GAP - A CASE STUDY OF THE SOUTHEASTERN ANATOLIAN PROJECT OF TURKEY

by

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Abstract

The objective of this thesis is to investigate and analyze the history, current status, planning and construction phases, organizational structure, schedule, and the management of GAP, an integrated regional development program in southeastern Turkey.

The first part of the thesis discusses the history, scope of work, current status, and objectives of the program, followed by cashflow projections. Also included in this section is an analysis of the results of the cashflow projections and payback period calculations for each part of the program. The next section critiques and provides insight as to issues that are not directly related to construction, but are as important, such as the environmental effects, infrastructure and residential development, and social changes related to water resources development projects.

Finally, the construction part of the project is analyzed from the organizational structure, management control, and schedule perspectives. This portion of the thesis also includes recommended alternative systems as well as modifications to the existing ones. The conclusion summarizes the principals discussed above and results of the analyses.

Thesis Supervisor: Charles H. Helliwell, Jr.

Title: Senior Lecturer, Center for Construction Research and Education.

DEDICATION

To my mother

Acknowledgments

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CHAPTER 1

INTRODUCTION

Water resources exploitation has been regarded as one way of initiating regional economic development in many countries since the start of the century. Two of the most successful examples would be: (i) the western USA in the 1930s, where the program created employment and subsequently settlement and development in the region, (ii) in India, providing food and infrastructure for the people, following British colonization in the 19th century. The methodology for major "water resources utilization" projects has improved since the beginning of the century through including environmental studies as well as social studies into planning, in addition to economic studies. This fact proves that, water resources development cannot be carried out by engineers only. Inputs of other expertise especially in management (project and development), and planning (economic, environmental, construction and social) fields are also necessary. (Stephenson & Peterson, 1991).

A project being planned for "water resources management and development" usually has two main dimensions: irrigation and energy.

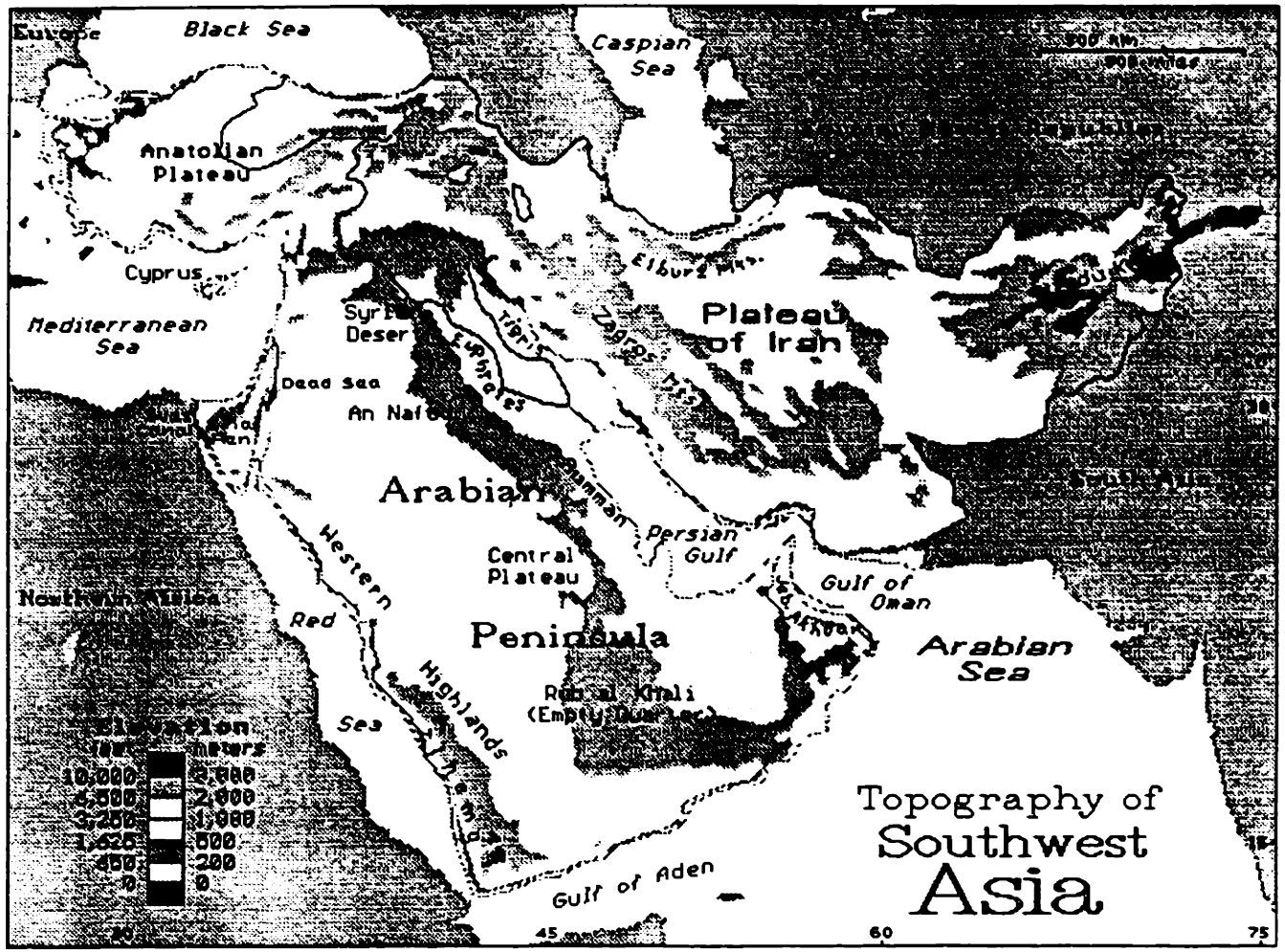
Throughout the history, many civilizations developed on the basis of irrigation (Egypt, Mesopotamia, China and more recently North America and India). Recent data from Stephenson and Peterson, however indicate that, the financial return of some irrigation schemes is only 15-30% of those predicted. One of the causes for this high deviation can be inappropriate engineering, but the main reason, most probably, is incorrect projections, in other words: poor planning. Planning of an irrigation scheme requires detailed examination of various data such as soil classifications, weather and geographic conditions, previous use of water, ownership issues, social and political attitudes, economies of scale, crop suitability, marketing, human resources, and financing alternatives.

Energy production from water resources would be through hydroelectric power plants. A developing country could use cheap energy to support its industrial

development. Some of the reasons that encourage developing countries to invest in and build dams, tunnels, and power stations to produce electrical energy is: (i) it is a lot cheaper than importing (Stephenson and Peterson, 1991), and most nations do not want to be dependent on other countries, (ii) the construction period and afterwards the development creates employment. An important advantage of hydroelectric power plants over other alternatives, such as thermic power plants is that, it is easier and faster to adjust the productivity to demand changes by turning the turbines on and off (G. Aykut, 1994). These demand changes are mostly caused by temporary economic condition changes in developing countries, due to economic and political instability.

Traditionally, water-storage reservoirs to capture water in order to produce energy and irrigation have been provided by constructing dams across deep-river canyons or natural basins that have sufficient runoff from their watersheds to fill these reservoirs. Dams in such locations will always be required. Some dams, on the other hand, are also constructed on natural storage basins that do not have sufficient runoff to fill the reservoirs. These dams cannot be considered feasible. But owners may still decide to build them due to lack of alternatives because of social, environmental, and location factors (Parker, 1971).

Dams may be any combination of concrete, earth, or rockfill. The oldest water structure (parts of a small earth-rockfill dam) was found in Burdur in southern Turkey, and is estimated to be constructed before 5500 BC (Turfan, 1988). The first regulations about water (as a section of Hammurabi Laws, BC 1700), were established in ancient Mesopotamia (Middle East), in order to control and plan the usage of Euphrates and Tigris waters (Map 1.1), that were captured by structures built around BC 3000 (Turfan, 1988). The same river, Euphrates, one of the twin rivers that define the ancient Mesopotamia Basin, ran dry in January 1990 when Turkey turned off the flow to accelerate the filling of Ataturk Dam's reservoir. Ataturk -the fourth largest earthfill dam in the world- is the centerpiece of Turkey's Southeast Anatolia Regional Development Project, known by its Turkish acronym: GAP. The scheme in the Tigris and Euphrates river basins includes 22 dams and 19 hydroelectric power plants, water tunnels, thousands of miles of irrigation canals, roads, airports and urban improvements, costing approximately



Map 1.1. Anatolian Plateau, Euphrates, and Tigris

(Source: Electromap, Inc., 1992)

US$ 29 billion to the Turkish government (ENR 6/25/87, ENR 2/1/90, Dunya 10/9/1994). This thesis, in five chapters, is a study of GAP.

In Chapter 2, I concentrate on the GAP scope of work, and the planning phase and the factors that affected this phase, criticizing and commenting on some of the actions taken by the planners, and projecting the economic outcomes and feasibility of construction of the project. In Chapter 3, I describe and comment on the four most important issues other than construction, namely the environmental, and social effects of GAP, the GAP-Industry-Private Sector relationships and expectations, and the infrastructure development in the Region. Chapter 4 is a study of implementation of GAP's construction phase; explaining, analyzing, and suggesting changes in the organizational structure and the parties involved, the control system, the information flow, the management contract and methods, and the schedule of the Project. Conclusions are set forth in Chapter 5.

