information collected through an interview with the Department of Fisheries), and GAP, mention that the cooperatives for fishermen are still not fully organised in the project area. The only cooperative active in 1994, was the one in Bozova District. The rest of the districts were either in the process of being established, in the bidding process, or there were no activities at all. As of October 1997, all fishermen who do not belong to any cooperative, are carrying out illegal activities, according to the legislation.

According to the Provincial Agricultural Directorate, no cooperatives are being organised in Diyarbakır, and there are no data on the fish produced or on the number of fishermen.

In the assessment carried out by DSİ in 1992-1993, it is mentioned that no marketing activity resulted from fishing activities. However, by 1996, according to GAP data, water products were already being packed in Adıyaman and Şanlıurfa, and sold to fish traders to be consumed in Gaziantep, Adana, İzmir and Manisa. No marketing prices are mentioned.

According to GAP, DSİ, and the local population, no fishing boat construction activities are carried out in the local districts

The Directorate of Agriculture in Şanlıurfa provided us with information on the quantity and market value of freshwater fish, caught in Şanlıurfa and in Adıyaman, from 1993 to 1997. There are no data from 1st April to 1st July of any year, because no fishing is legally permitted in the Atatürk Lake during these months. After we had been provided with monthly lists of freshwater fish yield from Adıyaman and Şanlıurfa, 1993-1997 (except April-June), we were asked not to consider any information given to us from January-March, 1993, 1994, and 1995, because "it did not exist." Thus, this may mean that either there are fishing activities even though they are not allowed, or there are not reliable records in the Directorate of Agriculture in Şanlıurfa.

Adıyaman. The Directorate of Agriculture in Adıyaman provided us with information on the quantity and market value of freshwater fish, January-March 1993. However, based on the fact that the Directorate of Agriculture advised us not to consider information on these months, we can not include it in the analysis. İt was the same case or 1994, in which it was necessary to ignore also data from January-March.

In 1994, more than 370.000 kg of fish were sold, with a market value in dollars of $ 38.742. In 1995, the revenues decreased dramatically. Even though almost 105.000 kg of fish were sold just durng three months of the year, just $ 10.512 were paid, which represents a decrease of more than 70% from one year to the other. Two years later, in 1996, about 370.000 kg of fish were sold again, and the prices went up just 13 % compared to the prices in 1994. Finally, in 1997, the amount of fish sold until September seems to be very low compared to the previous year : 13.300 kg of fish sold and a revenue of just $ 16.000 (Figure 4).

Şanlıurfa. Market values varied significantly between 1993 and 1994. While in 1993, 24.000 kg of fish sold ha a market price of about $ 35.000; in 1994, 20% of this amount (less than 5.000 kg) were sold for 65 % more. In 1995, in 6 months of activity, 30.000 kg of fish were sold for almost $90.000. However, 9 months of fishing activities in 1996, resulted in 41% more of fish sold, and the market value increased just 15% more. In January-March 1997, 5.000 kg of fish had been sold, and already the value in the market had been of more than $ 30.000 (Figure 5).

Data on January-March 1995 were not considered.

As seen in these tables and graphs, fishing activities do not seem to be an increasingly good business. There are very big fluctuations from one year to other in terms of fish production and market value. The general consensus is that fishing is a relatively new activity in the area for most of the population, and knowledge is very little on the appropriate management. The fact is that if the governmental institutions want to make fishing an income-generating activitiy for the people, resulting this in the benefit of the region, it would be necessary to make a lot of effort on

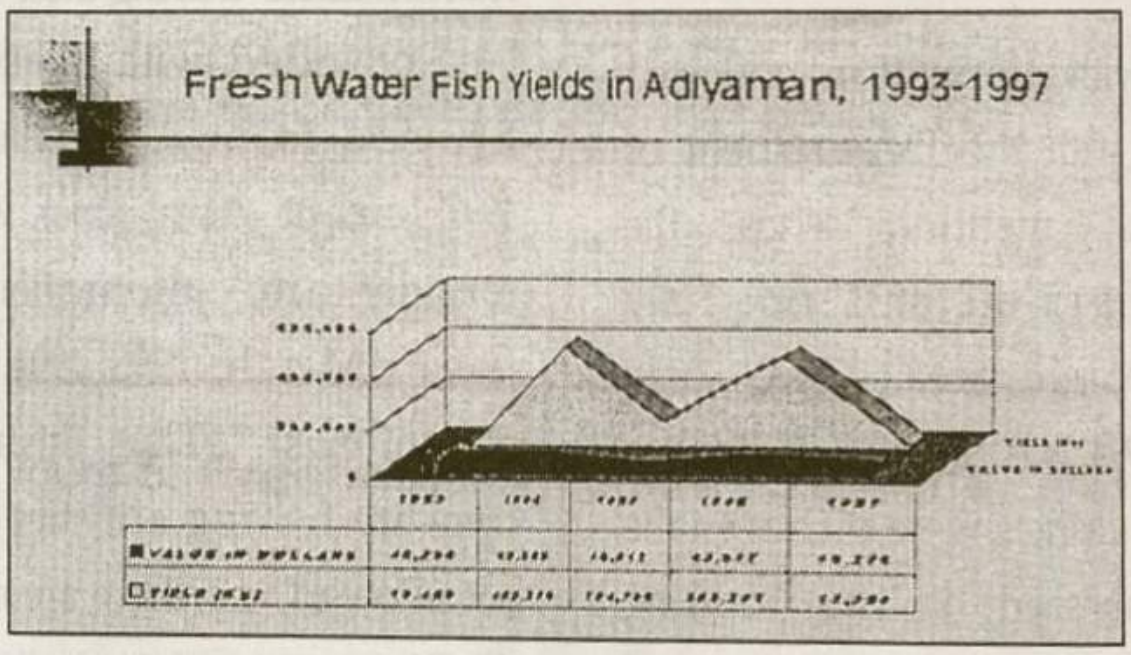


Figure 4. Freshwater fish yield in Adiyaman, 1993-1997

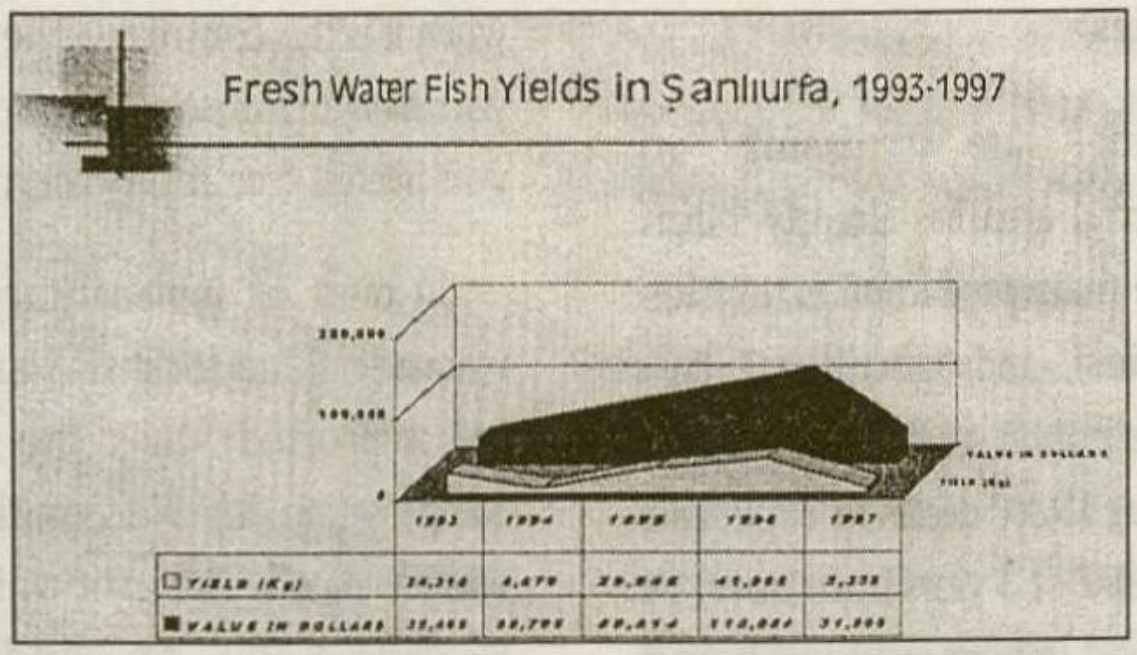


Figure 5. Freshwater fish yield in Şanlıurfa, 1993-1997

developing training and education activities in the area. Fishing could be definitely an alternative for the people, but they should be supported in terms of technical knowledge and equipment.

Agricultural production through pumped irrigation directly from the reservoir.

Based on information from DSİ and from personal interviews with people living in the district of Şanlıurfa, there are very few people that irrigate pumping directly from the reservoir or the canals. These people cultivate in very small scale and for self consumption mainly.

Ferry boat, tourism (new hotels, restaurants, etc.).

Neither tourist activities have increased due to the Atatürk Lake, nor infrastructure as hotels or restaurants have been developed in the area as a direct result of tourists visiting the area. GAP Administration has organised a water festival already for two years, in which the main attractions are water sports in the reservoir. However, once the festival is over, the tourists leave the place.

Ferry boats represent a small-scale means of transportation.

Irrigated Agriculture.

Before the irrigation started, the main cultures in the region were wheat and barley. In 1995, thanks to the irrigation, about 30.000 irrigated hectares were cultivated, mainly with cotton. It was grown about 90.000 tons of cotton was cultivated, with a revenue of 5.400.000 millions of Turkish Liras, at 1996 prices (about dollars). As a consequence, Şanlıurfa has been established an Industrial Area.

The production of secondary crops has increased, from about 500 decars of maize in 1995, to about 4,000 decars in 1997. The private sector buys this production to feed the livestock. Underground water is used for green houses.

However, DSİ allows them informally to use the water in the canals. No big-scale agricultural activities are carried out in this way. The main agriculture is by irrigation in the Harran Plan.

Industrial Activities

Industrial activities are increasing in Şanlıurfa. One industrial area has already been established, where the main production is textiles (2 or 3 cloth factories), and agricultural by-products (for example, cotton seed oil). A second industrial area of about 11,000 decars in expected to be developed within 2 or 3 years from now. A free zone for exports and imports would be being developed in this second zone.

Even though the industrial activities would certainly generate employment and development in the area, one of the main concerns is water quantity for the industrial processes, and quality of wastewater discharged. The industrial area is located 15 km from Şanlıurfa, but nearby from other villages. So far, the factories were discharging wastewater without any treatment, with the risk of contaminating soil and surface and groundwater. Discussions were underway for the possible construction of a wastewater treatment plant.

The administrator of the "Investment Development Centre" mentioned that skilled labour is very much needed if industrial development is expected.

RESETTLEMENT POLICIES

In Turkey, exportation and resettlement activities are regulated by law. In the case of water and soil development project, the executing agencies are DSİ for expropriation, and the General Directorate of Rural Services for resettlement. When the value of the expropriated properties exceeds the cost of resettlement, the difference is paid back to the owners. However, when it is the contrary, the owners are given a 5 year moratorium on the debt, followed by a 20-year interest free repayment period.

In cases of involuntary resettlement, those who are entitled for rural and urban resettlement are supported by the government, their compensation depends on the size of the land that was inundated. The amount of this compensation is decided by an independent valuation commission, and DSİ transfers the amount needed to the Special Resettlement Fund run by the General Directorate of Rural Services.

People have the opportunity to decide whether they want to be resettled in a rural or in an urban location. In the case of rural areas, the government provides rural resettlement for the population. Each household is entitled to housing, farm land, credit for animal husbandry, farm land, credit, etc. According to the law, the farmers who are resettled receive from the government training on new agricultural production methods. All rural resettlements should be provided with a health centre, a doctor, a nurse, and a midwife.

In urban resettlements, the people receive a house and needed commercial facilities, a well as credits for commercial activities.

In the State Government Organization, we were informed that in general, most of the people that ask for financial help to the government to be resettled, are landless or poor. In many cases, land owners with big properties choose the money the government offers, and establish small industries in the cities. In the cases when families are expropriated part of their land, it is common to find that part of the family moves to the city, and

part of it stays in their land. The experience has shown that the second generation of people who moved to the cities and invested their money successfully, become entrepreneurs.

In general, the problem for relocation of populations is the lack of land, not of money. It is very well known the magnitude of the problem which results from people who take the money which corresponds to their land, and resettle by themselves. GAP Region is not the exception. People from rural areas, non-skilled, that have received their money and have not managed it properly, are at present with no house, no job, and no money. This represents a main problem if we consider that more dams will be built in the region, and that more people can be in this situation, contributing to the slow development of the area, from the economic and social viewpoints.

For this rapid assessment, the information on resettlement came from different sources. The XVI Regional Directorate of DSİ provided information to GAP staff on the state of urban and rural resettlement work as of 1993, and to the state of expropriation as of 1996. According to GAP staff, DSİ did not have data on resettlement after 1993 because request on resettlement were abandoned. The Directorate of Rural Affairs and DSİ provided us with information on the number of displaced population in the case of Atatürk, number of families already resettled, and number of families waiting to be resettled.

As of 15 September 1997, the expropriation of real properties up to the code of 542 metres has been completed. The total cost has been 13,057 trillion TL at 1995 unit prices. In the case of those properties that are within the codes of 535-542 metres, it is still necessary to pay 715 million TL (at 1995 prices).

As of the end of 1995, and by decision of the courts, 2,979 trillion TL (at 1995 prices) have been paid to settle disputes with resettled population.

Regarding resettled population, the Directorate of Rural Affairs estimates that 1129 families have been displaced from 1988 to 1997. Out of this amount, 44% would be resettled in rural areas, and 56% in urban areas. So far, just 30% have been resettled (344 families), and more than 69% still have to be resettled (369 families in rural areas, and 416 families in urban areas). An average of 10 persons per family is calculated.

However, the records of DSİ do not include the total number of displaced families. The records mention that the number of families that were unvoluntarily resettled from 1988 to 1997 is 344 (133 in rural areas, and 211 in urban areas), and that the number of families that are waiting to be resettled is rural areas is 369. The families to be resettled in urban areas are not included.

In order to have a clearer idea of the perspective of the people living in Adıyaman and Şanlıurfa, the mission carried out extensive field trips and discussions.

The negative and positive impacts of Atatürk Dam are viewed with very different perspectives in Adıyaman and in Şanlıurfa. In general, the people in Adıyaman have the feeling that the government has not been fair with them. Several towns of Adıyaman were affected by the construction of the dam, but the people do not have access to water for irrigation purposes. This is because their lands were expropriated and they do not benefit from the water of the reservoir. On the contrary, in general, the people living in Şanlıurfa seem to be very positive towards the dam and the reservoir.

Some of the negative effects of resettlement were the fragmentation of the families, individualisation, and impoverishment and lack of education for children when the money is not managed properly. Some of the positive ones are the drop in fertility rates and the higher demand of education when the money is managed properly.

Following is the analysis of the interviews with people from different settlements.

New Samsat

When Samsat was submerged due to the construction of the dam, most of the people of the town, as well as people living nearby, were relocated in New Samsat. The new town was established about 8 km from the old location. The population recognized many differences between the old and the new towns, and between their old and new life styles. The men interviewed agreed that Old Samsat was a non-planned city; their houses were small, and made out of mud, and there were no roads, water or energy. Their main activity was agriculture, and they produced mainly cereals and cotton. In New Samsat on the contrary, there is better infrastructure, roads, energy and water, but since the people do not have water they have to grow tobacco which results in a lower income. However, their houses are built with cement, people have T.V., refrigerators, telephones, washing machines, and water in the houses.

Old Samsat did not have medical personnel or facilities. Now there are 3 doctors in the town permanently, and there is also a small hospital. There are also more schools (2) primary, 1 high-school) compared to before (one primary school). There is also other primary school under construction.