CHAPTER 2

PLANNING OF GAP

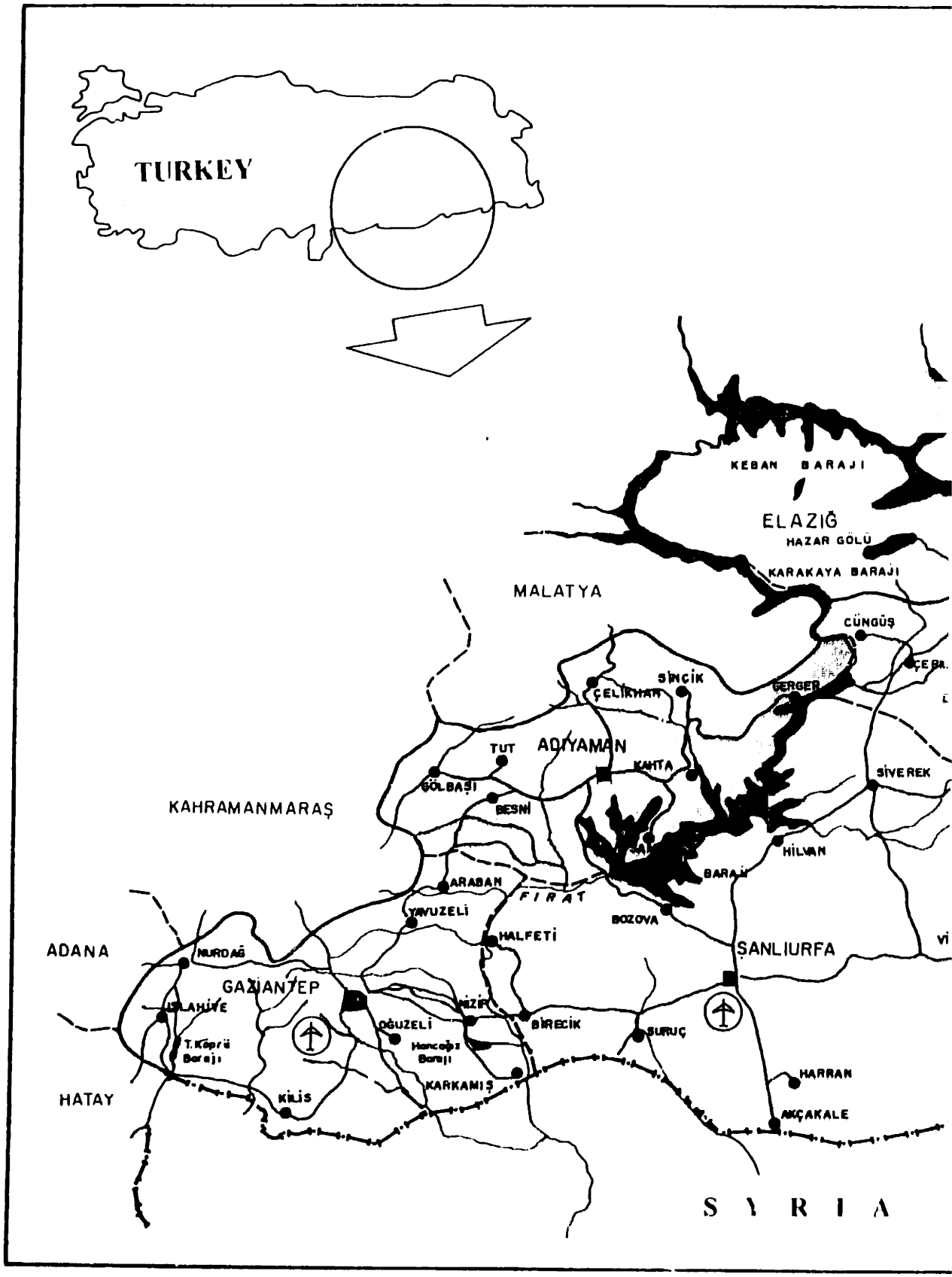
Planning is a process, a systematic way of investigating a problem. It consists of managing information, acquiring information, evaluating it, and analyzing it and then making decisions. Planning is also a systematic study of alternative solutions to a problem or need (in GAP case, the need is development for the GAP region), including the costs, benefits, and adverse impacts of the alternatives, and selection of the best plan (Stephenson & Peterson, 1991). In this chapter, I will try to explain, criticize and comment on the planning path and the factors that affected this phase in the Southeastern Anatolian Project of Turkey.

2.1. GAP and a Comparison of GAP Region and Turkey as a Whole

The Southeastern Anatolian Project (GAP) Region (the Region) is defined as the jurisdictions of eight provinces : viz. Adiyaman, Batman, Diyarbakir, Gaziantep, Mardin, Siirt, Sanliurfa and Sirnak (Map 2.1). Two large rivers, Euphrates and Tigris, in this region have been flowing unused and uncontrolled through Anatolia (Asian side of Turkey), Syria, and Iraq for centuries (considering that there has been civilization in Middle east for more than 4000 years) either flooding the area, mostly in Syria, or causing drought. To regulate the water flow for the preservation of water, which has become the most precious source in Middle East, to produce more electricity, and to irrigate arid land, the Southeastern Anatolian Project (GAP), a massive dams project due for completion in 2005, was planned by the Directorate of State Hydraulic Works (DSI) starting in early 1960s (G. Ramazanoglu).

DSI has an admirable record of building dams in Turkey. So far they oversaw the construction of 334 dams, the design of 132 dams, and the planning of 24 more dams including completed parts of GAP (Statistical Year Books of Turkey 1985, 1987, 1990).

GAP was planned to increase hydroelectric power production in Turkey by 50%


TURKEY
KEBAN BARAJI
ELAZIĞ
HAZAR GÖLÜ
KARAKAYA BARAJI
MALATYA
CÜNGÜŞ
SİNCİK
ÇELİKHAN
GERGER
TUT
ADIYAMAN
KAHTA
SİVEREK
GÖLBAŞI
BESNİ
KAHRAMANMARAŞ
HİLVAN
BARAJI
ARABAN
FIRAT
YAVUZELİ
BOZOVA
HALFETİ
ADANA
NURDAĞ
ŞANLIURFA
GAZİANTEP
İSLAHİYE
NİZİP
OĞUZELİ
BİRECİK
SURUÇ
T.Köprü Barajı
Hancağız Barajı
KARKAMIŞ
HARRAN
HATAY
KİLİS
AKÇAKALE
S Y R I A

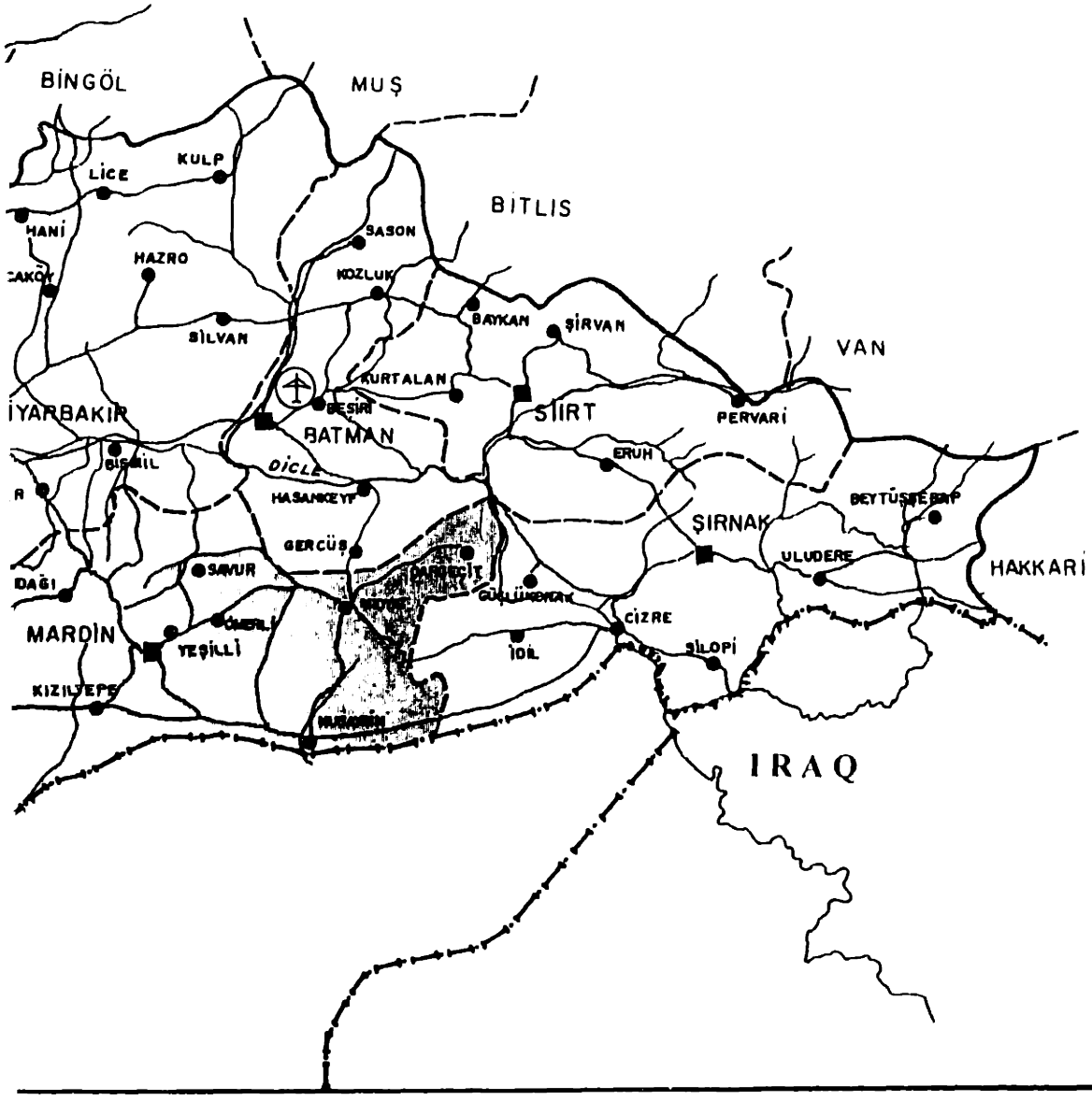
1/1 650

REGION

National Border - - - - - - -

GAP Region Border ----------

Province Border -- -- -- -- -- --



until the year 2025 and by this, bring to the people in the Region new opportunities in employment, and a better living standard (Stevens-Yurur). Figure 2.1 shows the contribution of various sources, to Turkey's energy consumption by the year 1991. During the first five months of 1993; hydroelectric power plants accounted for 47% of the total electricity output, compared with 29% from stations burning lignite, 15% from natural gas, 8% from fuel oil, and 2% from stations which burn hard coal (EIU, 1994).

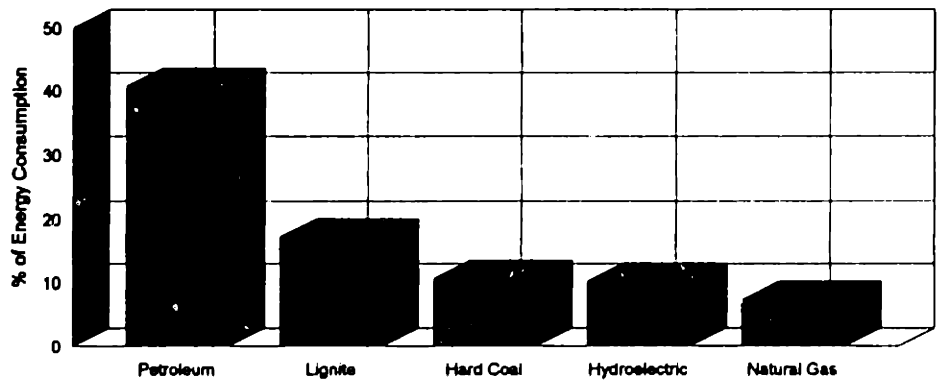
Turkey, exporting electricity (mostly produced by hydroelectric power plants), to some of its neighbors by the year 1994, decided years ago in the 1960s, that the anticipated benefits would make the investments into GAP worth it. Figure 2.2 proves that this projection was correct. More than 50% of construction of GAP projects were completed between the years 1980-1992 and the total electricity production of Turkey has increased by 187% at the end of this period. In addition to the energy benefits of the power plants, approximately 1.8 million hectares of land was planned to be made available for irrigated cultivation (GAP Final Master Plan Report).

GAP region occupies the southeastern part of Turkey bordering on Syria to the south and Iraq to the southeast, covering a land area of 75,358 km2 (29,096 sq miles), and corresponding to 9.7% of the total national land area (Map 2.1).

The total population in the GAP region at the 1992 census was 5,158,013, accounting for 9.1% of a national total of 56,473,035, which is expected to reach 66 million by the year 2000 (EIU ,1994). In all eight provinces in the Region, out-migration is a significant fact. People are leaving the Region in order to find jobs and live in large cities. The reason for this large out-migration is the low level of income, terrorism, and the harsh geographic nature of the Region (especially the winters are very tough, closing most of the roads, damaging communication systems, and threfore reducing the overall productivity rate of the people and businesses). Still, the population growth in this part of the country is relatively high because families usually have at least four children in order to be able to take care of the farms. The annual growth of the Region's population has been 3.48% in the past half decade (GAP Final Master Plan Report and 1992 Status Report), much higher than the national average of 2.17% (EIU, 1994).

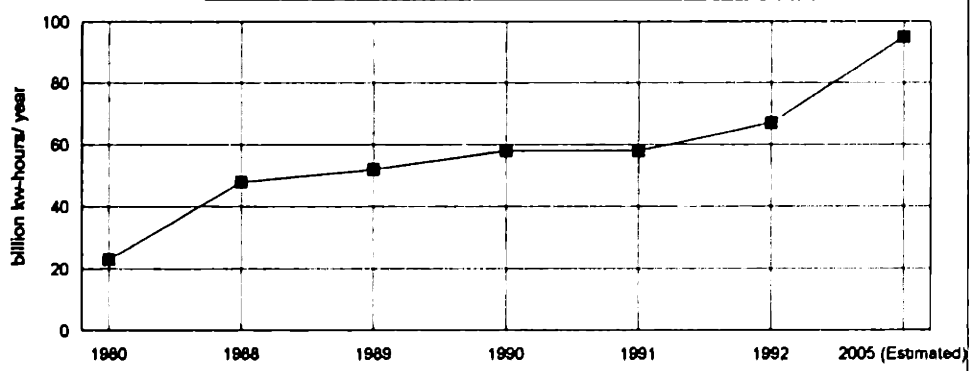
The GAP region is one of less developed regions in Turkey, with a 1985 per

Figure 2.1. Contribution of various sources to energy consumption of Turkey by 1991



Source: EIU, 1994

Figure 2.2. Turkey's total energy production between 1980-2005



Source: EIU, 1994

capita production of only 47% of the domestic per capita production of Turkey as a whole. However, the Region has attained self-sufficiency in basic foodstuffs and is even a significant producer of some of the nation's major agricultural products: wheat, barley, lentils, cotton, sesame, pistachio, pomegranate, grapes, vegetables, milk and meat.

The major socio-economic indices of the GAP region are compared with the indices of Turkey as a whole in Table 2.1.

The basic conclusion that can be obtained from these ratios using rounded numbers is:

- *1 Man living in the REST of Turkey produces 2.3 Units.*
- *1 Man living in the GAP region produces 1 Unit.*

Above mentioned facts describe the productivity of the people living in the GAP region. Therefore, GAP is planned to increase the per capita gross domestic production (GDP) of the Region to the nation's average (GAP Final Master Plan Report).

A Master Plan has been prepared and published in June 1992 (latest edition) by a consortium of two private companies, namely Nippon Koei Co. Ltd (Japan), and Yuksel Proje A.S. (Turkey) and the Turkish government. This Master Plan dictates the development objectives and strategy in the Region, in detail.

2.2. Development Objectives and Strategy

Stephenson and Peterson state that, if it is accepted, that orderly development must take place within a national framework, then a national policy must be developed. Therefore, four levels should be observed in planning of large scale water resources development projects, namely; national, departmental (environment, agriculture, forestry, water and other national resources, education and training, urban and rural infrastructure eg. water, electricity, communications and security, and trade and industry), regional, and project.

The expected impacts of the GAP on the Region and on all parts of Turkey are

INDEX	UNIT	TURKEY	GAP	TURKEY/GAP
Land Area	km2	779,452	75,358	10
Total Population (1990)	persons	56,473,035	5,158,013	11
Population Density (1990)	person/km2	72	68	
Population Growth (1985-1990)	%/ year	2.17	3.48	
Urban Population	%	59	56	
GNP (1990)	billion US$	$152	$6	25
Per Capita GNP (1990)	US$/person	$2,692	$1,179	2.3

TABLE 2.1. Comparison of the GAP Region and Turkey as a whole by selected indices (Source: Statistical Year Books of Turkey 1985, 1987, 1990)

very high, since both the area and the population are approximately 10% of Turkey as a whole. Every investment done into the Region will reduce the available financial resources for investments in other parts of Turkey. But, at the same time, every bit of increase in the Region's GDP will increase the GDP of all Turkey and will contribute to the national development. The state is very much aware of this importance of GAP, thus there is even a Minister of State in charge of GAP: Mr. Baki Atac in 1994. Planning, and the activities in the GAP region have the highest priority in Turkey. Benefits of the completed portion[1] of the planned construction investments, other than the expected energy and irrigation benefits, can be already observed. For example: the price of land has already started increasing, less people are leaving the Region, terrorist activities have decreased, two cities became provinces (Sirnak and Batman: whether this is a result of the development or an action taken as a step within the development plan can be discussed, most probably both), and more touristic activity in the Region are indicating a come-back. Although these examples are signs of a development, the following three important facts remain:

1. The largest investments in Turkey's history are being made in the Region, effecting the economy of the country, by being one of the reasons that cause temporary economic crisis every now and then (last one in April 1994), due to heavy payments made to contractors and equipment/material suppliers. Because of the unavailability of World Bank credit due to objections raised by Syria and Iraq over the volume of Euphrates waters being dammed by Turkey, the Turkish government is financing the project itself. Most of the money came from foreign bank loans and export credit agreements (G. Ramazanoglu). However, a substantial amount has been raised internally. It was a mixture of the state budget, sale of bonds, public participation through privatization of other public assets (toll bridges, toll roads, dams etc.), and additional taxes on alcohol and tobacco

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1 Completion of construction by 1992 is 50.49% (Table 2.2). This ratio has reached 56% by November 1994. Additional funds needed to reach 100% completion of the whole project (construction and development investments together) are US$ 18.9 billion (1994) (Dunya Newspaper, November 1994).

		PROJECT	COMPLETED	COMPLETE	FUNDS
		COST	1992 US$ millions	%	NEEDED
NO	PROJECT	1992 US$ millions			1993-2005
					1992 US$ millions
1	Karakaya	$2,638	$2,638	100.0%	$0
2	Lower Euprates	$7,188	$5,693	79.2%	$0
3	Birecik	$450	$0	0.0%	$450
4	Suruc-Baziki	$361	$0	0.0%	$361
5	Adiyaman-Kahta	$507	$12	2.3%	$483
6	Adiyaman-Goksu	$575	$0	0.0%	$575
7	Gaziantep	$371	$73	19.8%	$283
8	Dicle-Kralkizi	$1,294	$185	14.3%	$957
9	Batman	$482	$67	14.0%	$353
10	Batman-Silvan	$1,069	$0	0.0%	$1,069
11	Garzan	$606	$14	2.3%	$593
12	Ilisu	$786	$0	0.0%	$786
13	Cizre	$868	$0	0.0%	$868
	TOTAL	[illegible]	[illegible]	[illegible]	[illegible]

TABLE 2.2. GAP Projects completion percentages by the end of 1992. (Source: The Status Report, 1993)

products (G. Ramazanoglu). In the early 1980s, the government introduced revenue sharing certificates of assets, such as the Bosphorus Bridge, and the Keban and Oymapinar dams, in order to finance infrastructure projects in the GAP region. But falling returns reduced the demand for these instruments and no new ones have been issued in the 1990s. Legislation for privatization of the State Telecommunication Works (PTT) has passed in 1994. PTT is one of the most profitable public enterprises in the country, which will probably be privatized within the next couple of years.

2. The Region is economically and socially underdeveloped (GAP Final Master Plan Report), because government efforts to link the private sector investments into this region have been unsuccessful in the past decades. The private sector has preferred to invest into the western parts of Turkey because the geographic conditions, weather, infrastructure (transportation), the distance to Europe (Export and Import easiness) are more suitable, and most important of all: the demand for consumer goods is higher there

3. Terrorist activities exist in the Region (1992 Status Report). The solution for the problems of terrorism is closely tied to the other above mentioned two factors, since investments (agricultural, infrastructural, social, and manufacturing) would help to reduce many of the economic and social problems, which are causing terrorism in the first place. A complete solution to terrorism might require important political (both national and international) decisions, which are out side of this thesis subject

A Regional Plan has been established by the government in order to use the potential available financial resources, to help the Region through investments into agriculture, manufacturing, infrastructure, and social development. It is a five year public investment plan called "The Action Plan". This plan defines investments by time and place and answers these questions: What? Where? When? By whom? and How much should be done. The following objectives for the Region's development have been set on the basis of national development objectives and on the analysis of present conditions, available resources, and economic constraints (The Action Plan and GAP Final Master Plan Report):

1. To raise the income level in the Region to that of other regions

by improving the economic structure.

2. To increase the quality of health and education services at least to the levels of the nation's averages.

3. To increase the productivity and employment opportunities in rural areas.

4. To contribute to the national objectives of sustained economic growth, export promotion, and social stability by efficient utilization of the Region's resources.

5. To improve the infrastructure in the Region.

6. To improve the transportation network in the Region.

7. To enhance the capacity of larger cities in the Region to attract technical personnel.

8. To be able to be self-sufficient in terms of energy production in order not to be dependent on neighboring countries: This goal is already achieved. The new objective should be to provide cheaper energy to the nation and expand the international sales.