When the population moved to New Samsat, DSİ gave them fish larvae to grow. However, there are few fishermen, and although some fish is produce and consume some fish, it is not considered a profitable activity.

In Old Samsat, the rate of migration was low, maybe because the people had good paid jobs. At present, however, people are migrating to other cities get better jobs. It was mentioned that are people in Şanlıurfa picking cotton.

Men mentioned that they sell tobacco to the government, and that they get advice from the Department of Agriculture on agricultural extension services regarding the cultures of tobacco.

In general, people agreed that their quality of life is better now that before, because the conditions in which they live now are better. However, the people insisted that from the economic viewpoint, the conditions were better before.

Akpınar

Akpınar is an old village where many people worked in the construction of Atatürk Dam as non-skilled workers. With their incomes, people constructed new houses of better material (cement, brick) compared to the previous one (mud); refrigerators and T.V. Some people also bought tractors, or established small shops. Many farmers got jobs in the dam as a secondary job. There are also fishermen in the town, but they do not sell the fish, it is just for their own consumption.

The economic and social conditions of the people improved because before the reservoir they grew tobacco, and now that they have water, they grow cotton, as well as other crops. In general, people think that the construction of the dam was benefical, although there are unemployed people that are looking for jobs. One of the benefits of having a higher income has been that the children (including girls according to the interviewed people) have been sent to the schools, even though most of the population of the town went just to primary school. Most of this people that worked in the construction of the dam were non-skilled. However, they were trained by the companies as drivers, motor mechanics, etc., and some them could get jobs in the construction of other dams.

Even though the town has access to water for agricultural activities, they have no drinking water. Their only source of drinking water comes to continuously running water pipe.

Kızılcapınar Vilage

This it is a village with about 15 families from Caili village still waiting to be resettled in a rural area.

OTHER SOCIAL, ECONOMIC AND ENVIRONMENTAL IMPACTS.

Urbanization. In the specific case of Şanlıurfa, one of the first impacts was the increase in urbanization. According to the mayor of Şanlıurfa, the first impact of Atatürk Dam was migration to the city: the population tripled in 7 years, which resulted in a big pressure on the city and the local population.

About 80% of the outside people came to Şanlıurfa bringing their own traditions and social structures to the city. This meant, and still means, conflicts between migrants and local people. The migration, mainly to Şanlıurfa, was because people were looking for job opportunities. However, many people could not get jobs and did not want to go back to their villages. At present, and according to several people, the informal employment (commerce activities) increased with time.

There were also problems because of the lack of housing and services for the increasing population in Şanlıurfa. The students in the schools increased very rapidly, and illegal settlements also developed in the city.

Roads. Şanlıurfa and Adıyaman were interconnected with roads before, but they were not good quality. The quality of the roads has now improved significantly. Dam side roads were constructed, a bridge in the Euphrates river, 20 km of roads for the tunnel, 100 km of roads for the villages (40% in better conditions than the rest within Şanlıurfa).

Because of the roads, the local population has better access to the markets in terms of commercialising their products.

Medical services have also become more accessible.

Electricity. After the construction of the Dam, the villages were electrified for the first time. Furthermore, all villages are now connected to a telephone network, thus, there is increasing communication.

In terms of education, more and more childeren (including girls) are now attending school. The roads now make it easier for them to attend school since now they do not have to walk long distances.

CONCLUSIONS

There is no question that the dam and the reservoir system have changed the way of living of the local people, employment opportunities and working conditions of the communities. Expanded economic activities have encouraged migration from the rural to the urban areas. The semi-urban and urban areas of the region are now facing an incoming population flow, with the attendant need for more and more housing, water, education, health services, and employment opportunities and efficient and reliable transportation systems.

Fortunately, the GAP Administration is not only aware of the essential necessity of a functional monitoring and evaluation system but it also is in the process of developing one. This could identify both successes and constraints of the development process within the region. Once this information is available, the GAP Administration can take appropriate and timely decisions to maximise the benefits and to minimise constraints.

WATER RESOURCES DEVELOPMENT PLANNING IN CALIFORNIA

Naser James Bateni
California Department of Water Resources
1020 Ninth Street
Sacramento, CA 95814

SUMMARY

Water supply development in California has shaped its economy. Without its abundance of water resources and the interconnected water supply infrastructure that exists today, California could not have become a leader in United States production of agricultural and industrial products. Since the late 1800s, water policy has shaped California's economy and quality of life.

During the 20th century, water policy in California evolved from an emphasis on developing storage and conveyance systems to managing water resources for sustained beneficial use. Over the years, water resources planners and managers learned many lessons from past practices, some of which compromised ecosystems or caused environmental damage. In the late 1960s and the 1970s, lawmakers and natural resource managers in California and the United States began enacting laws and developing programs to address air and water quality and ecosystem problems. Many had come to realize the limits of natural resource use and the impacts of our methods for using them.

Today, managing water resources to meet future demands is an intricate, complex challenge that focuses more on the planning process and systems analysis rather than building of infrastructures. A broad array of environmental requirements must be met, and innovative thinking and technology must be used if California is to continue sustainable use of its water resources. Water resources development planning now includes principles such as selection of environmentally least damaging practicable alternatives, least-cost planning, and integrated resources planning. This paper presents a history of water development in California with the intent of showing how various policies and water planning practices evolved. The paper concludes with an overview of a process that is the first of its kind in California, a joint effort of the State of California and the federal government. This collaborative effort, called CALFED, exemplifies how complex and integrated water resources planning and management has become.

ABSTRACT

Water supply development in California has shaped the state's economy. Without its abundance of water resources and the interconnected water supply infrastructure that exists today, California could not have become a leader in United States production of agricultural and industrial products. Since the late 1800s, water policy has shaped California's economy and quality of life.

During the 20th century, water policy in California evolved from an emphasis on developing storage and conveyance systems to managing water resources for sustained beneficial use. Over the years, water resources planners and managers learned many lessons from past practices, some of which compromised ecosystems or caused environmental damage. In the late 1960s and the 1970s, lawmakers and natural resource managers in California and the United States began enacting laws and developing programs to address air and water quality and ecosystem problems. Many had come to realize the limits of natural resource use and the impacts of our methods for using them.

Today, managing water resources to meet future demands is an intricate, complex challenge that focuses more on formulating consensus-based programs that address numerous and diverse objectives rather than on developing traditional water supply projects. A broad array of environmental requirements must be met, and innovative thinking and technology must be used if California is to continue sustainable use of its water resources. Water resources development planning now includes principles such as selection of environmentally least damaging practicable alternatives, least-cost planning, and integrated resources planning. This paper presents a history of water development in California to show how various policies and water planning practices evolved. The paper concludes with an overview of a process that is the first of its kind in California, a joint effort of the State of California and the federal government. This collaborative eforts, called CALFED, exemplifies how complex and integrated water resources planning and management have become.

INTRODUCTION

California is a state of great contrasts. With 34 million people, it is the most populous state in the United States, and it is the top-ranked state in dollar value of agricultural production (California Department of Water Resources, 1998). Even with its large population, there are still vast areas of open space and land set aside for public use and enjoyment. Population density ranges from over 16,000 people per square mile in the City and County of San Francisco to less than 2 people per square mile in Alpine County in the Sierra Nevada mountains. To put California's population into perspective, about one of every eight U.S. residents now lives in California. Over the next two decades, California's population is forecast to increase by more than 15 million people (DWR, 1998). Today, four of the nation's 15 largest cities (Los Angeles, San Diego, San Jose, and San Francisco) are located in the state. Figure 1 shows California's location in the U.S.

Figure 2 is a relief map of California. In roughly north to south order, major geomorphic features are: the Klamath Mountains, Modoc Plateau, Cascade Range, Central Valley, Sierra Nevada, Coast Range, Great Basin, Transverse Ranges, Mojave Desert, Peninsular Ranges and Colorado River Desert. The Central Valley, an alluvial basin which makes up about 38 percent of the state's land area, is bounded by the Coast Range on the west and the Sierra Nevada on the east (DWR, 1998). Within the Central Valley, the Sacramento River (the state's largest river) flows through the southern portion called the Sacramento Valley, and the San Joaquin River flows through the southern portion called the San Joaquin Valley. The two rivers converge to form

the Sacramento-San Joaquin River Delta estuary, the hub of Californa's surface water delivery system.

California is a state of diverse climates and landforms. Much of California enjoys a Mediterranean-like climate with cool, wet winters and warm, dry summers. Average annual precipitation is about 23 inches (58 cm) but ranges from more than 90 inches (229 cm) on the North Coast to about 2 inches (5 cm) in Death Valley in the southern desert (DWR, 1994). Most of California's water supply facilities have been planned and constructed in response to the extremes of droughts and floods. The average yearly statewide runoff of 71 million acre-feet (87.6 cubic kilometers) includes the all-time annual low of 15 maf (18.5 km3) in 1977 and the all-time high of 135 maf (166.5 km3) in 1983 (DWR, 1994). Sacramento River flows for these years were 5.1 maf (6.3 km3) and 37.6 maf (46.4 km3) respectively. Figure 3 illustrates variations in Sacramento River flow from 1906 to 1996.

Uneven distribution of water resources is part of the state's geography. Roughly 75 percent of the natural runoff occurs in the northern one-third of the state; about 75 percent of the water demand is in the southern two-thirds of the state. About 40 percent of California's surface water runoff originates in the North Coast Region (DWR, 1951). The largest urban water use is in the South Coast Region where roughly half of California's population resides. The largest agricultural water use is in the Central Valley where fertile soils, a long, dry growing season, and water availabilty have combined to make this area one of the most agriculturally productive areas in the world (DWR, 1998). This geographic disparity between supply and demand has led to the development of the state's intricate water storage and conveyance systems.

HISTORY OF WATER DEVELOPMENT IN CALIFORNIA

Water development in California started under the authority of Spain with the founding of the San Diego Mission in 1769 when water was diverted from the Diego River to irrigate fields surrounding the mission (Hundley, 1992). After 1850, irrigation expanded significantly as the amount of irrigated agricultural land increased dramatically. This increase was encouraged by the mining boom, which provided a nearby market for agricultural products. During the 1920s, large reservoirs were built in Northern California; in many cases, they were partially funded by hydroelectric power companies. Beginning in 1930, a number of critically dry years reduced snowmelt and streamflow and motivated another era of water storage development to provide more stable and reliable supplies (DWR, 1994).

In response to drought and floods, and the uneven geographic distrimbution of California's water resources, facilities have been constructed to store and convey water from one watershed to another. Figure 4 shows major water projects in California. The first long-distance, inter-regional water project in California was the Los Angeles Aqueduct, completed by the City of Los Angeles in 1913. The aqueduct stretches over 290 miles (470 km) from the Owens Valley east of the Sierra Nevada mountains; its original capacity was 330,000 af (0.4 km3) per year. A second section was added in 1970, which increased its potential annual deliveries to 480,000 af (0.6 km3) per year.

The East Bay Municipal Utility District completed the Mokelumne Aqueduct from Pardee Reservoir in 1929. With the addition of a third barrel in 1965, this aqueduct's capacity increased from 224,000 af (0.3 km3) to 364,000 af (0.4 km3) per year. Camanche Reservoir was added in 1963. In 1934, the City of San Francisco completed the Hetch Hetchy project, which diverts water from the Tuolumne River. The current capacity of the Hetch Hetchy Aqueduct is about 330,000 af (0.4 km3) per year.

In the 1930s, construction began on two major conveyance facilities diverting water from the Colorado River. The All-American Canal System has the capacity to divert over 3 maf (3.7 km3) annually for use in the Imperial and coachella valleys. The Colorado River Aqueduct has capacity to divert as much as 1.3 maf (1.6 km3) to Southern California.

The federal government began construction of the Central Valley Project, the largest water storage and delivery system in California, in the 1930s. The keystone of the CVP is the 4.6 maf (5.6 km3) Lake Shasta, the largest reservoir in California. The CVP delivers about 7 maf (8.6 km3) annualy for agricultural, urban, and wildlife refuge use. Most CVP water goes to agricultural water users in the Central Valley.

Planning for the multipurpose State Water Project began soon after World War II when it became evident that local and federal water development could not keep pace with the state's rapidly growing population. Construction of the project began in the 1960s. The major reservoir of the SWP is Lake Oroville, the second largest reservoir in California after Lake Shasta. State contracts with 29 long-term water contractors obligate the Department of Water Resources ultimately to deliver 4.2 maf (5.2 km3) of water per year from the SWP. Of this amount, about 2.5 maf (3.1 km3) is to serve Southern California and about 1.3 maf (1.6 km3) is to serve the San Joaquin Valley. The remaining 0.4 maf (0.5 km3) annual entitlement is to serve the San Francisco Bay, Central Coast, and Feather River areas.

Today, there are about 1,200 non-federal dams in California, and the reservoirs formed by these dams provide a gross storage capacity of rouhly 20 maf (25 km3). There are also 181 federal reservoirs in California, with a combined capacity of nearly 22 maf (27 km3). There are also 181 federal reservoirs in California, with a combined capacity of nearly 22 maf (27 km3). Taken together these 1,400 or so reservoirs can hold about 42 maf (52 km3) of water (DWR, 1994).

Of the state's 42 maf (51.8 km3) surface reservoir storage, over 65 percent is in the Sacramento and San Joaquin River basins. Most large reservoirs are multipurpose impoundments designed to provide water supply storage, hydroelectric power, flood control, recreation, water quality, and downstream fishery needs. Often, large reservoirs would not be economically feasible as single purpose projects. Multipurpose designs maximize the beneficial uses of large reservoir sites and provide regional water supply benefits.

ROLE OF WATER DEVELOPMENT IN CALIFORNIA'S ECONOMIC GROWTH

California's human end natural resources support a gross state product of over one trillion dollars (California Trade and Commerce Agency, 1998). Based on 1997 California (UCLA Anderson

Forecast, 1999) and national values (World Bank Atlas, 1999), a country producing as much value as California would be placed eighth among the nations in the world. California is the United States' leading agricultural export state and the nation's number one dairy state. It also produces 55 percent of the nation's fruits, nuts, and vegetables and accounts for almost 17 percent of the nation's exports (TCA, 1998). One of the most important natural resources making this level of agricultural and industrial production possible is water.

California urban and agricultural water use is currently about 35 million acre-feet (43 km3) annually. This use depends on both locally developed water (surface and ground water) and imported surface water-in some cases, imported over great distances by large water projects. About 28 maf (34 km3) annually, or about two-thirds of the state's total urban and agricultural use, is served by the major water projects-state, federal, and local-which deliver water from great distances. In the San Francisco Bay Region, over 70 percent of the water is imported. The South Coast Region imports nearly 70 percent of its supplies. Figure 5 shows regional imports and exports. Over three-quarters of the gross state product is generated in these two hydrologic regions, evidence of the crucial link between water availability and economic strength.

The basin of the Central Valley of California covers about 58,000 square miles (150,200 km2). About 23,000 square miles (59,600 km2) or 14.8 million acres (6 million hectares) is either in farms or ranches in the valley and surrounding foothills. With about 5.6 million acres (2.3 million hectares) under irrigation, the Central Valley has about 60 percent of the total irrigated farmland in the state. The Central Valley's rich soils and favorable climate support about 250 crop types, permitting an unusual degree of flexibility to respond to changing market conditions.

In the San Joaquin Valley, where over half of the $27 billion of statewide gross agricultural production value was generated in 1998, developed surface water projects serve about 80 percent of agricultural and urban water use. (Ground water serves the remaining 20 percent of use.) About 35 percent of surface supply is imported.

ENVIRONMENTAL CONSIDERATIONS IN WATER DEVELOPMENT

The Sacramento and San Joaquin Rivers are the most developed river systems in California, providing water for three-Quarters of the state's irrigated agriculture and over 20 million people. Extensive networks of dams, diversion facilities, and pumping plants on these rivers have affected their ecology and ecosystem. It is impossible to discuss water issues in California without discussing the Sacramento-San Joaquin River Delta estuary.

Near the confluence of the Sacramento and San Joaquin Rivers, the system of waterways and islands comprises a delta and a series of embayments leading to San Francisco Bay and the Pacific Ocean. Figure 6 shows the San Francisco Bay and Sacramento and San Joaquin River Delta estuary. This estuarine system has long been an important resource to California. The rivers flowing into and through the Delta play a multiple role in the estuary. In a simple sense, these rivers provide conduits for migratory fish,

such as salmon, to move to and from the ocean. Migratory fish move upstream for spawning. For other fish species, Delta waterways provide spawning and nursery habitat. River inflow contributes much of the dissolved nutrients needed to support estuarine food chains.

The major state and federal water export facilities are located in the southern part of the Delta. These facilities consist of large fish screens and pumping plants, together with numerous dams built on most of the major tributaries upstream. These facilities all play important roles in determining the abundance and distribution of fish, wildlife, and plants in the estuary. There are many unscreened agrucultural diversions in the Delta and on tributaries to the Delta that cause fish losses. Upstream dams change the flow regime and are barriers to fish migrating to spawning habitat. Diversions from the estuary reduce the flow through the estuary. In short, water development is one of the major factors adversely affecting fish and wildlife resources in this ecosystem.

INSTITUTIONAL FRAMEWORK FOR WATER DEVELOPMENT IN CALIFORNIA

Today, water resource management in California is at a critical point as evolving policies, financial realities, and physical limits of the state's water supply infrastructure collide. Three major interest groups-urban, agricultural, and environmental-must work their way throuh California's institutional framework toward solutions that should benefit all Californians and their environment.

Since the mid,1950s, attitudes toward and methods for managing the state's natural resources have gone through many vhanges. The population in the United States in general, and in California particularly, has become more environmentally sensitive. This sensitivity is reflected in statutes such as the National Environmental Policy Act, California Environmental Quality Act, the federal and state Endangered Species Acts, the Clean Water Act, and the federal and state Wild and Scenic Rivers Act.

In California, water use and supplies are controlled and managed under an intricate system of federal and state laws and agencies. Common law principles, constitutional provisions, state and federal statutes, court decisions, and contracts or agreements all govern how water is allocated, developed, or used. All of these components, along with the responsible state, federal, and local agencies, compose the institutional framework for allocating and managing water resources in California.

The keystone to California's water law and policy, Article X, Section 2 of the California Constitution, requires that all uses of the state's water be both reasonable and beneficial. It places a significant limitation on water rights by prohibiting the waste, unreasonable use, unreasonable method of use, or unreasonable method of diversion of water.

After a 1983 landmark court decision, much attention is now focused on the public trust doctrine, which provides that the state holds navigable water and their underlying lands in trust to protect pubhlic interests (DWR, 1994). Traditional public trust rights include navigation, commerce, and fishing. California law has expanded the traditional public trust uses to

include protection of fish and wildlife, recreation, scenic values, and environmental preservation. Consequently, in issuing or reconsidering any rights to appropriate and divert water, the state must balance public trust needs with the need for other beneficial uses of water.

The heightened environmental awareness that flourished in the 1960s and 1970s led to enactment of state and federal laws that protect free-flowing rivers under a "wild and scenic" designation. The National Wild and Scenic Rivers Act was passed in 1968, while the California Wild and Scenic Rivers Act was passed in 1972. Both acts are intended to preserve rivers with extraordinary scenic, recreational, fishery, or wildlife values, in their natural state for the benefit of the public. The acts generally prohibit construction of any dam, reservoir, diversion, or other water impoundment on a designated river, diversions needed to supply domestic water to residents of counties throuh which the river flows may be authorized if it is determined that the diversion will not adversely affect the river's free-flowing character. Most of the rivers in the North Coast Region are designated as wild and scenic, prohibiting water development and export of water supply from these rivers.

The National Environmental Policy Act directs federal agencies to prepare an environmental impact statement for all major federal actions that may have a significant effect on the human environment. It is a procedural law requiring all federal agencies to consider the environmental impacts of their proposed actions during the planning and decision-making processes. CEQA, modeled after NEPA, requires California public agency decision-makers to document and consider the environmental impacts of their actions. It requires an agency to identify ways to avoid or reduce environmental damage and to implement those measures where feasible.

The state and federal Endangered Species Act is designed to preserve endangered and threatened species by protecting individuals of the species and their habitat and by implementing measures that promote their recovery. Over 650 species have been listed as threatened or endangered in the United States. Of those, 110 are native to California-the largest number in any state (DWR, 1998). Once a species is listed, the act requires that state and federal agencies ensure that their actions do not jeopardize the continued existence of the species or habitat critical for the survival of that species. The ESA has been interpreted to apply not just to new projects, but also to ongoing project operation and maintenance.

Section 404 of the federal Clean Water Act regulates the discharge of dredged and fill materials into the waters of the United States, including wetlands. This section of the act has been defined broadly to include the construction of any structure involving rock, soil, or other construction material. This section also requires the project proponent to evaluate all alternatives that meet the project purpose and select the least environmentally damaging practicable alternative. This section of the act has significant implications in water development, as it requires all alternatives, including water conservation, recycling, and land fallowing, to be evaluated along with the proposed water projects.

Section 10 of the 1899 Rivers and Harbors Act requires a permit for obstructions to navigable

water. Most water development projects must comply with Section 404, Section 10, or both.

Increased environmental awareness, public interest in protecting and preserving the state's natural heritage, and enactment of various laws to protect environmental resources have changed water resources development planning in California. Water resource planners are learning the new tools of planning as they develop a new planning vision that balances urban and agricultural water needs with the need to protect the environment. This evolving process, as well as the higher costs of development, has created a gridlock in water resources planning and has slowed down water resources development in California,y as competing water needs and water users are working on an acceptable and financially feasible solutions to complex water management issues.

As evident from Table 1, which shows the historical development of reservoirs in California, the majority of large dams (impounding reservoirs with capacity of 50,000 af (61.7 million m3) or more) were constructed prior to the 1970s. In the last two decades, only a few large reservoirs have been built, reflecting the need to change strategies in water resources development planning. The current planning process focuses on increasing water supply reliability by various means, including nonstructural alternatives such as demand management (such as water conservation, water recycling, and water transfers). The most recent major reservoirs planned and constructed in California have been offstream storage projects. Offstream storage reservoirs are constructed on a small stream that does not significantly contribute to the water supply of the reservoir. Most of the water supply for an offstream reservoir is conveyed from other sources. Offstream storage has an inherent environmental advantage because the reservoirs tend to be on minor tributaries, which reduces impacts on live stream habitat and would not be a barrier for fish migration to upstream spawning habitat.

CURRENT WATER DEVELOPMENT PLANNING PROCESS IN CALIFORNIA

The Sacramento-San Joaquin River Delta estuary is the hub from which two-thirds of the state's population and millions of acres of agricultural land receive part or all of their supplies (DWR, 1994). It provides habitat for many species of fish, birds, mammamls, and plants while also supporting extensive farming and recreational activities. Many different interests have a vital stake in the Delta: farmers, fish and wildlife groups, environmentalists, boaters, people involved with shipping and navigation, and the people and industries that receive water from the Delta and the state's two largest export systems, the State Water Project and Central Valley Project. Therefore, the focus of the state's water resources development planning process is on the Delta.

Competing needs and various governmental agencies with different jurisdictional claims on the Delta have made today's water resources planning process more complex than ever. The challenge for water resources planners and policy makers is to create a planning strategy that can balance the diverse and often conflicting interests, and to resolve the water management gridlock that exists today.

The water resources development planning process in California today must adhere to some fundamental principles to succeed. These principles include:

- Selecting the least environmentally damaging practicable alternative. This principle requires a comprehensive environmental evaluation of all alternatives to determine which practicable alternative has the least environmental impacts. This evaluation must include non structural alternatives such as water conservation and land fallowing, and the no-action alternative.

- Using an integrated resources planning process. This principle recognizes that meeting future water needs is often best served by implementing a variety of water management actions in an integrated form. Critical to the success of integrated resources planning is that its goals are best accomplished in an open planning process with all the affected parties actively involved. Integrated resources planning ensures that all resources be evaluated and considered in a water management plan, and all the concerns of the interested parties be addressed fully and without bias.

- Using a least-cost planning process. This principle gives all available alternatives an equal chance in the selection process. In this process, the water manager's objective becomes one of meeting all water-related needs of customers. For example, if a growing service area's need for additional water and sewer treatment can be met by an ultra-low-flush toilet retrofit program rather than by additional water supplies and treatment facilities, then the retrofit program should be considered on its merits and compared with all other options when developing a water management plan. With the least-cost planning process, the cost of implementing new water management programs must be weighed against the benefits resulting from implementation of a project or the economic losses, including unattained benefits, associated with not developing additional supplies.

- Protecting ecological and ecosystem health. This principle is a primary consideration in any water development planning process in California. Such protection is needed to preserve the state's natural heritage for future generations.

Because the Sacramento-San Joaquin River Delta estuary is the hub of California's water plumbing system, most of the water resources development projects should take into account the estuary's complex issues. To address these issues and to formulate a long-term strategy for California water management, the CALFED program was established by the Governor of California and the U.S. Secretary of the Interior.

The CALFED Bay-Delta Program, initiated in 1995, is a collaboration among state and federal agencies and the state's leading urban, agricultural, and environmental interests to address and resolve the environmental and water management problems associated with the San Francisco Bay and Sacramento and Sand Joaquin River Delta estuary system. The mission of the program is to develop a long-term comprehensive plan that will restore ecological health and improve water resources management for beneficial uses of the Bay-Delta system.

During the last four years, the stakeholders within CALFED are evaluating various water management strategies and negotiating an acceptable solution for meeting future water needs, while protecting the ecosystem of the Sacramento-San Joaquin River Delta estuary. The result of these efforts is a draft programmatic environmental impact statement published this year. This document presents strategies for ecosystem restoration, water quality improvements, Delta levee system integrity, and water supply reliability. Water supply reliability strategies are developed considering the principles listed above and consist of water use efficiency, water transfers, and integrated storage investigations (CALFED Bay-Delta Program, 1999).

The Integrated Storage Investigations program will evaluate the feasibility of conjunctive management of surface and ground water resources, nine offstream surface storage projects, enlargement of three existing reservoirs, and re-operation of existing reservoirs. This is the most comprehensive storage investigation in California in recent years and was formulated after years of negotiations and assurances that the Sacramento-San Joaquin River Delta estuary ecosystem will be restored and protected, and that all reasonable water use efficiency programs will be in place.

With continued efforts to prepare for the future within this framework, California can have safe and reliable water supplies for urban areas, adequate long-term water supplies to maintain the state's agricultural economy, and restore and protect fish and wildlife habitat for the enjoyment of future generations of Californians.

Figures

Figure 1. California is located in on the western coast of the 48 contiguous states of the United States of America.

Figure 2. A relief map of some of California's major geographic and geomorphic features.

Figure 3. The annual variability of historic flow in the Sacramento River, the largest in California, illustrates the state's climatic variability.

Figure 4. California's uneven distribution of water resources has led to the state's extensive water storage and conveyance systems.

Figure 5. Many regions depend on imported surface supplies to sustain its population and economy.

Figure 6. The Sacramento-San Joaquin Rivers converge to form the Delta, the hub of California's surface water delivery system.

Tables

Table 1. Historic development of reservoirs with capacity of 50,000 af (62 million m3) or more in California.

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WATER AND THE BRAZILIAN DEVELOPMENT : THE ROLE OF INTERBASIN TRANSFERS

By
B.P.F. Braga

ABSTRACT

This paper presents recent developments on the subject of integrated water resources management and the role water plays in providing the driving force for development. In particular the main Brazilian interbasin water transfers are revisited. This includes existing transfers and proposed transfers in urban and rural environments. Multiple water uses and users in highly demanding areas generate all sorts of conflicts that need to be systematically addressed and resolved. In the specific case of urban environments other sectors must be incorporated in water resources planning including: solid waste collection and disposal, transportation and land use management. On the other hand, water planning and management will only provide sustainable and durable solutions to problems if there is an adequate public participation.

In the past the issue of planning and management in the water resources sector was treated as a problem with the single objective of maximizing economic efficiency. More recently, however, the concept has evolved to incorporate other facets of the decision making process including issues such as: environment, social and political impacts, equity and the like. In less developed countries, however, where levels of use of energy are low, social imbalance is high, uneven distribution of income is common, it is very difficult to implement these modern concepts. Emergent economies of the world face today the challenge of growing economicially and at the same time conserve their natural and environmental resources. Many developing countries, from Asia to Latin America are facing this situation today. A common characteristic of these countries is the degradation of the water environment both in the urban and rural environments.

In Latin America after the democratization process that took place in most countries after the 80s, public pressure though NGO, professional associations, etc. imposed new models of management in the water sector. These new models have been extremely successful in bringing the political class more aware of the water problems and in many countries have resulted in effective measures to improve the quality of life of many basin dwellers. The Brazilian experience is no exception to this rule. Public pressure, after the democratization process that took place in 1983, forced congressmen to propose a new Federal Constitution in 1988 in which environmental and water issues are explicitly considered. Professional associations related to water resources, lead by the water management commission of the Brazilian Water Resources Association, played a definite role in the technical and institutional arrangements for implementation of integrated water resources management in the country.

Under this new institutional and legal setting the paper shows advantages and disadvantages of two major diversions in Brazil. One that is in operation for more than 30 years in the urban environment and was designed to domestic water supply and hydropower generation and the other is a projected transfer in the NE Brazil to irrigation development.

The MRSP includes the city of Sao Paulo plus 39 adjacent cities occupying an area of 8.050 km^2 of urbanized area. The present population is about 16.5 million, with estimates of about 19 million for yer 2010. This region (Figure 1) is the largest urban concentration and the largest industrial complex of Latin America. Its industrial output encompasses around 27% of the national total production and 62% of the state total. Population represents approximately 52% of state total of 33 million inhabitants. An extremely high population growth rate in the last 30 year has posed tremendous demands on water supply and water quality control. This fast economical development was due to a river inversion that was implemented in the 30s to produce hydrolecetric energy in a high head hydropower plant nearby São Paulo. Due to these diversions and interbasin transfers São Paulo is today the leading industrial and commercial center of Latin America.

On the other hand, the fast urban growth generated severe conflicts of water use in the upper Tiete River basin. Urban water pollution that resulted from inadequate effluent discharge treatment made the diversion for hydropower generation to be stopped. This is generating an annual economic damage for the electrical sector of the order of US $ 200 million.

The diversion of the waters of the São Paulo Francisco river (Figure 2) is today the major technical-political issue in the water resources sector in Brazil. The proposal of transferring the waters of that river to the semi-arid region on NE Brazil (Figure 3) dates back to 1886 when the first ideas to share the "River of the National Integration" with the more water scarce areas of NE Brazil. The average annual flow of the São Francisco river at the transfer point is 2.060 m^3/s and the transfer flow proposed in 1985 was 300 m^3/s to irrigate 600.000 ha in the semi-arid states of Ceara, Rio Grande do Norte and Paraiba. More recently these studies wre reviewed and currently the alternative selected is proposing a transfer of 75 m$^{3/s}$ to increase reliability of water supply for almost 200 cities located in the so-called "drought polygon". The transfer will also allow a more flexible operation of the reservoirs and irrigation of high economic return agriculture, mainly exotic fruits.