The basic strategy adopted to reach those goals includes the following elements (The Action Plan, GAP Final Master Plan Report, and 1992 Status Report):

A. To develop and manage water and related land resources for irrigation, urban and industrial uses. To identify and promote industries of strategic importance, those that utilize locally available raw materials and labor. To establish at least one such strategic industry in each of the less developed provinces in consideration of comparative locational advantages and inter-provincial relationships.

B. To Improve the infrastructure (water works, electrical works, transportation), so that the capacity can satisfy the forecasted population growth and industrial development within the next

several decades.

- Improvement of east-west transit ways through additional lanes to existing roads.

- Construction of Gaziantep-Sanliurfa motor way (O-52). Planning of this project is going on and construction is expected to finish by 2000. Further planning is being done to expand thismotorway to Iraq over the provice of Diyarbakir (Ergelen, 1993).

- To establish access over Ataturk Dam lake through construction of a railroad/ motor way bridge.

- Construction of additional airports (an international airport).

- Renovation of existing roads.

C. To improve the land use by managing cropping patterns and establishing better farming practices and farm management.

D. To provide better social services (education, health, arts: the Region is considered to be an open air museum since people have been living there for over 2000 years) in order to meet the requirements of local people and to attract technical and administrative staff to come and stay in the Region. A boarding school system is suggested in order to cope with the problems occurring due to uncentralized residential areas. Construction of Harran University facilities in addition to existing universities in the Region. Systematic growth of residential areas should be encouraged.

E. To promote manufacturing industry with emphasis on agro-related ones and those based on indigenous resources.

F. To encourage the local entrepreneurs through the provision of credit, information and technical supports. To establish (by Turkish government) a private or public agency to provide consulting and

support to private sector. Planned functions and purpose of this organization is explained in 3.2. GAP, Industry and Expectations of the Private Sector.

2.3. Development Areas and Priority Projects

GAP consists of three major projects and ten smaller ones. Following is a summary of the projects that all together constitute GAP. Names, locations, capacities, estimated completion dates and funds have changed since the 1960s (initial planning), but this is the updated plan. Completion percentages of those projects are given in Table 2.2.

2.3.1. Euphrates Projects

1. Karakaya Dam and powerplant: The planned annual energy production of this project was 7.354 billion kw-hours. Today, all six units are in operation. Karakaya was the first dam to be constructed on the Euphrates within the GAP plan (second on Euphrates ever, first one was Keban Dam, 1975). Construction started on October 18, 1976. The dam was completed in 1988 and started producing energy in the same year. An article, from a daily Istanbul newspaper "Turkiye Gazetesi", in November 1994, states that the dam has paid for itself in the first four years.

2. The Lower Euphrates Basin: The area between Karakaya Dam and Ataturk Dam, Sanliurfa-Harran, Mardin-Ceylanpinar, Siverek, and the Hilvan plains possess one-third of the economical hydroelectric power potential in the GAP region and one-fifth of the irrigatable land capacity of Turkey. This project also fulfills the potable water requirements of Sanliurfa province and nearby settlements. This project has two separate sections, namely the Ataturk Dam and the Sanliurfa Irrigation Tunnels. Ataturk dam, the centerpiece of the GAP project, is the biggest of all structures ever built in Turkey and the 4th largest earthfill dam in the world (ENR, Feb.1990). A comparison of Ataturk Dam

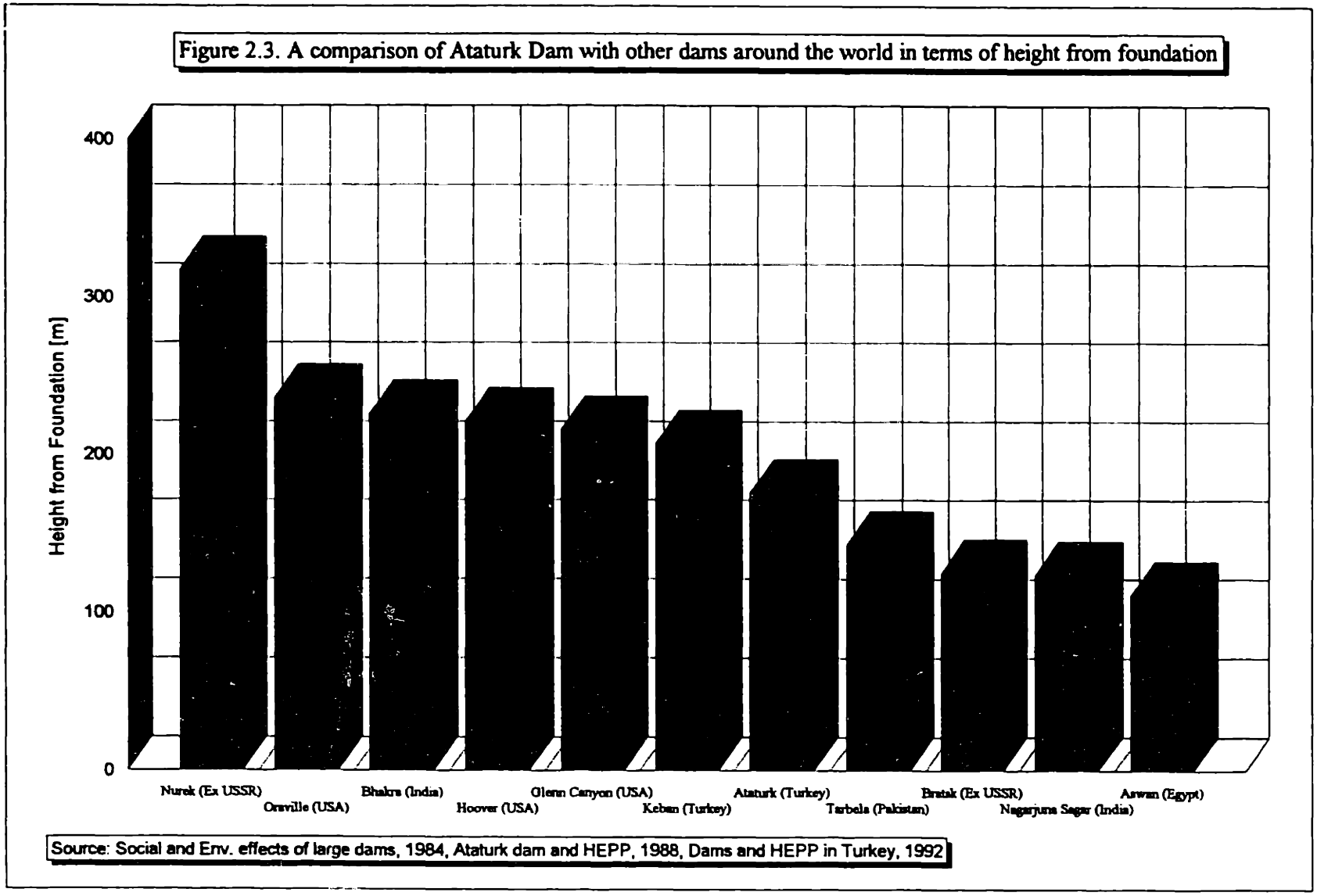
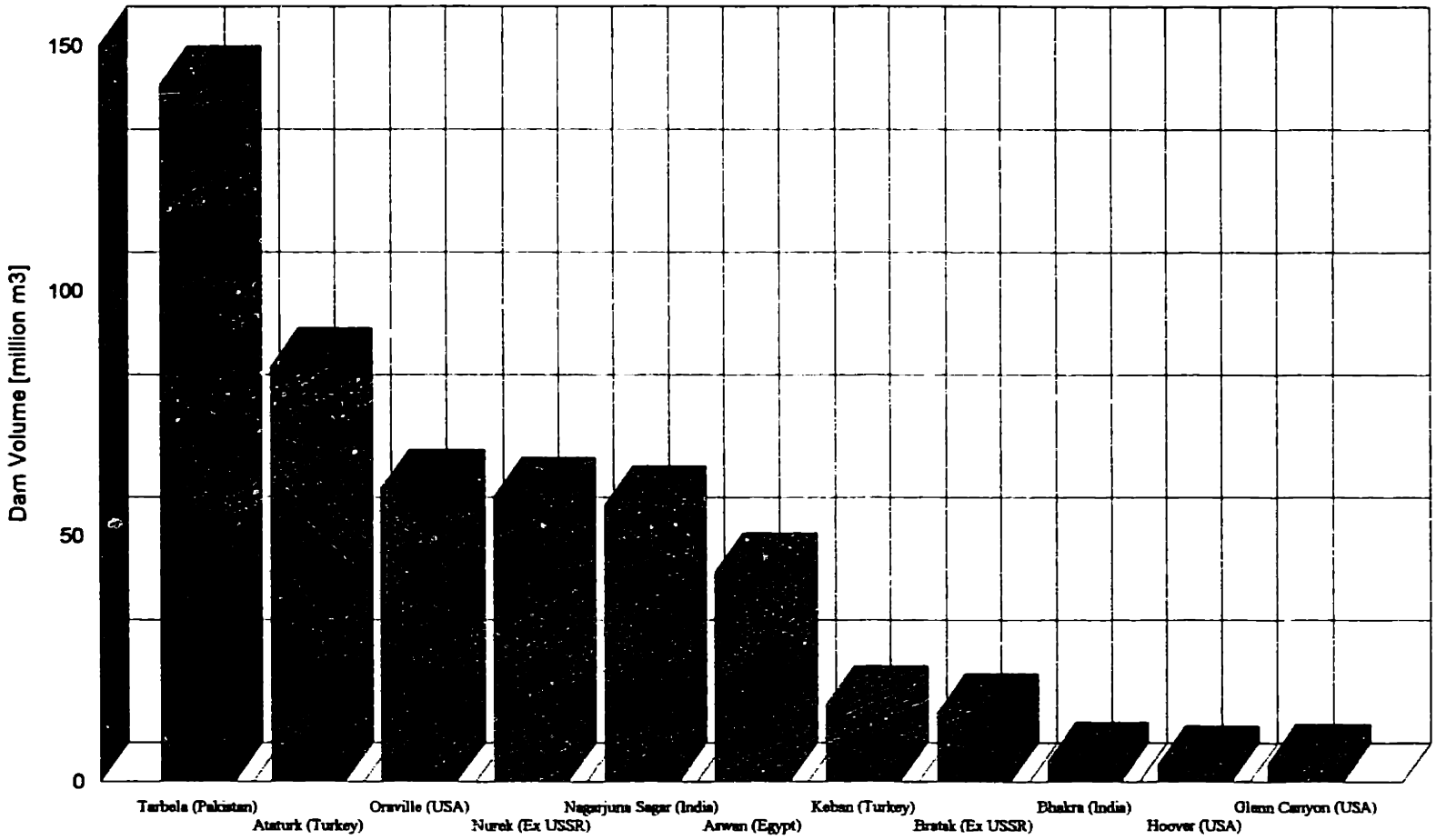