The major debate today around this project is related to the loss of economic benefits that the São Francisco basin would occur due to the water transfer. Over the last 50 years the Companhia do Vale do São Francisco - CODEVASF has promoted the regional development of the basin. Today, a cascade of 5 large hydropower plants with an installed capacity of 10.356 MW of a total of 26.435 MW potential are in place in the basin and the transfer would impact the electrical energy generation of the system. There is also a very productive agriculture in the São Francisco Valley with productivity indexes which are double or even triple the rest of the country. Although the São Francisco river basin encompasses 7 states (Minas Gerais, Bahai, Goiáas, Pernambuco, Sergipe e Alagoas) and the

Federal District, most of its 640.000 km² and its 15.1 million population are located in the state of Bahia.

Some of the lessons learned from the transfer schemes described above, allow us to list the following :

- Interbasin water transfers should consider long term impacts in both the donor and and receiving basins
- Impact analysis should not be limited to economic issues but and more importantly should consider environmental and social issues
- Water availability alone does not provide development, what is needed is an integrated plan including all social, economic and environmental considerations
- interbasin transfers are only possible if all trade-offs are explicitly indicated and compensatory mechanisms can be established under a clear and institutional arrangement

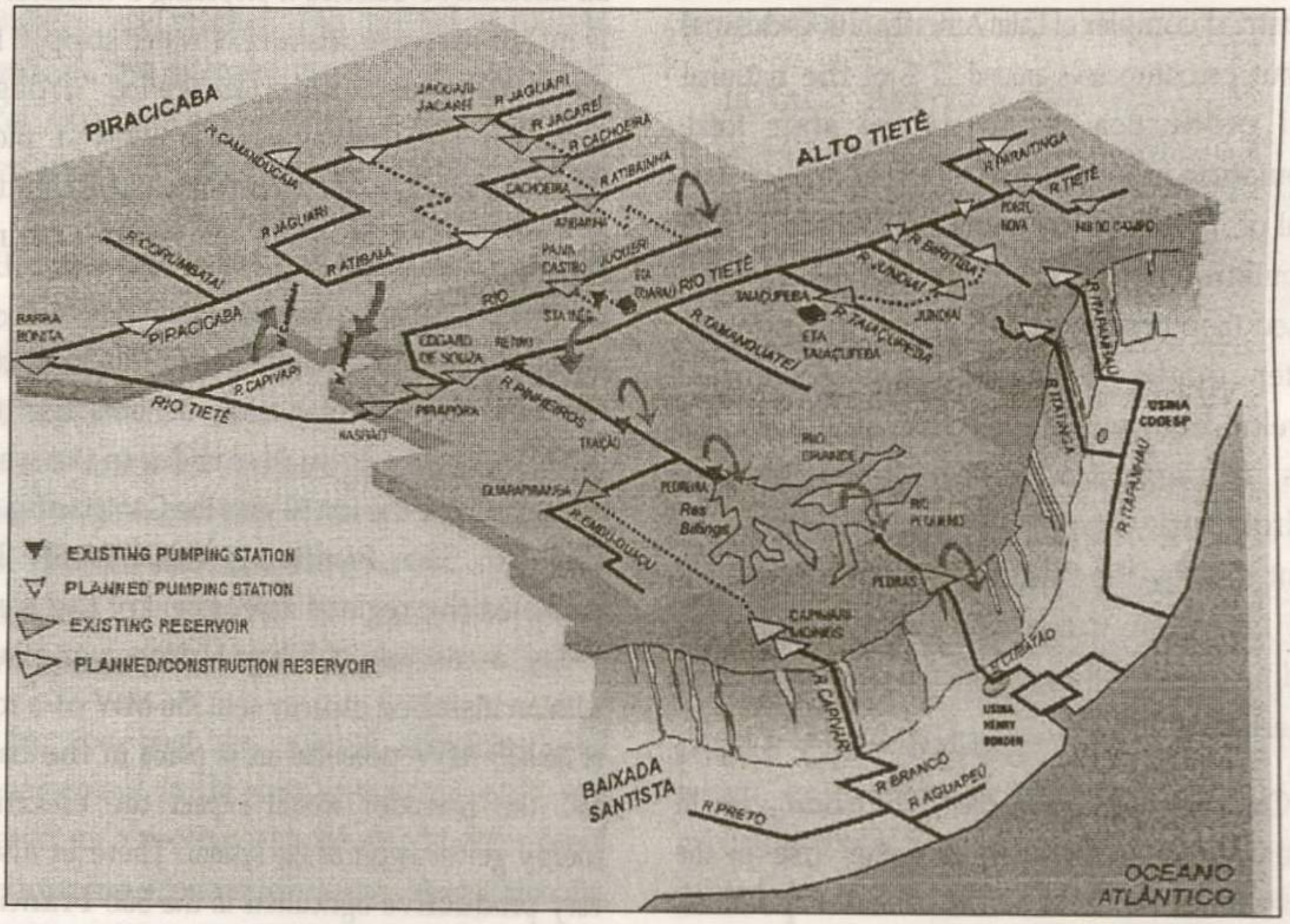


Figure 1. The Interbasin Transfers in the Metropolitan Region of São Paulo

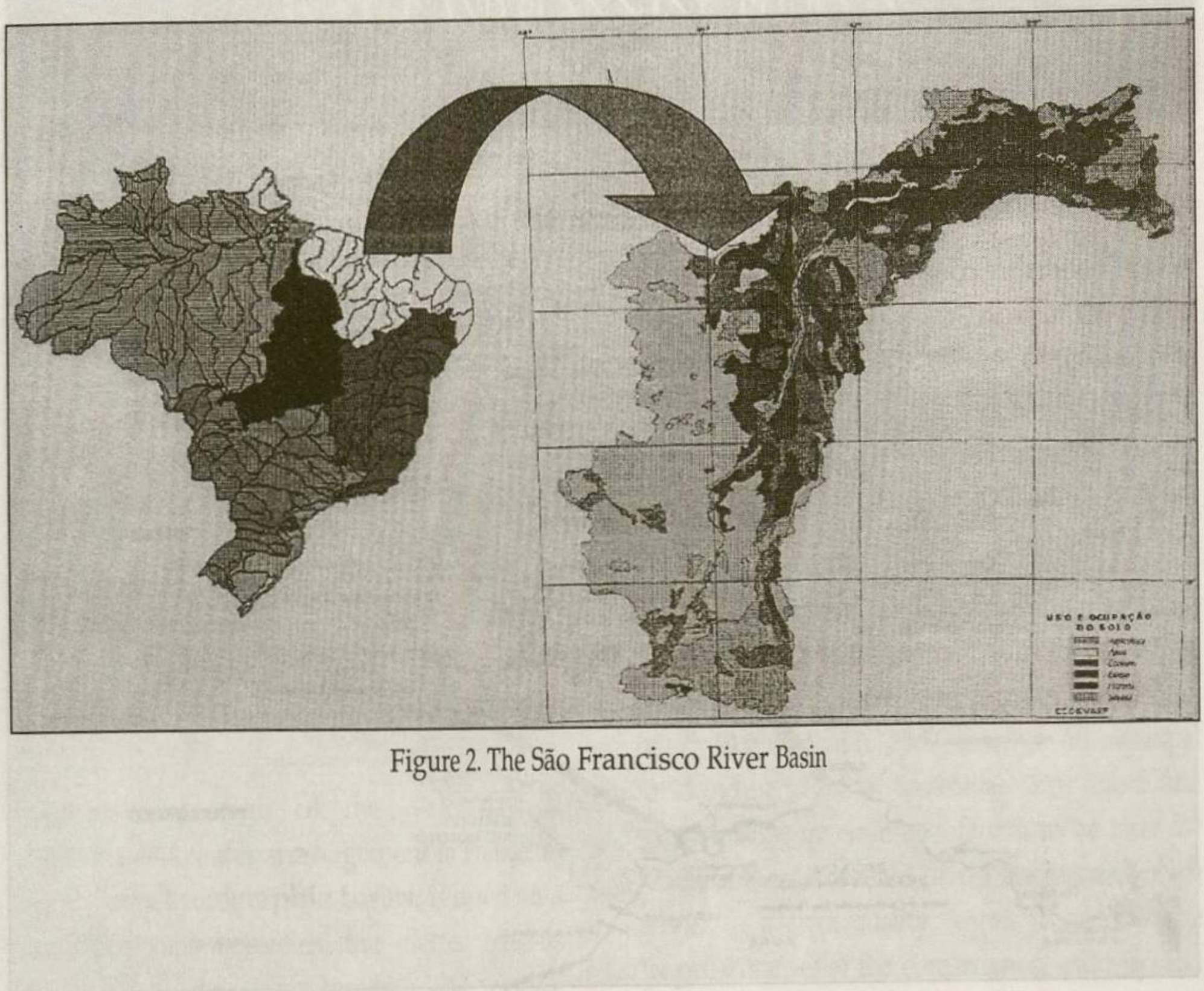


Figure 2. The São Francisco River Basin

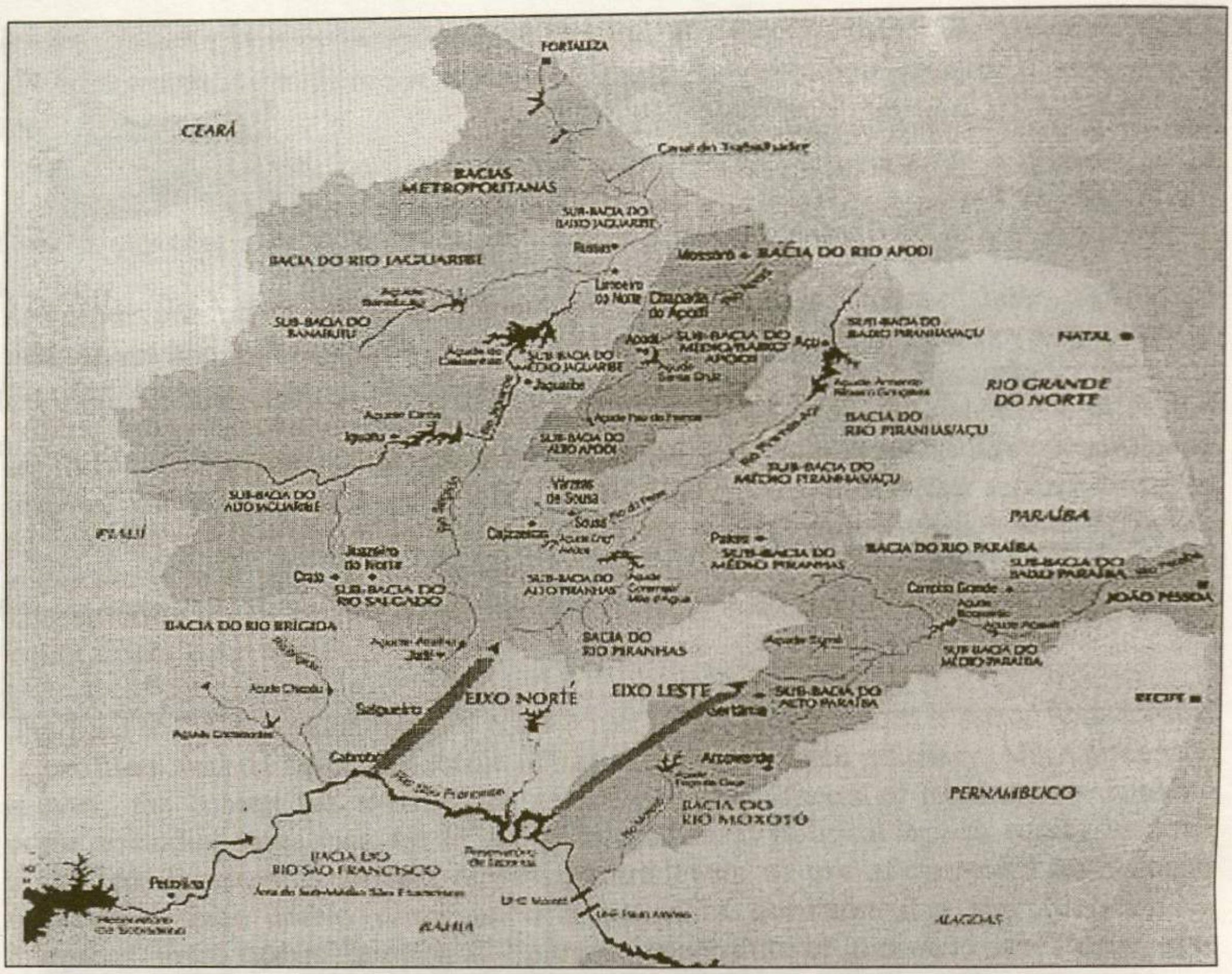


Figure 3. The São Francisco Water Transfer Scheme

WATER AND PLANNING POLICY IN FRANCE THROUGH CASE STUDIES

Şanlıurfa-Turkey
November 8-10, 1999
M. ROUX, Chairman of the Board of Directors of the Rhône-Mediterranean-Corsica Water Agency
M. SALVETTI, Project Manager, Seine-Normandy Water Agency M. VALIRON, Secretary general, Water Academy

I. THE 1964 LAW

Since the passage of the Water Law in December 1964, water management in France, in the six major hydrographic basins, is based on a close association between the elected officials designated by the départements and regions, users (industry, agriculture, private consumers, fishermen, environmental protection), as well as civil servants.

The Basin Committee, with its three groups, discusses and adopts every five years an action plan for water management in its basin and approves the financial means to implement it, drawing on fees on waste and pollution produced and on the volume of water withdrawn or consumed.

The Water Agency, a public instutition, drafts and submits the plan and then collects the fees and distributes the revenues in the form of assistance (grants or loans) for projects of common interest *(chart and table on transparencies)*.

I.1 The fight against pollution

The system, which began operation in 1968, has developed gradually, in most of the projects for which it provides 40% to 60% of the financing, the nations of planned and integrated management and an association not only with the communes, as institutional decision-makers, but also with industry and users.

To put an end to pollution in rivers and rehabilitate them, the agencies have instituted a policy of quality goals, after counting up for a river like the Vire (in Normandy) all municipal and industrial wastes, assessing their effects, and determining the clean-up efforts to be taken for each of them in order to bring each stretch of the river to a given quality level. Then, with the representatives of the communes, industry, and environmental protection associations working in concert, parties involved adopt a plan for the gradual reduction of wastes, with the ultimate goal being the improvement of the water quality, to which the Agency then provides financial assistance.

This mechanism has since been installed in every French département for all their rivers, in the form of a plan setting contracts for rivers that exceeded the départemental limits or for the rivers of a region like the Ile-de-France, in the form of a multiyear clean river plan. The river contracts deal not only with water quality improvement, but also with the flows required to provide drinking or irrigation water. For example, on the Viaur, a tributary of the Aveyron,

a river that flows down from the Massif Central to the Dordogne and Atlantic Ocean, the goals are much broader: to control wastes and at the same time to rehabilitate the river and its banks based on local diagnosis. The local partners (federation of fishers' associations, riverside residents, associations, farmers, Electricité de France, and the national government) are all represented on a steering committee, while relying on the Adour-Garonne Water Agency to draft a river contract drawing on the accrued revenues. With the support of an association, the steering committee intervenes even before the project begins, through an official, starting with a diagnosis, to define approaches and a plan under the auspices of an appropriate structure. In particular, it drafts a plan to lower upstream weirs during dry spells to reduce pollutant levels. The projected budget for this operation, which is just getting under way, is 167 million francs.

I.2 Integrated planning

Integrated planning concerns not only the river course but also an expanded area, which may be a hydrographic basin with all the run-off and economic development of the entire zone, in all its aspects (urban, agricultural, industrial, energy, touristic, etc.) or a specific and coherent planning district, such as the territory associated with some particular agricultural activity or an urban agglomeration with a significant urban-rural interdependence.

E.P.I.Dor, a public institution, submits the action taken as an agency representing the six départements traversed by the Dordogne and its tributaries to promote the coordinated and harmonious development of the 24,000 sq. km. of the valley and provide quality of life to its 1.2 million inhabitants. E.P.I.DOR has the following missions:

- Seeing to the protection and restoration of the environment;
- Improving water resources with regard to quality, quantity, and the management of the Dordogne and its tributaries;
- Providing coherent development of the economic activities associated with the Dordogne;
- In the domain of tourism, promoting and developing the "Dordogne" label.

To attain these goals :

- It can conduct or commission any study that may be useful for accomplishing its mission;
- It may advise contracting authorities and represent them if they so request;
- It may have a special relationship with regional agencies and contracting authorities.

Its involvement, which dates from 1995, developed after major efforts accomplished by the municipalities and industry, with heavy financial support from the Adour-Garonne Water Agency, which has made it possible to sharply reduce pollutant wastes and reclaim the basin.

E.P.I.DOR. has drawn up a cooperation chart and detailed action plan for the period 2000-2006, at a cost of about 1.5 billion francs. It set four priorities:

- Heritage and environment
- Green tourism and blue arteries

■ Quality agriculture

■ Development and environment

It relies on information from and cooperation with all public and private partners, in particular the tourism, and environmental protection and fishers associations, endowed with significant financial means (about 10% of the plan). Increasing public awareness and training are important so that the départmental steering and follow-up committees can derive full benefit from the presence of the associations and users.

The action itself takes various forms:

- A subsidy to river-management syndicates, provided with 10% of the budget, that operate pursuant to the methods described in the previous paragraph as well as the river committees like that of the Viaur. There are already three of them, on the Haute Dordogne, the Lèze, the Isle, and the Rhue, where many hydroelectric dams play a major role. Their management must obviously take account of downstream water needs for the environment, wildlife, and tourism.
- Various specific actions, such as protection against eutrophication of reservoirs behind dams, definition of the threshold flows of the Dordogne, return to the sources for migratory fish, the protection of sensitive and wet zones, the promotion of a long-term regional planning and development policy.

I.3 Quantitative water management

In the Paris region, flooding by the Seine and the Marne made it necessary to build dams to hold back the autumn and winter flow, while the potable-water needs of the Paris agglomeration and its 10 million inhabitants demanded more water than the low-water mark of these two rivers could provide. Thus the works originally undertaken to control floods also served to raise the low-water mark. The interdépartemental dam agency, with representatives from Paris and the four départements of the inner ring, the "Grands lacs de Seine," has received major assistance from the Seine-Normandy Water Agency, both for construction and for management of the three major reservoirs, all located outside the Ile-de-France: the Seine (or Orient Forest lake) and Aube dams in the département of the Aube and the Marne dam (or Der lake) in the département of the Marne.

A coordinating committee with representatives of the various parties concerned (civil service, water-distribution companies, etc.) for managing the dams and their gates provides for cooperation in the satisfactory management of these works (COTECO).

Although the floods do not endanger human life, their economic consequences are considerable: close to 50 billions francs in damage for a flood of the 1910 level, before controlled management was introduced. It was to limit such damage that the three dams mentioned above were built, along with that of Pannessière on the Yonne. The four together have a capacity of 800 million m3 to reduce floods and raise the low-water mark. Their management is complex but the effect is quite noticeable in lowering the high-water line of minor and moderate floods at Paris. It is based on a notification center that issues 24- or 48- hour forecasts to make it possible to take the necessary precautions in low-lying areas. To

this are added instructions for avoiding flood risks, whose application is tricky because of urban pressures.

I.4 Agglomeration contracts

As for the rivers, Agencies have gradually set up five-year contracts with many French urban areas (more than 300 all told). These bring together officials of these entities with representatives of the central municipality and neighboring communes that form an "agglomeration." The goal is to define and finance collectively a series of integrated operations to improve the water demand of the inhabitants, industry, and green space, as well as the drainage and purification of wastewater and rainwater, while respecting the environment, locally as well as upstream and downstream.

For example, at Reims, an urban area with 200,000 inhabitants, the city itself, which accounts for 85%, the five suburban communes, and the Seine-Normandy Water Agency have concluded a contract to invest 360 billion francs, of which more than 200 billion come from the Agency.

The working plan calls for the following:

- The creation and the development of a new impoundment field upstream of Reims, on the Vesle, and the reservation of a tract for another located to the north, on the Suippe, to increase water resources and replace former impoundments now inside the city;
- The development of networks to collect rainwater and wastewater and upgrading of the purification plant to permit the spreading of treated water and its reuse for agriculture;
- In concert with the "clean Vesle" campaign, reclamation of the riverbanks inside the city.

II. THE 1992 LAW

The defect of the process specified by the 1964 law was that all actions were part of a five-year plan. This is why the legislature, in the new 1992 law, provided for planning with a twenty-year horizon.

Finally, to guarantee the coherence of the action by different water-related agencies and implement balanced management of the resource, the 1992 water law provided for planning on two levels:

- At the river basin level, the mandatory water management master plan (SDAGE) sets management approaches and global objectives;
- For each sub-basin, optional water management plans (SAGE), drafted at local initiative, determine local goal modes of action.

II.1 SDAGEs

SDAGEs are defined by article 3 of the water law of 1992. They constitute the first application of the principles laid forth in the first two articles of the law: "Water is part of the common heritage of the nation. Its protection and use, and the development of the resource while observing natural equilibria are a matter of general interest." SDAGEs are mandatory. They have been set up by the basin committees, approved by the government (basin coordinator prefect) and in place since 1997.

SAGEs are an optional local initiative. To set up a SAGE, the local communities and their

intercommunal groups can form a public institution known as a Local Water Community (CLE), which draws half its members from local communities, one quarter from those representing the water cycle (users and associations), and one quarter from government agencies.

Drawing up SDAGEs took nearly four years in each basin, starting from the efforts of several geographic and thematic working groups whose members included, along with water specialists, all those responsible for urban and rural planning who are interested in having water resources and needs correspond, in both quantity and quality, as a function of population distribution and activities, while protecting the environment. They were conducted in smaller geographic zones, generally by breaking down a basin into sub-basins, so that the members of these commissions (geographic commissions), close to the ground, could share their experience and ideas.

To hold down costs, thanks to the participation in each major basin of more than one hundred persons (elected officials and users) and experts, in addition to the committee members themselves, the documents prepared and revised at meetings were submitted to boards organized with the regional councils and départemental assemblies. The latter approved their general tenor after inserting, as appropriate, their own comments and modifications. In this way the documents ratified by the authorities had been endorsed in each basin by around one thousand local, departmental, and regional officials and experts. They respect the principles of long-term development: thrifty management for and with citizens, safeguarding the environment and quality of life, and comprehensive in that they take account of all aspects of planning and are meant for the inhabitants of both today and tomorrow.

The SDAGE: **A Water Plan on the Basin Level**		
Regulations	**Planning**	**Definition of local water management**
The SDAGE applies to administrative decisions	The SDAGE guides public plans	The SDAGE identifies the relevant hydrographic units and sets the rules of coherence

Figure 1.

The procedure to draft a SDAGE
Water Law of January 3, 1992

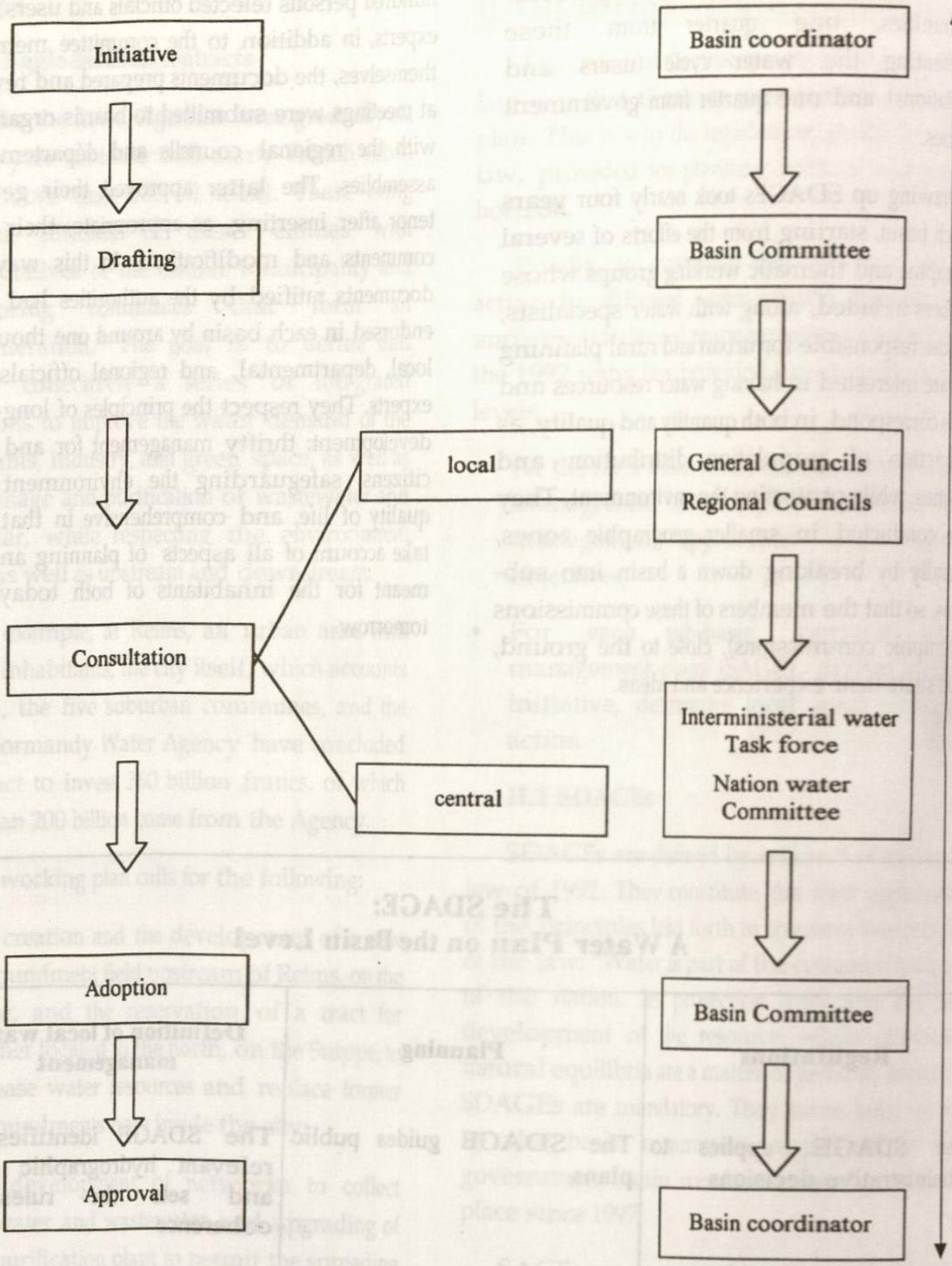


Figure 2.

Finally, an SDAGE is composed of a written document that sets goals (e.g., for surface water quality) and priorities (demarcation of sensitive natural environments).

Figure 2 traces the long path followed to draft such a document.

By way of example, the SDAGE of the Rhône-Mediterranean-Corsica basin defines ten basic approaches: continuing to pursue the fight against pollution, guaranteeing water quality at the level of user needs, reaffirming the strategic importance and fragility of aquifers, managing better before investing, respecting the natural functioning of environments, restoring or preserving special aquatic environments, restoring without delay particularly degraded environments, making more effective investments in risk management, thinking about water management in terms of regional planning, and reinforcing concerted local management.

Every SDAGE provides for the elaboration of reports to follow up the recommended measures. These are annual documents intended for broad distribution among all those active in the basin.

II.2 SAGEs

With regard to the SAGEs proposed in the various basins, with a surface area of 1,000 to 2,000 km2, some sixty are currently being drawn up; about of them have a Local Water Community (CLE), and about ten have set up their action plans. The modes for establishing these plans, which must obey the stipulations of the SDAE, are analogous to those for the master plan but more detailed and operational, because they apply to much smaller areas. To draft them, the CLE calls in outside figures and experts and also relies on the advice of users and sectorial associations. They are this the favored venue for the adoption of long-term development policies.

II.3 An example of a SAGE: The Lower Ain Valley

The Ain is the most important tributary of the Rhone upstream of Lyons. Its upper and middle stretches are affected by a series of hydroelectric installations. The SAGE applies, on a north-south axis, from downstream of the last dam until the confluence of the Ain and the Rhone, and from west to east from the Dombes plateau as far as the edge of the Bugey massif. It constitutes a hydrogeological and landscape unit with an area of 600 sx. km. (16% of the total drainage basin of the Ain), covering 40 communes.

This sector involves a strategic groundwater resource of regional importance, a resource heavily used by the irrigated farms that are widespread in the valley. On its lower stretch, near the confluence of the Ain and Rhone, is the "Ain Plain" industrial park, with about 40 factories. The lower Ain is a shifting river that creates a mosaic of remarkable natural environments of national and even European importance. Its waters are home to a typical species of fish, the common grayling, which attracts heavy fishing activiy (the Ain is the only river in France listed as containing this fish). Finally, the proximity to Lyons, only about 30 km away, fosters the development of tourism strongly oriented toward water sports and recreation.

Since 1990, the General Council of the department of the Ain and the Rhone-

Mediterranean-Corsica Water Agency have conducted a study to define a global plan for management of the lower Ain valley, which made it possible to being a SAGE for this sector and provide elements for defining its scope. This demarcation and the creation of the Local Water Commission (CLE) were completed in 1995. The first steps of this SAGE were actually taken when the 40 communes covered by the SAGE formed a SIVU of the Lower Ain valley drainage basin, providing the CLE with the financial means to implement the SAGE and setting up a joint executive office for the CLE and the SIVU. The hiring in 1998 of a project manager and half-time secretary, for two years, should make it possible to draw up a definitive SAGE document by the beginning of the year 2000.

The major problems found concern the following:

- Threats to groundwater
- Disturbances to the fluvial dynamics of the river and subsidence of the riverbed
- Degradation of water quality and especially eutrophication
- Erosion of the banks on all watercourses and filling in of their beds
- Deterioration of piscicultural quality (common grayling) and increasing scarcity of unique natural milieus

And, in general, usages that are not compatible with the level of water utilization and management.

II.4 Rural contracts

First we must list the methods used to draw up and develop a rural contract:

- The partners and their needs:

The phase of preparing and drawing up a rural contract is based on a preliminary information gathering stage and inquiries as to the expectations and the suggestions of the inhabitants and socioprofessionals. This stage is handled in concrete terms by a "rural water" manager who is hired by a local employer with the financial assistance of the Water Agency and its technical backing. This stage is decisive for maximizing the prospects for success of the local contract, because it makes it possible to fully understand the expectations of those involved and to design with them the multiyear project for joint water management, uniting them around this shared resource.

- Consulting and working together with the population:

The drafting of a rural contract, and its implementation after signing, is based on a local steering committee that is statutorily defined in the arrangement for this operation. In the contract-preparation phase, this steering committee is named in the clauses of the financial assistance agreement between the agency and the employer of the manager. The obligation for full consultation with local actors and a minimum frequency of meetings is specified in it. This takes place with the elected representatives of the communities, socioprofessional representatives (associations and chambers of commerce) and the local associations.

In the phase of applying the rural contract, the steering committee, supplemented as appropriate by theme committees, is the keystone of its application, because it confirms every annual action plan drawn up by the rural water manager on the basis of projects advanced by the partners in the field. This collaboration is indispensable, because they are the ones who cover the cost of the works and approve the collective actions.