Figure 2.3. A comparison of Ataturk Dam with other dams around the world in terms of height from foundation
Height from Foundation [m]
400
300
200
100
0
Nurek (Ex USSR)
Oroville (USA)
Bhakra (India)
Hoover (USA)
Glenn Canyon (USA)
Keban (Turkey)
Ataturk (Turkey)
Tarbela (Pakistan)
Bratsk (Ex USSR)
Nagarjuna Sagar (India)
Aswan (Egypt)
Source: Social and Env. effects of large dams, 1984, Ataturk dam and HEPP, 1988, Dams and HEPP in Turkey, 1992

Figure 2.4. A comparison of Ataturk dam with other dams around the world in terms of dam volume



Sources: Social and Env. effects of large dams, 1984, Ataturk dam and HEPP, 1988, Dams and HEPP in Turkey, 1992

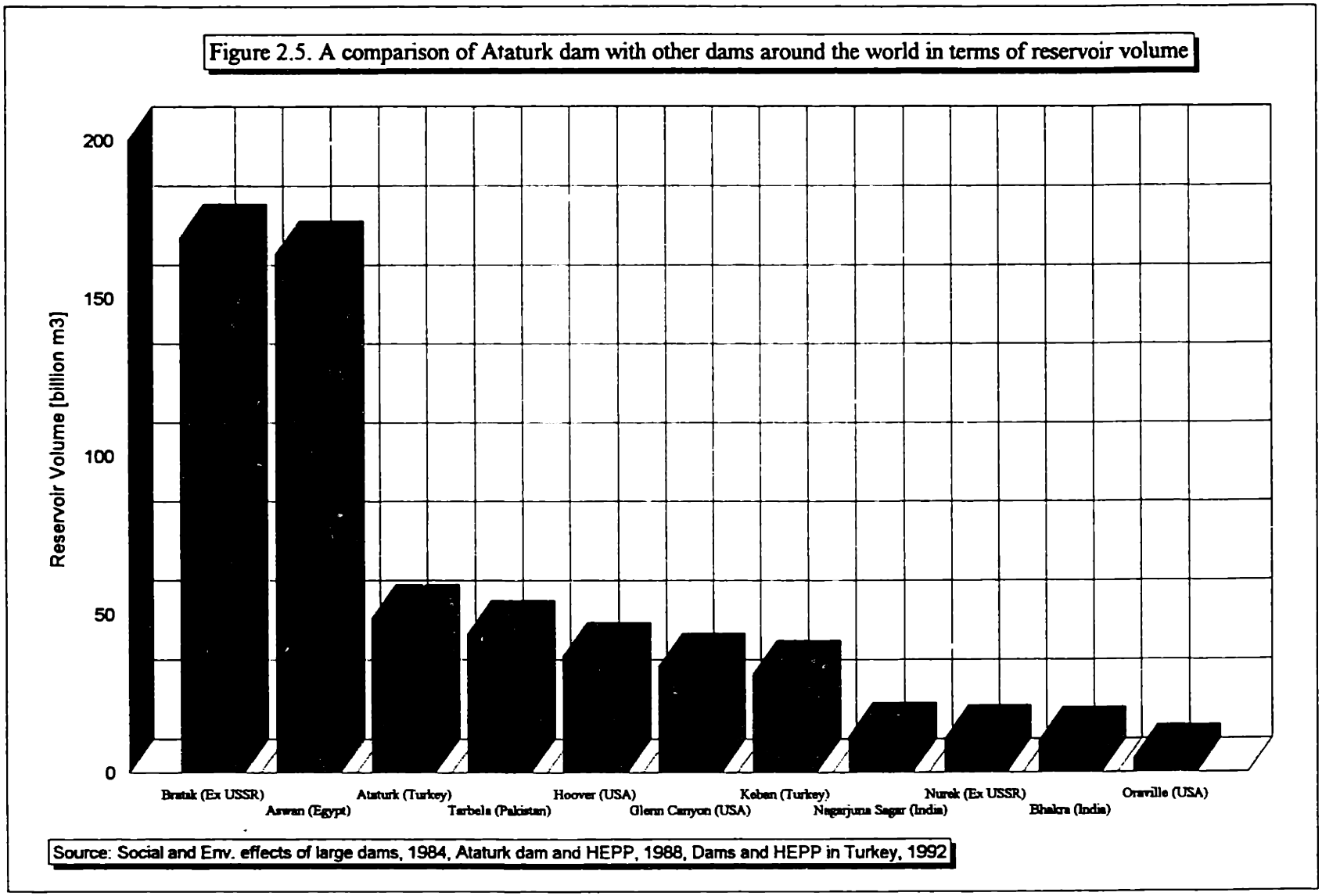
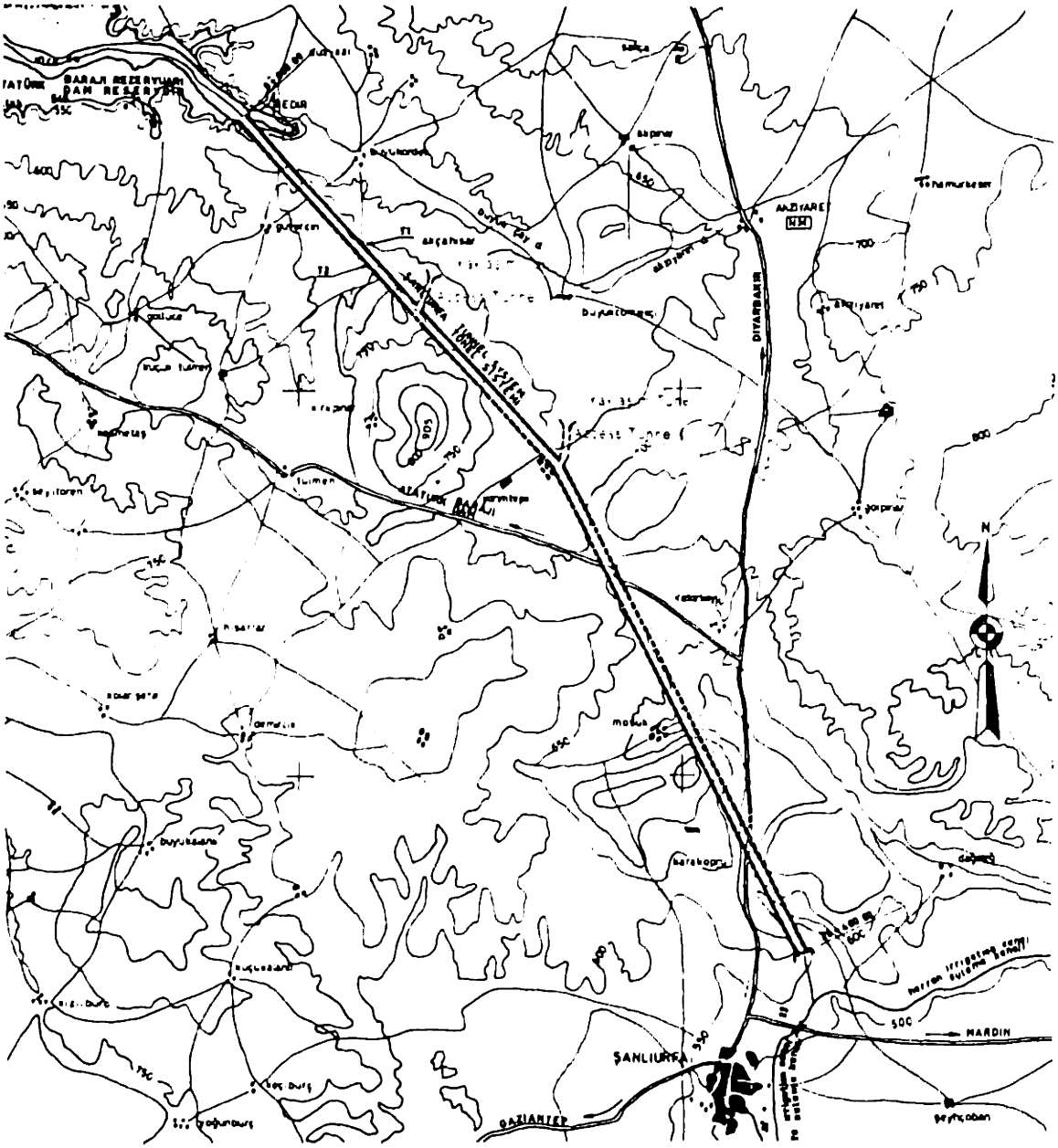


Figure 2.5. A comparison of Ataturk dam with other dams around the world in terms of reservoir volume
Reservoir Volume [billion m3]
200
150
100
50
0
Bratsk (Ex USSR)
Aswan (Egypt)
Ataturk (Turkey)
Tarbela (Pakistan)
Hoover (USA)
Glenn Canyon (USA)
Keban (Turkey)
Nagarjuna Sagar (India)
Nurek (Ex USSR)
Bhakra (India)
Oraville (USA)
Source: Social and Env. effects of large dams, 1984, Ataturk dam and HEPP, 1988, Dams and HEPP in Turkey, 1992

with other large dams around the world is shown in Figures 2.3 through 2.5. The Ataturk dam currently has a capacity of 48.7 billion cubic meters (1,705 billion cubic feet) and its eight unit power plant annual capacity is 8.9 billion kw-hours. This corresponds to approximately 2.2 billion tons of imported fuel oil per year. Ataturk dam's total concrete volume is 3.1 million m^3 (109 million cubic feet). Construction was scheduled to start on October 29, 1980, but was delayed 3 years due to a military coup in September 1980. Finally, the mobilization started on November 1983. This dam was completed in 1992, starting energy production the same year. This is the third dam built on Euphrates (second within GAP scope).