- Increasing public awareness, information, and education:

The objective of the action is defined by the local population. This entails clear and complete information as well as answers to many questions. This is done by means of lectures and debates, articles in the media, and by the "word of mouth" conveyed by socioprofessional or local representatives, by the associations, by educators, and encouraged by the rural water manager and the steerin gcommittee.

Information by itself is not enough. It is also necessary to educate users so they understand why and how they should modify some of their habits. This is the role of technical advisors and of the fitting out of demonstration parcels. Going beyond education, there is a need to teach about the management and cost of water. The preferred venue for this education is the schools, where the rural water managers and Water agencies can be involved. The organization of exhibits and debates can reinforce the impact of these educational activities and involve both children and their parents.

About that example point it is usefull to quote that, in the Seine-Normandy bas in a very heavy program of education and training is implemented from over than 13 years; the "Water classes". It concerns everybody, schoolchildren, experts, adults, elected people... There is 850 water classes each year : that is to say about 27,000 persons having a five-days training period on water per year.

- Evaluation and increased financing:

A rural contract comprehends a continual process of evaluation, involving technical monitoring of the natural environment and works, financial oversight of public grants, and the support and commitment of local players, both private and public.

An ongoing feedback between supply and demand is indispensable because this process, with no regulatory character, is based on the notion of voluntary participation. Hence it is essential to listen to the expectations of the inhabitants and socioprofessionals, to organize the corresponding actions so they are effective, and to accompany all of it with financial assistance specific for this type of contract.

In Seine-Normandy, a rural contract is possible thanks to the financial dynamics added locally by the increased allocations from the Water Agency. This is the result of the voluntary policy chosen by its administrators to encourage the cooperation of local actors toward a local goal of concerted and long-term management of water resources and is based on the solidarity of the basin.

Today, 32 rural water managers are employed in the Seine-Normandy basin, eight of them to implement the eight contracts that have been signed to date and 24 to draw up new contracts.

By way of example, the "Clean Water" plan supported by the Loire-Bretagne Water Agency and Loïc Caubet, the mayor of Lamballe, has initiated operations to restore water quality in all of Brittany, leavily disrupted by the large number of industrialized poultry and swine farms as well as agriculture that imposes poor controls on fertilizer use. The action taken in 20 pilot basins apply to waste treatment, the use of liquid manure, and "fertimieux" and "irrimieux" projects (improved use of fertilizer and irrigation) in close partnership with producers and farmers. Each one includes a project carrier and manager, who direct the actions approved by a committee of representatives of all the public and private partners, which monitors execution. The financing is conveyed to the various contracting authorities by each of these committees, which resemble the six French basin committees, on a smaller scale but very close to the field.

In addition, they plan a role in the day-to-day control of implementation of the plan. This application of a close private and public partnership fits in very well with the arrangements desciribed above. The projected investment is 1.5 billion francs, derived in particular from the European Community, local communities, and the Water Agency, in addition to that based on user fees.

III-SOME PERSPECTIVES BY WAY OF CONCLUSION

This overview of French water and planning policy has emphasized its gradual progress over three decades and shown how the tripartite management of water has moved down from the basin committees, at the top, toward the field. Then, with the 1992 law, planning was expanded from a five-year to a 15- and even 20-year horizon, with SDAGEs, and the instutitionalization of tripartite management with SAGEs and local water communities (CLEs).

In parallel, these integrated management methods have also been applied, in stages, to several international basins, such as Lake Geneva between Switzerland and France, or the Rhine, with Switzerland, France, Germany, Belgium, and the Netherlands. There has also been movement from targeted actions, such as the restoring water quality in Lake Geneva, to basin-wide planning or, for the Rhine, from the management of saline wastes to management of floods and pollution as a whole.

As for the integration of users in this management, there is still much to do, but the indispensable development of information, training and education and the greater awareness evident everywhere are certainly steps in the right direction.

Finally, this process should lead to a **new mode of water management** for the twenty-first century, the means of which are described in the Social Charter for Water drawn up by the Water Academy and Vision 2025 (see Appendix 1). The methods derived from it, which have been applied in many places in the world, have demonstrated their effectiveness.

APPENDIX 1

USER PARTICIPATION IN THE DRAFTING OF THE WATER CHARTER

Since the start of 1999, the Water Academy has been circulating a draft of the Charter and questionnaire to many organizations in the water sector, associations, elected officials, and so on, almost everywhere in the world. They were also asked about the recommendations and their content, so as to improve and expand the draft on the basis of the replies received.

THE CURRENT DRAFT OF THE WATER CHARTER

The revised draft Charter advances seven recommendations to implement four principles raised by the many international water conferences since that held in Rio:

- access to water by all: an inalienable right
- water, an economic and social asset
- mandatory financial cooperation between rich and poor
- management shared by decision-makers, experts, and citizens.

To accomplish this, it is recommended that political decision-makers, managers and funders enhance the direct active participation of the general public in water management while doing the following:

1. Identifying the various local partners to be attracted and included before implementation;
2. Proceeding to an evaluation of the needs of the population;
3. Supervising the implementation of procedures of consultation and negotiation with the general public and its representatives;
4. Defining and implementing, in collaboration with the general public and its representatives, the mode and content of public participation;
5. Making sure to accompany every project with an appropriate education and information policy;
6. Carrying out a regular evaluation of the match between supply and demand with the public and its representatives and organizing a network of exchanges and experiences among those responsible for action in the field all over the world;
7. Constructing the basis for a North-South fund and the rules needed to assemble the financial resources required to make possible all the actions enumerated above.

NORTH SINAI DEVELOPMENT PROJECT FOR RECLAMATION OF 400,000 FED. IN EGYPT

Eng. Mohamed Nabil Salem
General Director of Studies,
NSDO
M.P.W.&R., EGYPT

• INTRODUCTION:

Due to the limited Nile water resources of Egypt, which is only 55.5 Milliards cubic meters per year, the Ministry of Public Works & Water Resources stated a policy for there - use of agricultural waste water which was drained to the sea. This policy can add about 7 Milliards cubic MeterS per year. The Minstry is actually applying such policy in cultivating new lands using Nile water mixed with the above waste water.

The project of North Sinai Development for land reclamation of 400.000 feddans is one of the leading projects in this respect using 2.34 Milliards m^3/year of the fresh Nile water, that water will be transferred through Al Salaam Canal. The 400.000 feddans in the Sinai are an extension of another 220.000 feddans on the western side of Suez Canal irrigated by the same canal. Together, these areas constitute 17 % of the 3.4 million feddans increase in agricultural land that Egypt has planned for the year 2017.

The Al Salaam Canal originates on the Damietta branch, upstream of Damietta Dam. The part of the canal west of the Suez canal (87.000 km) was completed in 1995. A syphon unter the Suez Canal (capacity 160 m^3/sec) was Canal (190 km), will be completed in 2002.

The total investment of North Sinai Development project is about 5.74 Billion L.E.

• PROJECT PURPOSE:

The North Sinai Development project is a key element in Egypt's policy to increase the agricultural production and maximize the use of the country's limited water resources. The project has the following objectives :

* The reclamation of an estimated gross area of 400.000 feddans of desert land, situated along the Mediterranean coast of Sinai;

* The increase of agricultural production, to reduce Egypt's dependence on food imports;

* To improve income distribution and generate employment by the resettlement of families form the rural population of other over-populated areas of the country; and

* To maximize the re-use of drainage water by re-using over 2 milliard m^3 excess drainage water, presently lost to the sea.

• WATER RESOURCES OF THE PROJECT:

The El Salaam Canal is to convey a required water of 4.45 milliard m^3 $10^9 m^3$) per year. Monthly water discharge fluctuates between 160 million m^3 in October and 570 million m^3 in June.

Out of annual supply water 4.45 milliard m^3 2.11 milliard m^3 will constitute fresh water supplied from Nile water and the remainder from Hadous and Serw drains. Mixing of drainage

water was planned in 1977. The salinity of the drainage water is about 1.300 ppm, and after mixing with fresh water of a salinity of 300 ppm at a rate of 1:1, the salinity of the mixture will be of range 800-1.000 ppm.

1- From Nile Damietta Branch
2.11 milliard cubic meter annually

2- From Lower Serw Drain
0.435 milliard cubic meter annually

3- From Bahr Hadous Drain
1.905 milliard cubic meter annually

Total
4.450 milliard cubic meter annually

• AREA OF THE PROJECT :

Construction of the El Salaam Canal was initiated in 1979. The intake facilities are located about three (3) km upstream of the Faraskour Barrage on the Damietta Branch of the Nile River. The El Salaam Canal project is implemented in two stages; construction of the first stage, from the intake to the Suez Canal, was completed in 1995; the second stage includes construction of a Syphon underneath the Suez Canal and extension of the El Salaam Canal. Construction of the second stage works is underway.

The total command area of the El Salaam Canal is 620.000 feddans gross; 220.000 feddans for the west of the Suez Canal (First stage projec); 400.000 feddans gross for the east of the Suez Canal (NSDP). The area of the project is :

- Tina Plain 50.000 feddans
- South Eastern Kantara 75.000 feddans
- Rabaa 70.000 feddans
- Bir El Abd 70.000 feddans
- El Sir & El Kawareer 135.000 feddans

Total 400.000 feddans

• PROJECT COMPONENTS :

The components of North Sinai Development Project can be divided into :

1- Infrastructure works
2- On farm works

1- Infrastructure works including :

- Infrastructure works for irrigation and drainage
- Infrastructure works for power supply
- Infrastructure works for roads

2- On farm works including :

- Irrigation & Drainage on farm network
- Establish integrated housing communities areas
- Public service buildings
- Sewage drainage network
- Internal power supply network
- Internal road network
- Communications networks

• SHEIKH GABER EL SABBAH CANAL :

The extension of El-Salaam Canal called "Sheikh Gaber El Sabbah Canal" as a symbol of the close relations between Egypt and Kuweit, which is the canal extending directly behind the syphon east Suez Canal until its end west of Al Arish Valley in the south of Al Arish city, and which is 195 km. long approximately and runs across Port Said and North Sinai governorates.

Some parts of the Main Canal as well as subsidiaries canals will be lined to minimize leakage.

It was planned for the canal to follow the shortest track to run in El Tina plain area and along the center line of El Salaam Canal west Suez Canal.

The canal is aiming to the reclamation of lands of sedimentary formation from ancient Nile branches.

It was taken into consideration that water level of canals in Tina plain region should not be less in depth than 0.5 meter above M.S.L.

The canal shall run east of Beir El Abd/El Maghara Highway pipelines under pressure to enable pumping water for the areas of El Ser & El Kawaree and thus avoiding any sand dunes impact in this area.

In order to realize all these considerations. Seven main pumping stations constructed along the Canal, three on EL **SALAAM CANAL** West Suez Canal and four on **SHEIKH GABER CANAL** East Suez Canal.

The characteristics of these stations as following :

Nr.	Location	Capacity [m^3/s]	Head [m]
1	km 22 El Salaam Canal	132	1.75
2	km 52 El Salaam Canal	132	2.50
3	Bahr Hadous drain	116	2.00
4	km 3 Shiekh Gaber Canal	160	2.00
5	km 24.750 Shiekh Gaber Canal	102	12.00
6	km 46.50 Shiekh Gaber Canal	92	9.50
7	km 109 Shiekh Gaber Canal	52.60	83.00

•EL SALAM CANAL SYPHON UNDER SUEZ CANAL

One of the basic elements of the irrigation and rdainage infrastructure is the EL Salaam Syphon under Suez Canal which carries EL-Salaam Canal water from west Suez Canal to El Sheikh Gaber El Sabbah Canal east Suez Canal.

This syphon pass under Suez Canal and many of the other constructions/services as Port Said - Ismailia road, Port Said - Ismailia railway, port Said Canal For potable water, Port Said pipeline for potable water, Suez Canal highway, always taking into consideration future expansion of the Suez Canal. The construction works of Syphon finished in the end of 1997.

Hydraulic data of the syphon

- maximum discharge 160 m3/sec.
- minimum discharge 40 m3/sec.
- maximum water velocity 2m/sec.
- water level at west + 1.50
- water level at east + 0.60

Tunnel data

- Syphon is composed of 4 tunnels.
- Each tunnel is 770 meter long.
- Internal diameter of the tunnel 5.10 meters.
- Least depth of the upper draw from future base of the canal.

  (after final expansion) about 12 meters.
- Outer lining of the tunnel is pre-fabricated reinforced concrete segments (thickness 30 cms)
- PVC insulating coating water proof (thickness 2 mm.).
- Internal lining with plain concrete (thickness 32 cms.).

• SOIL CLASSIFICATION OF THE PROJECT AREAS & PROPOSED CROP PATTERNS

Clay Soil :

Gross area of clay soils east the Canal is 60 thousand feddans at Tina Plain. The propesed crop pattern of this area which is to be irrigated by superficial improved irrigation system :

. Farm crops	42 % of the area
. Vegetable crops	42 % of the area
. Pasture crops	16 % of the area

Sandy Soil :

Gross area of 340 thousand feddans, planned to be irrigated by dripping or sprinkling system according to each area's condition. The proposed crop pattern for such areas is as follows :

. Farm crops	27 % of the area
. Pasture crops	22 % of the area
. Fruits	15 % of the area
. Vegetable crops	14 % of the area
. Olives	6 % of the area
. Oil crops	6 % of the area

• PLAN FOR AGRICULTURE DRAINAGE

TINA PLAIN BLOCK

Its discharge will be in Suez Canal through pumping by the two main drainage stations of El Farama and Balouza, into the Suez canal 21.400 - 34.000 from Port Said, as this area needs a meticulous drainage system, washing operations for a period not less than two years - and it is currently construction of open drains network for both northern and southern areas.

AL SOUTH KANTARA EAST BLOCK

Which requires a less degree of rdainage system than Tina plain region in view of its higher elevation from the sea surface level, and water

will be discharged from this region to the Suez Canal too, but without pumping.

RABAA AND BEIR EL ABD BLOCKS

In order to preserve water properties Bardawill Lake has been taken into consideration not to discharge in it and go far with the planned areas for reclamation in these two regions by a distance not less than one kilometer from lake border.

It has been also planned for a cut - off drain to border north these two regions and its discharged water will be directly spilled into the sea near Balouza shore.

EL SER & EL KAWAREER BLOCK

It is planned to get rid of the agriculture drained water of its southern part on the Arish Valley track by means of open drains without pumping.

As for its northern part, it is possible to use the agriculture drained water which will be collected at its north, in the plantation of forests and trees fixed in the ground to protect and minimize the influence of the sandy dunes on this area and on the way from Masfak to Arish. In general the agriculture drained water which is seeping into the ground from irrigation in all this area, will have a positive impact in increasing the underground water and improve its properties West of Al - Arish city, for feeding the wells in this region.

• SETTLEMENT AND SOCIAL INFRASTRUCTURE :

The project aims to settle about 750.000 persons to relieve the population density on the Nile valley and to manage the human energy in economic development.

The settlement projects of the five zones of North Sinai development project will be implemented in three phases; phase 1 consisting of two zones : the Tina Plain zone and the South Eastern Quantara zone, phase II of two zones : the Rabaa zone and the Bir El Abd zone, and phase III will include the Sir & El Quarir zone. The construction of Shikh Gaber El Sabah Canal is in progress : from 1992 however, settlement and social infrastructure projects started in 1997. It is takin into consideration that an area of 7500 fed. is to be served by one branch village and a central village is to be established for (4-6) branch village.

Zones	Branch Village	Central Village
- Tina Plain area	6	1
- South Quntara area	8	2
- Rabaa area	8	2
- Beir El Abd area	8	2
- El Ser & EL Quarir area	15	3
Total	45	10

• LAND ALLOCATION IN THE PROJECT :

Land allocation rules have been set by the Ministerial committee for the North Sinai Project. The committee has drawn up these regulation in conjuction with the Ministry of Public Works and Water Resources, the General Authority for Reconstruction and Agricultural Development, the State Assembly, and representatives of the Port Said, Ismailia, and North Sinai governorates.

Settlers are categorized into three (3) groups : small farmers / graduate farmers, small scale investors and large scale investors. The reclaimed lands will be allocted to the selected settlers as follows :

Land Allocation by Category

Category	Percentage of Land	Unit Land Area
Small / Graduate Farmer	35	10 feddans
Small Scale Investor	15	10 to 500 feddans
Large Scale Investor	50	over 500 feddans

• ELECTRICITY SUPPLY FOR PROJECT :

The Ministry of Electricity and Energy, represented by Egypt Electricity Organization and villages Electricity Organization, carries out the measures to supply the electrical energy for the irrigation and drainage pumping stations of the project lands as well as for all the electrical loads for the new villages and for the industrial development.

In this regard, voltage electrical network will be established (High/Med./Low)

• TOTAL COST FOR NORTH SINAI DEVELOPMENT PROJECT :

(cost by Million L.E.)

ITEM	TOTAL	FOREIGN	LOCAL
MAIN INFRASTRUCTURE FOR IRRIGATION AND DRAINAGE	2647.40	828	1819.4
MAIN INFRASTRUCTURE FOR ELECTRICITY	694.9	246.3	448.6
INFRASTRUCTURE & RECLAMATION WORKS	2400	800	1600
TOTAL COSTS FOR MAIN & INTERNAL INFRASTRUCTURE	5742.3	1874.3	3868.0

• FINANCING OF THE NORTH SINAI DEVELOPMENT PROJECT :

LOCAL COMPONENT : THROUGH NATIONAL INVESTMENT BANK of Egypt :

The Total local currency 4798 millions L.E (equivalent to **US$ 1411 million.**

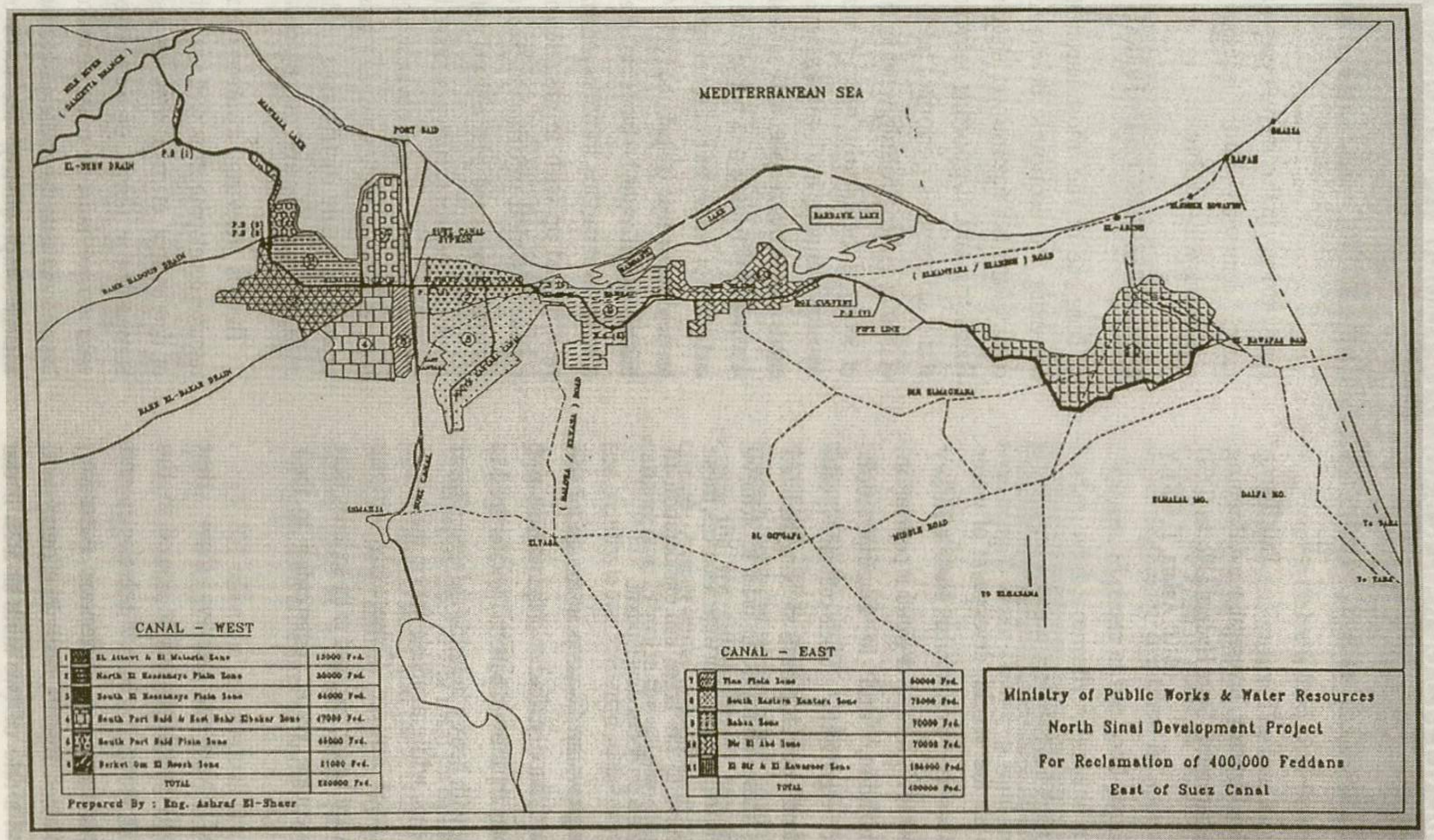
FOREIGN COMPONENT :

1- KUWAIT DEVELOPMENT FUND :

Kuwait funds is financing in full the foreign component for the infrastructure for irrigation and drainage 71 million Kuwaiti Dinars (equivalent to **U.S.$ 200** million) through a soft loan.

2- SAUDI DEVELOPMENT FUND :

Saudi funds is financing apportion from the foreign component for electricity element in the project 94 million Saudi Riyal (equivalent to **U.S.$ 25** million) through a soft loan.



1	El Attawi & El Mataria Zone	15000 Fed.
2	North El Kassaseya Plain Zone	36000 Fed.
3	South El Kassaseya Plain Zone	64000 Fed.
4	South Port Said & East Bahr Elbakar Zone	47000 Fed.
5	South Port Said Plain Zone	46000 Fed.
6	Berket Om El Reesh Zone	11000 Fed.
	TOTAL	220000 Fed.

7	Tina Plain Zone	60000 Fed.
8	South Eastern Kantara Zone	75000 Fed.
9	Rabaa Zone	70000 Fed.
10	Nw El Abd Zone	70000 Fed.
11	El Sir & El Kawamser Zone	104000 Fed.
	TOTAL	180000 Fed.

BENEFITS OF WATER BASED DEVELOPMENT PROJECTS IN TURKEY

Faik Turan
Section Director, Investigation and Planning
Department, State Hydraulic Works (DSI)
06100, Ankara, TURKEY

1. INTRODUCTION

As in all the world, development of water resources has been an important issue for Turkey because of the high rates of growth in population, in urbanization, and in industrialization. Economic growth, socio-cultural, and environmental developments are being realized following these changes. In order to achieve sustainable management of water resources, these changes have to be taken into consideration in water related projects development.

Although water resources are enough for the entire world, the distribution of them in time and space shows an uneven pattern. The water need is increasing with heavy industrial and agrucultural requirements, while available water in the world remains fixed source. Consequently, serious problems are being exposed to the societies that have inadequate water corresponding to their needs.

United Nations surveys show that considerable problems will be exposed in the coming 30 years, if the new technologies and developments are not implemented. According to the obtained results, water insufficiency will increase at a rate of two thirds till 2025. If the current tendency in this increase goes on as that of today, domestic and industrial water requirements will double.

2. WATER RESOURCES IN TURKEY

Being one of the most important factors influencing the economic development of a country, water is a natural, yet limited resource. Engineering and supporting interdisciplinary studies and activities performed for the purpose of utilizing and controlling water for the benefit of society is commonly referred to as water resources planning and management. For the efforts made in this respect to be successful, what is required to be known is not only the quantity and quality of water, but also, among others, the temporal and spatial distribution of it. Although this information could be made available through observations at various locations and times, what we would end up with in this case would only consist of historical information. Since all water resources projects are planned and designed for meeting the needs of future generations, historical information alone would obviously not suffice; however, it could well serve as a basis for the prediction of future distributions - both in time and space - of quality and quantity of water.

There is growing awareness that water resources development as well as all other types of development efforts must be sustainable. Sustainability in terms of water suggests that water resources must be managed and conserved in such a way as to meet the needs of the present without compromising the needs of future

generations. Sustainable development and management of water resources cannot be accomplished without a sound assessment of water resources, which can be described as the determination of the sources, extent, dependability, and quality of water resources, on which is based an evaluation of the possibilities for their utilization and control.

A number of governmental and non-governmental organizations have direct and indirect interest in the development and conservation of water resources in Turkey. Institutional structure consists of three levels; namely, decision making, executive and users levels.

DSI, under the jurisdiction of Ministry of Energy and Natural Resources, is the major organization responsible for the development and management of water resources in Turkey. Development, management and conservation of groundwater resources are also exclusively under the responsibility of DSI.

DSI is especially responsible for water works which are the planning, developing and managing irrigation infrastructure especially for large irrigation schemes, construction of dams for water and power utilization, flood control, river training, water supply schemes, groundwater development, swamp reclamation and domestic water supply for cities with population over than 100.000.

On-farm development works and small scale irrigation projects are the responsibilities of the General Directorate of Rural Services, GDRS.

Turkey is located at the crossroads of Europe and Asia, and extends over the Dardanelles and Bosphorus straits allowing a natural connection between the Mediterranean and the Black Sea. The country has a total surface area of 779.452 km^2, of which 765.152 km^2 is land and the remaining 14.300 km^2 is water surface. The total length of the coastline along the surrounding seas is 8.300 km, whereas the length of political boundaries with eight neighboring countries is approximately 2.900 km. 65 percent of the total population of Turkey, which is currently around 65 million, is presently dwelling in urban centers whereas the remaining 35 percent is living in rural areas.

The climate of Turkey is semi-arid with extremes in temperature. Climate and precipitation figures exhibit great variance throughout the country: in the higher interior Anatolian Plateau, winters are cold with late springs, while the surrounding coastal fringes enjoy the very mild-featured Mediterranean climate. Average annual precipitation is 643 mm, ranging from 250 mm in the southeastern part of the country, to over 3.000 mm in the northeastern Black Sea coastal area. This average annual precipitation figure for Turkey corresponds to an average of 501 billion m^3 of water per year.

Approximately 70 % of total precipitation falls from October to March, and there is little effective rainfall during summer months. At elevations above 1.000 m, a considerable part of the precipitation is in the form of snow.

Of 501 billion m^3 of annual precipitation given, 274 billion m^3 is assumed to evaporate from the surface and transpire through plants. Water potential of Turkey is slightly augmented by inflow from adjacent countries, which contributes to the water potential of Turkey as much as 7 billion m^3 a year. 69 billion m^3 of

precipitation directly recharges the aquifers, whereas 158 billion m^3 forms the precipitation runoff. There is a continuous interaction between surface runoff and groundwater, but it is estimated that a net 28 billion m^3 of ground water feeds the rivers. With the surface runoff within the country reaches 193 billion m^3. However, not all of the renewable water resources can be utilized because of technical and economical reasons. Exploitable portions of surface runoff, inflow from bordering countries, and groundwater are 95, and 12 billion m^3, respectively. Thus, the total of exploitable water resources amounts to 110 billion m^3.

According to gross potential, water available per capita per year in Turkey as of 1998 is about 3.250 m^3. Nevertheless, as a consequence of population increase, it is expected to be 2.750 m^3 /cap/a by the year 2010, and exploitable annual average would be around 1.300 m^3 /cap/a. Thus, certain regions of the country have water deficit problems now and will have major water deficit problems during drought years in the future.

Although Turkey is not affluent in terms of hydroelectric power potential, it is ranked in the first quartile within the European countries. According to studies made in the early 90s, exploitable hydroelectric energy of Turkey has been found to be 123.040 GWh/year with installed capacity 34.740 MW. As of 1998, with the projects developed by DSI, 37.079 GWh of hydroelectric energy was generated with installed capacity 10.125 MW. This figure indicates that so far only 30 % of the exploitable hydroelectric energy has been developed. Trends in demand for electric power suggest that an energy shortage is imminent. For this reason, it is considered that hydroelectric energy should be given priority due to the fact that it poses much less of a threat for the environment compared to other types of energy sources.

Because of climatic conditions in Turkey, the precipitation-flow relationships which change seasonally also show considerable differences from year to year and natural water supply falls to minimum levels in summer time when the demands are maximum. The country's water resources are very sensitive to drought conditions and drought is seen every fifteen year period in which mean annual water yield decreases to one third of annual average value of long period. Beside irregular regime character, flood events, which are threatening natural life and other activities are creating great hazards. Therefore, the periodic droughts necessitates the construction of dams to regulate water in one year or longer.

In Turkey, parallel to dams construction either for prevention of these floods or for meeting demands, basin water management systems comprising other activities are being developed for providing the balance between resource and demand.

As in other countries in the world, irrigation has a great share in water consumption. To minimize water loss through distribution networks, to use water more conservatively during the operation and to increase irrigation efficiency, modern irrigation methods such as sprinkler or drip irrigation are mostly preferred in irrigation projects.

For the purpose of water resources development having importance for country's

progress, various projects have been developed in agriculture, energy, environment and the other sectors in Turkey so far. Beside domestic and industrial water supply, the projects developed in services sector comprise meeting of the tourism water requirements which plays an important role in development of the country.

Almost one third of the total area of the country is classified as agricultural land, which is about 28.05 million ha. One third of the agricultural land can be classified as irrigable land. According to the available comprehensive studies an estimated 8.5 million ha (7.9 million ha with surface water and 0.6 million ha with groundwater resources) is economically irrigable under available technolocy. In other words, the agricultural area is 36 % of total land and 30 % of the agricultural area can be irrigated technically and economically.

Table 1: Development of water consumption in Turkey and as of the beginning of years

	Water withdrawal		Sectors					
			Irrigation		Domestic		Industrial	
Years	(million m^3)	(%) of fully exploitable resource	(million m^3)	(%)	(million m^3)	(%)	(million m^3)	(%)
1990	30 600	28	22 016	72	5 141	17	3 443	11
1991	31 000	28	22 478	73	5 160	17	3 454	10
1992	31 600	29	22 939	73	5 195	16	3 466	11
1993	31 800	29	23 339	73	5 240	16	3 505	11
1994	32 400	29	23 652	73	5 295	16	3 564	11
1995	33 500	30	24 600	73	5 320	16	3 580	11
1996	34 200	31	25 308	74	5 352	16	3 590	10
1997	35 645	32	26 415	74	5 520	15	3 710	11
1998	37 500	34	28 050	75	5 580	15	3 870	10
1999	38 900	35	29 200	75	5 680	15	4 020	10
2000	40 700	38	30 500	75	6 000	15	4 200	10

3. WATER RESOURCES DEVELOPMENT IN TURKEY

In Turkey, for the purpose of irrigation, drinking, domestic and industrial water supply, hydro-electric energy generation and flood control, 683 large and small dams have been designed by DSI. In Turkey, as of the beginning of 1999, 195 large dams, 940 small dams have been constructed. 107 large dams and 228 small dams are under construction.