Ataturk dam also supplies irrigation water that is channeled through the twin Sanliurfa tunnels, 7.62 meters in diameter and 26.4 kilometers long (longest irrigation tunnels in the world currently). The flow is 328 m3/sec for 874,200 hectares of agricultural land. At the upstream end of the tunnels, the Sanliurfa hydroelectric plant will produce 124 million kw-hours annually. Construction of the twin tunnels (T1 and T2) started in 1977 and T1 was completed in November 1994. T1 and T2 will carry water from the Ataturk dam to one of the most fertile plains in the Middle East, namely the Harran Plain. The water will be transferred through T1 and T2 to Sanliurfa artificial pond, which is approximately 5kms away from the center of Sanliurfa province. The other end of the pond is connected to the Harran Plain through a canal. The first option for the tunnel was to construct a single, 9m diameter, tunnel. But working in a single tunnel is more inconvenient in terms of construction. Therefore, the final decision was to construct twin tunnels and open temporary channels between them every 1/2 km., so that construction could go on parallel, without having to purchase 2 sets of equipment. Construction of T1 and T2 was first bid out in 1977 and an additional tender had to be established in 1981. The construction cost of the first phase (1977 to 1980) was 81.7 million US$, and the lowest bid for the remaining construction was 313.5 million US$, in 1981. The total excavation was 2.125 million m^3 (75 million cubic feet), and 1.2 million m^3 (42 million cubic feet) concrete was used.

The priority area to be irrigated by Ataturk dam and T1, and T2 tunnels is the Harran Plain (350,740 acres= 2,000 sq miles). The irrigation network in the Harran Plain



Map 2.2. Sanliurfa Tunnels Scheme

(Source: DSI, 1987)

is 33% completed. In addition to the Harran Plain, two other areas (approx. 825,000 acres together) : Mardin and Ceylanpinar Plains, are being prepared for Euphrates waters. Construction of irrigation channel networks is also going on in these areas. Mr. Ziyaeddin Akbulut (Governor of Sanliurfa Province) stated in an interview in November 1994:

> *" We are spending a massive effort preparing the infrastructure of the town and the suburbs" (Turkiye Daily)*

First water was let to T1, early in the morning (6 am) on November 2, 1994, from the Ataturk Dam and it reached the Harran Plain at 4 pm. in the afternoon. The water that was transferred during that period is equal to what Istanbul (a city of approximately 10 million people) is receiving in two days. Dunya Newspaper stated in a research, that 3-4 harvests per year can be expected in Harran Plain, from now on. The Sanliurfa Tunnels section of the Lower Euphrates part of GAP is 96% completed by November 1994. It will be 100% completed and in full service by the end of 1995. Additional funds needed to reach 100% completion are US$ 100 million (1994).

3. Birecik and Karkamis dams and powerplants: Construction of these two projects, will be done on the BOT model. They are located within 40 kilometers of the Syrian border. The Birecik contract was awarded to a consortium of 9 companies (with a majority of German companies) including TEK (Turkish Electricity Authority, a public enterprise). Expected annual energy production from these two dams is 3.32 billion kw-hours. Construction of Birecik Dam started in May 1993 and is expected to be completed in 5.5 years. The Birecik Dam is 5 km away from the town of Birecik. Construction will be with 85% foreign funds. The contract was signed under the condition that the dam will be turned over to the Turkish Ministry of Natural Resources and Energy after 15 years of operation. Legislation for BOT projects has passed in 1994. Under this legislation, private companies are given the right to build public utilities, such as bridges, dams, motor ways, powerplants, and the like. They will be allowed to operate them for up to 49 years before handing them over to the state (EIU, 1994). The contract for the Birecik dam has the

following term to secure profit for the operating party: the electricity amount that can not be sold (within the 15 year private operation period) by the operating party, will be bought by TEK at commercial rates. Karkamis dam is the 4th dam & hydroelectric unit on the Euphrates. The dam is in the preconstruction phase.

2.3.2. Tigris Projects

4. Suruc-Baziki Project: Will irrigate 146,500 hectares of land in the area.

5. Adiyaman-Kahta Project: Will irrigate 77,409 hectares. The expected annual energy production is 400 million kw-hours.

6. Adiyaman-Goksu-Araban Project: Will irrigate 71,598 hectares.

7. Gaziantep Project: Three dams will be constructed and 90,000 hectares irrigated.

8. Dicle-Kralkizi : Two dams are under construction by two companies. The Dicle irrigation scheme covers 126,080 hectares by pumping or by gravitational flow. Expected annual energy production is 444 million kw-hours. Both of the dams are expected to be competed between 1995-1996.

9. Batman Project: Dam and irrigation project in process, will irrigate 37,744 hectares. The expected annual energy production is 483 million kw-hours. This dam is under construction and is expected to be completed in 1996.

10. Batman-Silvan Project: A power project to produce annually 1.5 billion kw-hours and irrigate 213,000 hectares. The preconstruction activities of this project are almost finished and it will be bid out in 1995.

11. Garzan Project: A power project to produce annually 315 million kw-hours and

irrigate 60,000 hectares of Garzan plain.

12. Ilisu project: About half the size of the Ataturk Dam, Ilisu will produce annually 3.83 billion kw-hours. It will be built on a BOT basis but no tender has been issued yet. It is close to the Syrian border and currently a trouble spot. An article in a daily newspaper (Dunya, November 1994) stated a tender for this project will be issued in 1995.

13. Cizre Project: Very close to the Syrian border, this is the last dam on the line, and will be built after completion of Ilisu Dam, but the tender is expected to be issued at the same time with Ilisu in 1995 (Dunya, November 1994). It will produce annually 1.208 billion kw-hours and irrigate 121,000 hectares of land, by pumping and gravitational flow.

Figure 2.6 summarizes the annual energy production capacity of dams already built or planned to be build within the GAP scope of work.

2.4. Development Scenarios and Phases

Construction of GAP is planned to finish in 2005, but in order to reach the objectives set forth in the shortest period possible, it is necessary to start the infrastructure, social, and industrial (both manufacturing and agricultural) development efforts before completion of construction. We discussed the national goals of this huge project (GAP) and the strategy formed to reach those goals in 2.2 Development Objectives and Strategy. Several scenarios have been suggested (by the State Planning Agency (DPT), to the governments) in which order to apply the necessary actions. All of the suggested scenarios are based on two main issues (Final Master Plan Report):
(i) structural changes in the Region's economy by agricultural product diversification and industrial development based on agro-industries and those utilizing indigenous resources;
(ii) more active and positive interactions between rural and urban areas with proper functional division.

These two main issues combined, form the major goals of the plan: economic

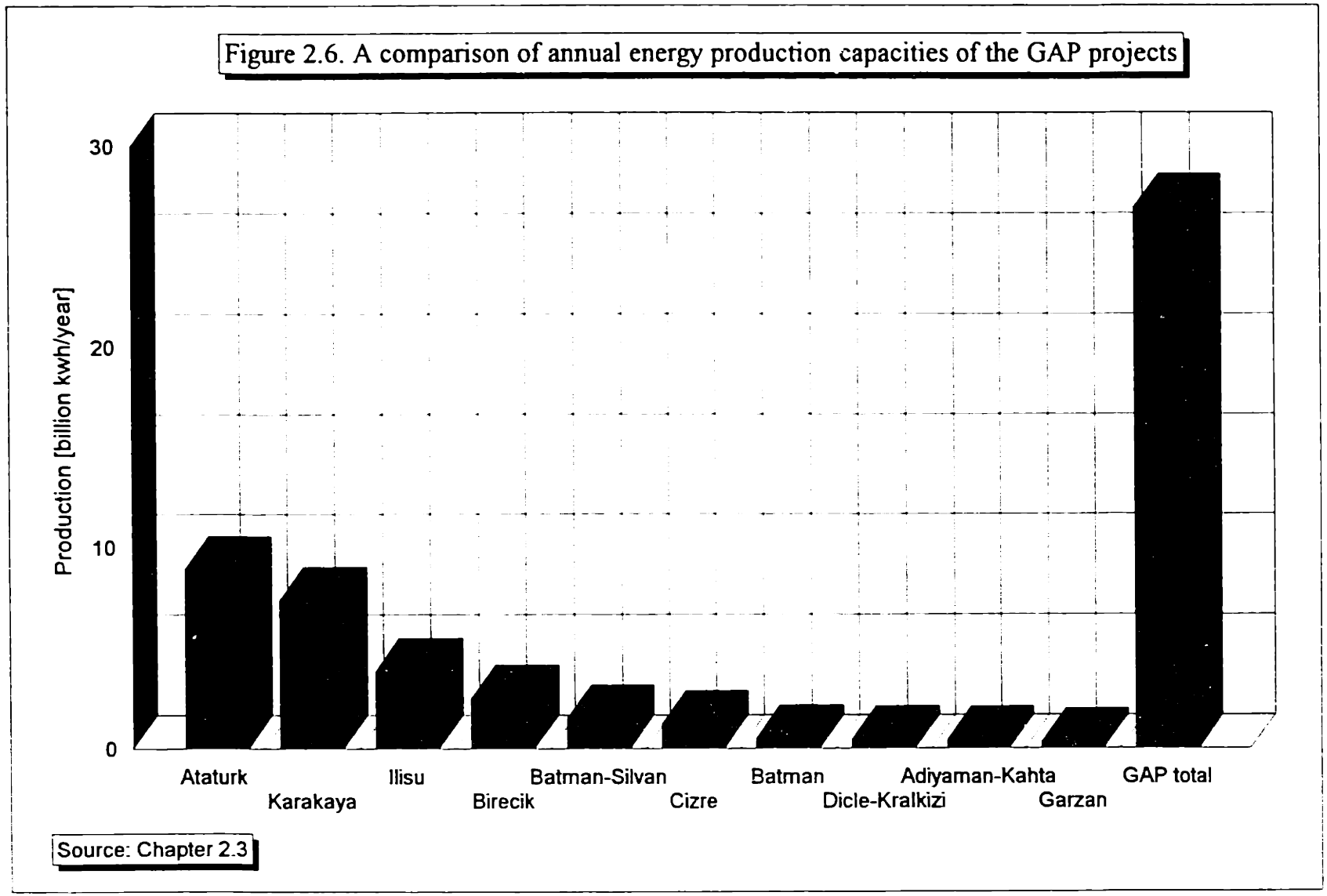


Figure 2.6. A comparison of annual energy production capacities of the GAP projects
Production [billion kwh/year]
30
20
10
0
Ataturk
Karakaya
Ilisu
Birecik
Batman-Silvan
Cizre
Batman
Dicle-Kralkizi
Adiyaman-Kahta
Garzan
GAP total
Source: Chapter 2.3

improvement, infrastructure improvement, industrial development, and improvement of social standards.

The infrastructural part of the main scenario consists of improved motor way network and central municipal areas that carry the administrative and social (health, education, arts etc.) services to all rural residential units in the Region. This part is explained in Chapter 3, in detail.