Water consumption for various purposes which occured as a result of the projects developed firstly by DSI and other government organizations and institutions responsible for water resources development, reached up to 37.5 billion m^3, of which 28.05 billion m^3 (75 %) has been used for irrigation, 5.6 billion m^3 (15 %) for drinking and domestic, and 3.9 billion m^3 (10 %) for industrial water requirements.

Development of water consumption in Turkey and as of end of the years are given in Table 1.

4. SOUTHESTERN ANATOLIAN PROJECT, (GAP)

The Southeastern Anatolian Project, shortly called GAP, is the most ambitious water development project in Turkey. It covers an area of 74.000 km^2, about one-third of the total area of Turkey, including the lower reaches of the rivers Euphrates (Fırat) and the Tigris (Dicle) and the fertile plains lying between them.

As a large-scale development project related to water, GAP is a combination of 13 projects for agriculture, energy and domestic water supply. At full development of these projects, of which 6 are located in Tigris basin and 7 in Euphrates basin, 27 billion kWh of hydro-electric energy will be generated annually with the installed capacity of 7.500 MW, 1.7 million ha of land will be irrigated, 22 dams and 19 HEPP will be constructed on main and tributary branches of Tigris and Euphrates rivers in the context of these projects.

16.418 billion kWh energy is being produced with 4.294 MW installed capacity and 200.000 ha area is being irrigated by means of existing structures constructed in the context of GAP.

When the water structures under construction put into operation, 25.432 kWh energy, corresponding to 93 % of the project goal, will be generated. 1.062.000 ha irrigation schemes are under construction and construction of the dams, that will provide water for this irrigation area, have been completed.

As an integrated development project, GAP will provide Southeastern Anatolian region with increase in the share from national income and therefore socio-cultural development.

In the context of GAP, it is seen that the expected social and economic benefit from irrigation is increasing very fast in irrigated areas. In March 1998 in the Harran plain, irrigation has been realised by giving water from tunnel for the first cereal grains. For two years in the region as a result of the irrigation a great agricultural yield has been obtained. At full development of the Southeastern Anatolian Project, US $ 2.1 billion contribution to the national economy, US $ 2 billion from irrigation and 2 billion US Dollar from energy generation, will be provided. In addition to this, by creating the direct employment opportunity for 500.000 persons,

social benefit having a great importance for the region will also be provided.

5. BENEFITS OF WATER IN IRRIGATION SECTOR

As of the beginning of 1999, the total irrigation area constructed by DSI, GDRS and public efforts reached 4.781.691 ha. This area is corresponding to 56% of 8.5 million ha of economically irrigable area under available technology. Out of the irrigation area in operation, 3.781.691 ha can be irrigated by technically and economically feasible projects. The rest of the 1.000.000 ha area is being irrigated directly by farmers.

With the projects developed by the State Hydraulic Works (DSI), as of the beginning of 1999, in 2.610.767 ha gross area (2.255.703 ha net area) irrigation has been started. As of the beginning of 1999, the total irrigation area under construction carried out by DSI is 630.000 ha. 422.465 ha land from total irrigation area constructed by DSI is being irrigated by ground water and 344.485 ha land out of this area is being operated by cooperatives. 1.499.893 ha area out of 1.833.238 ha surface water irrigation has been transferred to water users associations. The area operated by DSI is about 333.345 ha.

Irrigation contributes to Turkey's economic development and democratic stability of the country in great extent. In Turkey, the increase in yield in irrigated condition is three times greater than that of dry condition. While the share of the agriculture in GDP is about 14%, it has the maximum share in employment. In total employment the share of agriculture, industry, services and the other sectors are 42%, 16 %, 38% and 4%, respectively. In the agriculture sector, the maximum share belongs to fruit agriculture with the proportion of 34 %.

In Turkey, fruit and vegetable agriculture correspond to 55% of total agricultural production. Then the livestock with 35 %, forestry with 7 % and fishery with 3 % follow this figure.

Cereals are dominating and correspond to 59% of total agricultural production while fruit, vegetable, industrial plants and the others take part in total agricultural production with the proportion of 13%, 5 % and 24%, respectively.

The total agricultural land constructed by DSI is given in Table 2. In accordance with 1998's prevailing price, Gross Agricultural Product (GAP) values obtained from 3.055.500 ha net area which has been put into operation of the beginning of 1999, are given in Table 3.

Given that the Gross Domestic Product (GDP) of the year 1998 is 204 billion US$ (B$), the Gross Added Value of the water in irrigation would represent 5.995 million US$ (M$). Accordingly, the production of per m^3 of water is about 0.21 $.

The productivity of the water in irrigation is given below:

- The added value of the water destined to irrigation is corresponds to 3 percent of the GDP Turkey.
- For the year of 1998 it represents approximately, $5,995 million
- The production of $1m^3$ of water destined to irrigation corresponds to $0.21.

Table 2: Agricultural area constructed and put into operation by DSI and the corresponding years.

At the beginning of year	Surface irrigation (ha)	Groundwater Irrigation (ha)	Total (ha)
1980	828 934	171 640	1 000 574
1981	866 071	185285	1 051 356
1982	904 260	212 780	1 117 040
1983	950 380	231 605	1 181 985
1984	1 012 780	252 285	1 265 065
1985	1 107 360	263 510	1 370 870
1986	1 186 550	271 095	1 457 645
1987	1 230 390	277 045	1 507 435
1988	1 254 695	281 535	1 536 230
1989	1 307 318	289 855	1 597 173
1990	1 327 650	298 520	1 626 170
1991	1 375 789	312 105	1 687 894
1992	1 407 443	315 285	1 722 728
1993	1 454 849	336 130	1 790 979
1994	1 488 646	343 360	1 832 006
1995	1 542 525	355 325	1 897 850
1996	1 612 206	367 170	1 979 376
1997	1 663 574	394 574	2 058 148
1998	1 751 891	412 429	2 164 320
1999	1 833 238	422 465	2255 703

Table 3: Gross Agricultural Produc (GAP) obtained the areas irrigated by DSI, GDRS in 1998, with the prevailing prices of 1998.

Currently irrigated area	Production value			GAP		
	Without project	With project	Increase with project	Without project	With pproject	Increase with project
(ha)	(10^6)	(10^6)	(10^6)	(10^6)	(10^6)	(10^6)
3 055 500	2 093	8 038	6 215	1 491	7 486	5 995
Average (per ha)	685	2 719	2 034	488	2 450	1 962

6. BENEFITS OF WATER IN HYDRAULIC ENERGY GERERAGION

In parallel with rapid economic development and industrialization, a considerable rise is observed in the use of electricity. Use of electrical energy rose from 23.275 GWh in 1980 to 112.200 GWh of 1998, indicating an annual increase of 380% in 18 years as shown in Table 4. Despite this increase, per capita electricity consumption is 1.750 kWh, which is far less than average consumption of 5.000 kWh for the developed countries. On the other hand, it is seen that the share of hydroelectric energy in total energy projects fell from 49% in 1980 down to 33% in 1998. Development of power generation in Turkey is given in Table 4 below.

Table 4: Electric power generation in Turkey

Year	Thermal		Hydraulic		Total
	(GWh)	(%)	(GWh)	(%)	(GWh)
1980	11 927	51	11 348	49	23 275
1985	22 174	65	12 045	35	34 219
1990	34 395	60	23 148	40	57 543
1995	50 706	58	35 541	42	86 247
1998	75 124	67	37 076	33	112 200
2000	99 200	71	39 700	29	138 900

According to the evaluations of water resources in Turkey, hydro-electric energy generation takes an important part beside the energy generation from other resources. So far in Turkey, for the purpose of hydro-electric energy generation 485 projects have been developed. As of the beginning of 1999, 104 power plants have been constructed, 37 power plants are under construction and the other 344 power plants are at various project stages. As of 1998, hydro-electric energy production corresponds to 33% of total electrical energy production in Turkey.

Before the explanation of the economic valuation of the hydropower, it has to be emphasized that has an important technical characteristic of absolute flexibility which permits to adapt itself in a continuous form to the variations o the demand, assuring the fruquency and power at the same time that they provide the rolling load necessary to make good the defects that could be produced in other power stations of the system. This is taken into account in the whole sale market by way of the retribution of these comlementary services.

The average production of hydraulic energy is about 37.079 GWh per year. The benefit of hydro-electric energy production at the beginning of 1999 of the country are given Table 5, according to the prevailing prices of 1998.

It is estimated that the energy benefit per kWh is about $ 0.06/kWh. In total, a direct production have been obtained of $ 2.225 M/year. If we also consider flexibility and continuity of the production, its compensations and others complements, the valuation of the productivity of the water in hydropower increases to US $ 0.09 per kWh. In this case the total production of water in hydropower becomes about $ 3.337 M per year.

Table 5: The selling price of hydro-electric energy generation obtained from existing power plants in 1998.

Hydro-electric Power Plant		**Unit Price**	**Total selling price**
Installed Capacity	**Energy**		
(1)	**(2)**	**(3)**	**(4) = (2)* (3)**
(MW)	(GWyear)	(US$/kWh)	(US$ mi.)
10 215	37 079	9	3 337

When 60 % of this benefit is taken as GAV, the contribution provided by hydro-electric energy production is determined as 2.002 B$. This value corresponds to 1.0 percent of the GDP of the country.

7. BENEFITS OF WATER IN DOMESTIC AND INDUSTRIAL USES

As it is given Table 1, according to today's conditions in domestic and industrial sectors, 9 billion m^3 water is being consumed per year.

With relation to the water supply for domestic uses, the actual demand is about 5.600 hm^3/year. This value includes the municipal services and supply to the small industries that are connected to the municipal network, which can reach of up to 15 % of the total demand. This amount of water also includes the tourism water needs that are occurring mostly in summer time because of about 10 million visitors coming.

According to Law No. 1053, DSI has to develope, domestic water supply projects for cities having populations of more than 100.000 for the long term. So far in Turkey, by means of the project developed by DSI, domestic water is being supplied to 12 cities. With the projects under construction, domestic water will be provided to 10 cities. In completion of these projects, 1.113 billion m^3 water will be provided. Therefore, at full development, domestic water supply will reach 2.77 billion m^3 per year.

Out of the total domestic water requirement, 5.600 hm^3/year, approximately 35% proceeds from ground water. The mean prices of the water have increased during recent years, due to the inclusion in the value of the water of all the costs of production, and the costs of wast water treatments. The unit price of water oscillate between $ 0.50 and 1.25 for different part of the country and in some of the large cities. So, it can be estimated that the price for water supply is $0.75/$m^3$ for the 5.600 hm^3/year, that is to say some $4.200 million per year.

The benefit of domestic and industrial water production at the beginning of 1999 in Turkey are given in Table 6, according to the prevailing prices of 1998.

When 70 % of this benefit is taken as GAV, the contribution provided from domestic water production is determined as $2.940 B which corresponds to 1.5 percent of the GDP of the country.

The actual demands of water supply industrial uses are of 2.500 hm^3/year. The productivity of water in several sectors oscillates between $ 1.0 and 3.0/m^3. It can be estimated that the GAV for the 2.500 hm^3/year. So production of industrial water is about $ 3.750 M per year for the industrial uses.

When 70% of this benefit is taken as GAV, the contribution provided from domestic water production is determined as $ 2.625 MB which corresponds to 1.3 percent of the GDP of the country.

As for the other sectors with economic valuation of the productivity of the water, it is possible to quote the refrigeration of the thermal stations, the fishing and the recreative use of reservoirs and other recreative uses. The consuming and non-consuming demands are about 1.400 hm^3/year. And this activity is one of

the most productive per m^3 used. Nevertheless, there do not exist general evaluations of this productivity, for which it has been estimated with conservative valuations, a value between that of the irrigation and that of the water supply, of some \$0.45 /m^3. For these uses, production of refrigaregion water is about Ş630 M.

When 70% of this benefit is taken as GAV, the contribution provided from domestic water production is determined as \$ 441 MB which corresponds to 0.2 percent of the GDP of the century.

The sum up, Table 7 shows the economic value of the water which can be estimated about \$14.124 M per year, that is to say nearly 6.8% of the GAV. That signifies a mean value of the water for the different uses of \$0.10 /m^3 and \$0.38 /m^3 for the exception of hydraulic energy production.

Table 6: The selling price for domestic and industrial water supply in 1998.

Water Produced			Unit Price	Total Selling price
Year	Sector	Amount	(US\$/m^3)	(Billion US\$)
(1)	(2)	(3)	(4)	(5) = (3) * (4)
-	-	(Billion m^3/year)	(US\$/m^3)	(Million US\$)
1998	Domestic uses	5.6	0.75	4 200
1998	Industrial uses	2.5	1.50	3 750
1998	Refrigeration	1.40	1.50	2 100
TOPLAM				**10 050**

Table 11: Gross Added Value of water in 1998.

Sector	Consumed water	Value		GAV
	(hm^3/year)	(M$/year)	($/m^3$)	(%)
(1)	(2)	(3)	(4)	(4)
Irrigation	28 050	28 015	0,21	3,00
Water supply	5 600	5 600	0,53	1,50
Water for industrial uses	2 500	2 500	1,05	1,30
Hydropower	110 000	110 000	0,02	1,00
Refrigeration	1 400	1 400	0,32	0,02
TOPLAM	**147 550**	**14 124**	**Mean : 0,10**	**6,82**

If hydropower is excluded, mean added value of water would be about 0.38 $ per m^3 .

8. CONCLUSIONS AND RECOMMENDATION

- According to some estimations, world population might reach 12 billion in the next 50 years. With respect to this, water is becoming more important in provision of agricultural production and meeting the other requirements.
- The income corresponding to unit area is increasing with changing rates, at least two times, and therefore the security and sustainability is provided.
- Since 1971, while energy demand has increased with the rate of 70 % in the world it has increased 10 times in Turkey. It is estimated that, in coming years energy demand will increase 2 % in worldwide, 8 to 10 % in Turkey from year to year. In order to meet these demands, hydro-electric power plants development has a great importance with respect to providing sustainable and firm energy.
- Turkey has a great potential of water resources in the region. Taking into consideration the fact that water is an economic good, evaluation of these resources has a special importance for meeting the

region's demands and for providing sustainable development supported by rational projects.

- It is inevitable to construct dams so as to regulate unevenly distribution of flows according to place and time depending on climatic condition of the country for the aware of meeting demands, sediment movement prevention, flood protection and recreation.

- Development of water related projects having the objectives of agriculture, hydro-electric energy generation, domestic and industrial water supply, employment opportunity for approximately 4.5 million persons has been provided, and $ 14.124 M GAV will be provided as an income to the economy. This value corresponds to 6.8 percent of the GDP of the country.

- In consideration with indirect effects occuring as a result of these developments, more increase in employment opportunity extencive development of economy will be realized.

- By means of water - based agricultural projects, the rural areas' social, economical and cultural developments will be provided. Immigration will be prevented and therefore, there will not be a significant change in rural and urban population distribution which is currently 35 to 65 %.

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SOUTHEASTERN ANATOLIA PROJECT
REGIONAL DEVELOPMENT ADMINISTRATION

ADRESS: Willy Brandt Sokak, No: 5 06680 Çankaya - ANKARA - TURKEY Tel: (90.312) 442 23 24 Fax: (90.312) 440 13 84
REGIONAL DIRECTORATE: Şanlıurfa Tüneli Çıkış Ağzı, P.K. 155 ŞANLIURFA - TURKEY Tel: (90.414) 314 17 50 Fax: (90.414) 313 50 73
E-mail: gap-x@gap.gov.tr internet: www.gap.gov.tr

Afşaroğlu Matbaası • 425 22 44 - ANKARA