The agricultural development part is related to step-wise implementation of the irrigation schemes. The target is to attain higher productivity by higher crop intensity with proper water management and maximization of irrigation benefits and better income distribution within the Region. Agriculture consists of three main elements, namely soil, man and water. The purpose of GAP is to supply the third element to the Region.

The industrial development of the GAP Region is planned to follow the following process (GAP Final Master Plan Report):

> *1) Development of new industries of strategic importance (leather, textile, meat processing, edible oils, and tourism related) together with development of consumer goods and construction materials industries.*
>
> *2) Expansion of these strategic industries and more development of consumer goods and construction materials industries, as the income increases and the urbanization proceeds.*
>
> *3) Emergence of new industries meeting higher demands from other sectors such as fertilizer and agricultural machinery and equipment industries, followed by the general machinery industry.*

The basic development scenario for the GAP region, established by the DPT and the government, that is stated in the Final Master Plan Report, is to reach the development objectives in three phases. This phasing was formed considering the available natural and human resources, time, and funds needed to complete the development.

Phase I (Start - 1994): Development and preparation for taking-off.

1. Completion of on-going projects.
2. Emphasis on extension and information dissemination for better crop varieties and farming practices.
3. Demonstration activities for new commercial crops.
4. Steady growth of consumer good industries.
5. Urgent measures to improve water supply in major cities.
6. Improvement of communication facilities.
7. Completion of feasibility studies of post-Ataturk Dam projects.

Most of the goals planned in Phase I have been achieved. Completion of GAP as a whole is over 60% (at the end of 1994). Karakaya Dam (2nd largest part) is 100 % completed. The main part of the project (Lower Euphrates, the largest part), intended to provide 1/6 of Turkey's total hydroelectric needs and irrigate 48.1 % of the planned irrigation area of GAP, was completed and started operating in November 1994 [2]. Most of the other projects are under construction (Table 2.4). Efforts to convince the private sector to invest into the Region, in order to accelerate the consumer goods industry, still go on. Educational programs to instruct the farmers of new crop types and agricultural methods are being applied. Infrastructural improvements, to provide better water supply services in major cities in the Region are partly completed. Terrorism in the Region was an important issue that prevented Phase I from being 100 % completed on time. Most of the funds, planned to be spent on construction and development in the Region, had to be allocated to security forces.

Phase II (1995-2005): Economic re-structuring and accelerated growth.

1. Completion of all the hydropower and irrigation schemes of GAP.

---

2 GAP total land area: 29,096 sq miles
GAP irrigation planned: 7,088 sq miles
Lower Euphrates irrigation area: 3,410 sq miles

2. Intensification of land-use by mixed farming with intensive cattle raising, poultry, horticulture etc.

3. Expansion of new agro-industries depending on the experiences gained in Phase I.

4. Further improvement of urban infrastructure and utilities, since the urban population is expected to grow rapidly.

5. Major infrastructure development, eg. artery highways, industrial estates, selective railway reinforcement, an international airport, and container depots to support the social and industrial development in the Region.

Phase III (After 2005): Stable and sustained growth.

1. Active private sector investment in advanced infrastructural development and service sector rather than industrial.

2. Major urban centers, which offer advanced service functions such as communication/ conference centers, higher education/technology development institutes, and international tourism.

2.5. Economic Analysis of GAP

Planning of large scale water resources management projects utilizes a lot of basic data (flow records, weather records etc.) as well as economic data. Analysis of the benefits of such large projects, like GAP, may often indicate, at first appearance, not very attractive from the short term economic point of view. However there are many hidden benefits and costs in such projects, which should also be included in the feasibility studies through the Shadow Pricing concept, explained later in this chapter. In addition, an economic analysis using market prices and current interest rates may be unrealistic, as these figures are mostly disturbed by foreign exchange and political attitudes, especially in developing countries (Stephenson & Peterson, 1991).

As mentioned in the previous chapters, GAP is financed by the Turkish Government because of the unavailability of World Bank Credit due to objections raised by Syria and Iraq over the volume of waters being dammed by Turkey. Preliminary

economic studies by the State Water Works (DSI) for the GAP started in early 1960s and its feasibility studies were completed in 1970. The planning and studies conducted by DSI were based on the "Interconnected System Priority Report": A study prepared by Stone & Webster Engineering in 1967. The reference for this report was a unit group consisting of a fuel oil unit and a gas turbine. The report compared the forecasted benefits of GAP with this unit group and came to conclusion about the feasibility of planned GAP projects. This study was updated by the Turkish Department of Studies and Planning in 1979 due to changes in fuel prices and technology (DSI GAP Report, 1980).

GAP facilities were planned mainly for two purposes: Irrigation and Energy. These two factors actually create competition in benefitting from the available water capacity. If the government decides to increase the benefits of irrigation, keeping the same project scope and budget, it will automatically decrease the benefits from energy, since the available resources (water) are limited. A research by DSI has resulted in the yearly benefit estimations in Table 2.3. I took it a litte bit further and defined a 'yearly benefit/ total construction cost' ratio, to be used for comparison. The factors that would affect the calculation of benefits and costs in a project like GAP would be as following (Stephenson & Peterson, 1991), although most of them were not stated anywhere in the Final Master Plan Report:

a. The geography of the Region requires intensive pumping capacity for irrigation, because the water level is lower than the land in most parts. Therefore, the estimated pumping costs have been subtracted from irrigation benefits,

b. Project cost forecasts include feasibility studies, design, control (communication, coordination, scheduling) and land costs,

c. Some projects have started producing energy although construction is not 100 % completed yet.

d. The provision of employment, also on construction, because GAP is not a short term construction project with a planned duration of approximately 25 years.

e. Training costs for personnel.

f. Benefits from irrigation and energy production.

g. Construction (labor and equipment) and operation costs.

The US Water Resources Council, and the World Bank and the US Agency for International Development have developed a model for pricing hidden items, which could influence the viability or water resources projects: Shadow Pricing (Stephenson & Peterson, 1991). The shadow prices are added to the benefits and/or construction and operation costs. The following equation explains the shadow pricing concept:

$$Shadow\ Price = Market\ Price +- Shadow\ Cost\ or\ Benefit$$

Shadow Costs or Benefits are calculated using the factoral effects of the above mentioned issues (a-g).

The projected cash flow break-out for all projects, except 4-Suruc-Baziki and 6-Adiyaman-Goksu due to lack of information (these projects are still in the preliminary planning phase), are shown in Tables 2.4a thru 2.4k. The calculations are based on the data given and/or produced in Tables 2.2 and 2.3 and on the following assumptions:

1. Construction cost is assumed to be spread out equally throughout the years.
2. For only irrigation or only energy projects, benefitting is assumed to start after 100 % completion of construction.
3. For irrigation and energy projects, benefitting from energy is assumed to start after completion of dam construction and hydroelectric power plant and benefitting from irrigation is assumed to start after completion of the irrigation channels and tunnels.
4. Interest rate used is the one for Eurodollar and is assumed to be same through the GAP construction duration: 10% (Dr. M. Samii, November 10, 1994).
5. The inflation rate taken for Eurodollar is assumed to be same through the GAP construction duration: 6% (Dr. M. Samii, 1994).
6. The discount rate used for the cash flow projection is obtained through the following equation:

Discount Rate = Interest Rate - Inflation Rate

7. Project cost forecasts include study, design, control, and land cost.
8. Project cost forecasts are in 1992 US$ and have been calculated using estimated escalation indexes for Turkish Currency (TL) by the DPT (State Planning Agency).
9. Project cost forecasts have been transformed to 1992 US$ from 1992 TL through the mean value of the exchange rate in 1992 "1 US$ = 6879.31 TL ".

The following conclusions have been achieved using the data derived from the summary of cashflow projections (Table 2.5) and the charts that compare; (i) Payback Periods with Total Yearly Benefits/Construction Cost (Figure 2.7), and (ii) Construction Cost with Total Yearly Benefits (Figure 2.8):

A. A hyperbolic curve (the I curve) can be obtained from the data on the chart in Figure 2.7 that defines the NPV[3]= 0 values for each project within the GAP scope of work. It can be assumed that an additional 14th project in GAP would also lay on the I curve (with 5% variation), because the I curve reflects the following factors for the Region and the Project:

- weather conditions (reflected through construction duration-cost and yearly benefits),
- geotechnical conditions (reflected through construction duration-cost),
- productivity level of the construction work force (reflected through construction duration-cost),
- maintenance quality and operation productivity level of the construction equipment (reflected through construction cost-duration),
- geographic conditions and transportation/infrastructure status (reflected through construction cost-duration),
- maintenance quality and operation productivity level of the hydroelectric power plants

3 Net Present Value

and irrigation facilities (reflected through yearly benefits and payback period),
- capacity of the rivers (reflected through yearly benefits and payback period),
- capacity of the power plants and irrigation facilities (reflected through yearly benefits and payback period).

B. The payback periods for various parts of GAP is between 10 to 25 years including the construction duration. Shapiro states, that medium-size development banks (World Bank Group is not included in this group), usually offer loans for regional development projects, with repayment terms of over 5 to 15-year period. Considering that GAP is being financed partly by the Turkish government and partly by foreign loans, the benefits would most probably fulfill the foreign loan requirements without any problems, if the construction of each part is completed on schedule. The Birecik dam, being built on BOT model, has the fastest payback capacity of all GAP projects, being located at the extreme end of the I curve.

The major criteria used by the World Bank Group and other development banks, in order for a development project to qualify for loans (in other words, to be promising for payback and increase in the living standards of the people of the region) are following (Shapiro, 1992, Stephenson & Peterson, 1991):

- The project must have costs and revenues that can be estimated with reasonable accuracy, and must be technically, administrative and financially feasible.
- A government guarantee is necessary for World Bank and IDA (International Development Association, part of the World Bank Group) funding only, but not for other institutions.
- Clarity and acceptance of objectives must assure the importance for the development of the region.
- Repayment terms, for Regional Development Banks, for the loans in most cases, are over a 5 to 15 year period at favorable interest rates.
- The project should not present a dangerous impact on the environment.
- The senior management team should promise expertise and continuity.

C. The ratio of the yearly benefits to construction cost varies between 0.1 and 0.25 for the projects. On a large scaled diagram though, the relationship turns out to be approximately a linear curve with a constant slope of 0.134 (relatively close to the weighted average of GAP=0.144, from Figure 2.5). If this ratio is placed in the I curve in Figure 2.7, it would correspond to a payback period of 17 years, again close to the weighted average of GAP=17.4 years (Figure 2.5).

Most of the above mentioned requirements exist in GAP. Therefore, GAP can be considered a feasible project, with some risk of delays in the schedule due to the size and the political nature of the Project (the Project concept here, includes not only construction, but also the development of the Region). Projections in this chapter, using the data provided by the DPT, support this thesis.

NO	PROJECT	PROJECT COST	BENEFITS ENERGY	BENEF/COST	IRRIGATION	BENEF/COST	TOTAL YEARL IN 1992 US $	BENEFITS BENEFIT/COST
1	Karakaya	$2,638	$389	0.147	$0	0.000	$389	0.147
2	Lower Euprates	$7,188	$365	0.051	$582	0.081	$947	0.132
3	Birecik	$450	$117	0.260	$0	0.000	$117	0.260
4	Suruc-Baziki	$361	$0	0.000	$135	0.374	$135	0.374
5	Adiyaman-Kahta	$507	$25	0.049	$72	0.142	$97	0.191
6	Adiyaman-Goksu	$575	$2	0.003	$37	0.064	$39	0.068
7	Gaziantep	$371	$0	0.000	$67	0.181	$67	0.181
8	Dicle-Kralkizi	$1,294	$5	0.004	$115	0.089	$120	0.093
9	Batman	$482	$25	0.052	$24	0.050	$49	0.102
10	Batman-Silvan	$1,069	$32	0.030	$160	0.150	$192	0.180
11	Garzan	$606	$11	0.018	$35	0.058	$46	0.076
12	Ilisu	$786	$162	0.206	$0	0.000	$162	0.206
13	Cizre	$868	$46	0.053	$105	0.121	$151	0.174
	TOTAL	[illegible]	[illegible]	0.069	[illegible]	[illegible]	[illegible]	[illegible]

TABLE 2.3. GAP Projects forecasted project costs and expected yearly benefits in 1992 Million US$
(Source: GAP Status Report, 1993)

Project :	1-Karakaya Dam	
Construction Start:	1976	
Construction Complete:	1988	
Total Construction Cost (1992 US$):	$2,638	million
Yearly Energy Benefits:	$389	million
Yearly Irrigation Benefits:	$0	million
Yearly Total Benefits:	$389	million
Assumed Eurodollar Interest Rate:	10.00%	
Assumed Inflation Rate for Eurodollar:	6.00%	
Discount Rate Used for Cashflow:	4.00%	

# of Years	Year	Cumulative Cash In In 1992 $	Cumulative Cashflow In 1992 $
1	1989	$438	($2,200)
2	1990	$858	($1,780)
3	1991	$1,263	($1,375)
4	1992	$1,652	($986)
5	1993	$2,026	($612)
6	1994	$2,386	($252)

TABLE 2.4a. Cashflow Analysis of 1. Karakaya Project

Project :	2- Lower Euphrates Basin	
Construction Start:	1983	
Construction Complete (Energy Part):	1992	
Construction Complete (Irrigation Part):	1994	
Total Construction Cost (1992 US$):	$7,188	million
Yearly Energy Benefits:	$365	million
Yearly Irrigation Benefits:	$582	million
Yearly Total Benefits:	$947	million
Assumed Eurodollar Interest Rate:	10.00%	
Assumed Inflation Rate for Eurodollar:	6.00%	
Discount Rate Used for Cashflow:	4.00%	

# of Years	Year	Cumulative Energy Cash In In 1992 $	Cumulative Irrigation Cash In In 1992 $	Cumulative Total Cash In In 1992 $	Cumulative Cash Flow In 1992 $
0	1992	$365	$0	$365	($6,823)
1	1993	$351	$0	$351	($6,472)
2	1994	$337	$582	$919	($5,553)
3	1995	$324	$560	$884	($4,668)
4	1996	$312	$538	$850	($3,818)
5	1997	$300	$517	$817	($3,001)
6	1998	$288	$497	$786	($2,215)
7	1999	$277	$478	$756	($1,459)
8	2000	$267	$460	$727	($733)

TABLE 2.4b. Cashflow Analysis of 2. Lower Euphrates Basin Project

Project :	3-Birecik Dam	
Construction Start:	1993	
Estimated Construction Duration:	5.5	Years
Construction Complete:	1999	
Total Construction Cost (1992 US$):	$450	million
Yearly Energy Benefits:	$117	million
Yearly Irrigation Benefits:	$0	million
Yearly Total Benefits:	$117	million
Assumed Eurodollar Interest Rate:	10.00%	
Assumed Inflation Rate for Eurodollar:	6.00%	
Discount Rate Used for Cashflow:	4.00%	

# of Years	Year	Cumulative Cash In In 1992 $	Cumulative Cashflow In 1992 $
1	2000	$85	($365)
2	2001	$168	($282)
3	2002	$247	($203)
4	2003	$323	($127)
5	2004	$396	($54)
[illegible]	[illegible]	[illegible]	[illegible]

TABLE 2 4c. Cashflow Analysis of 3-Birecik Dam Project

Project :	5- Adiyaman-Kahta Project	
Construction Start:	1992	
Construction Complete (Energy Part):	1998	(ESTIMATED)
Construction Complete (Irrigation Part):	1998	(ESTIMATED)
Total Construction Cost (1992 US$):	$507	million
Yearly Energy Benefits:	$25	million
Yearly Irrigation Benefits:	$72	million
Yearly Total Benefits:	$97	million
Assumed Eurodollar Interest Rate:	10.00%	
Assumed Inflation Rate for Eurodollar:	6.00%	
Discount Rate Used for Cashflow:	4.00%	

# of Years	Year	Cumulative Energy Cash In In 1992 $	Cumulative Irrigation Cash In In 1992 $	Cumulative Total Cash In In 1992 $	Cumulative Cash Flow In 1992 $
0	1998	$25	$72	$97	($410)
1	1999	$24	$69	$93	($317)
2	2000	$23	$67	$90	($227)
3	2001	$22	$64	$86	($141)
4	2002	$21	$62	$83	($58)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE 2.4d. Cashflow Analysis of 5. Adiyaman-Kahta Project

Project :	7- Gaziantep Project	
Construction Start:	1991	
Construction Complete:	1996	(ESTIMATED)
Total Construction Cost (1992 US$):	$371	million
Yearly Energy Benefits:	$0	million
Yearly Irrigation Benefits:	$67	million
Yearly Total Benefits:	$67	million
Assumed Eurodollar Interest Rate:	10.00%	
Assumed Inflation Rate for Eurodollar:	6.00%	
Discount Rate Used for Cashflow:	4.00%	

# of Years	Year	Cumulative Cash In In 1992 $	Cumulative Cashflow In 1992 $
1	1997	$64	($307)
2	1998	$126	($245)
3	1999	$186	($185)
4	2000	$243	($128)
5	2001	$298	($73)
6	2002	$351	($20)

TABLE 2.4e. Cashflow Analysis of 7.Gaziantep Project

Project :	8-Dicle-Kiralkizi Dams	
Estimated Construction Completion:	1995 -1996	
Total Construction Cost (1992 US$):	$1,294	million
Yearly Energy Benefits:	$5	million
Yearly Irrigation Benefits:	$115	million
Yearly Total Benefits:	$120	million
Assumed Eurodollar Interest Rate:	10.00%	
Assumed Inflation Rate for Eurodollar:	6.00%	
Discount Rate Used for Cashflow:	4.00%	

# of Years	Year	Cumulative Energy Cash In In 1992 $	Cumulative Irrigation Cash In In 1992 $	Cumulative Total Cash In In 1992 $	Cumulative Cash Flow In 1992 $
1	1996	$4	$98	$103	($1,191)
2	1997	$4	$95	$99	($1,093)
3	1998	$4	$91	$95	($998)
4	1999	$4	$87	$91	($907)
5	2000	$4	$84	$88	($819)
6	2001	$4	$81	$84	($735)
7	2002	$3	$78	$81	($654)
8	2003	$3	$75	$78	($576)
9	2004	$3	$72	$75	($501)
10	2005	$3	$69	$72	($429)
11	2006	$3	$66	$69	($359)
12	2007	$3	$64	$67	($293)
13	2008	$3	$61	$64	($229)
14	2009	$3	$59	$62	($167)
15	2010	$2	$57	$59	($108)
16	2011	$2	$55	$57	($51)

TABLE 2.4f Cashflow Analysis of 8.Dicle-Kiralkizi Project

Project :	9-Batman Dam	
Estimated Construction Completion:	1995	-1996
Total Construction Cost (1992 US$):	$482	million
Yearly Energy Benefits:	$25	million
Yearly Irrigation Benefits:	$24	million
Yearly Total Benefits:	$49	million
Assumed Eurodollar Interest Rate:	10.00%	
Assumed Inflation Rate for Eurodollar:	6.00%	
Discount Rate Used for Cashflow:	4.00%	

# of Years	Year	Cumulative Energy Cash In In 1992 $	Cumulative Irrigation Cash In In 1992 $	Cumulative Total Cash In In 1992 $	Cumulative Cash Flow In 1992 $
1	1996	$21	$21	$42	($440)
2	1997	$21	$20	$40	($400)
3	1998	$20	$19	$39	($361)
4	1999	$19	$18	$37	($324)
5	2000	$18	$18	$36	($288)
6	2001	$18	$17	$34	($254)
7	2002	$17	$16	$33	($221)
8	2003	$16	$16	$32	($189)
9	2004	$16	$15	$31	($158)
10	2005	$15	$14	$29	($129)
11	2006	$14	$14	$28	($100)
12	2007	$14	$13	$27	($73)
13	2008	$13	$13	$26	($47)
14	2009	$13	$12	$25	($22)

TABLE 2.4g Cashflow Analysis of 9.Batman Dam

Project :	10- Batman-Silvan Project	
Estimated Construction Completion:	2002	
Total Construction Cost (1992 US$):	$1,069	million
Yearly Energy Benefits:	$32	million
Yearly Irrigation Benefits:	$160	million
Yearly Total Benefits:	$192	million
Assumed Eurodollar Interest Rate:	10.00%	
Assumed Inflation Rate for Eurodollar:	6.00%	
Discount Rate Used for Cashflow	4.00%	

# of Years	Year	Cumulative Energy Cash In In 1992 $	Cumulative Irrigation Cash In In 1992 $	Cumulative Total Cash In In 1992 $	Cumulative Cash Flow In 1992 $
1	2003	$31	$154	$185	($884)
2	2004	$30	$148	$178	($707)
3	2005	$28	$142	$171	($536)
4	2006	$27	$137	$164	($372)
5	2007	$26	$132	$158	($214)
6	2008	$25	$126	$152	($63)

TABLE 2.4h Cashflow Analysis of 10.Batman-Silvan Project

Project :	11- Garzan Project
Estimated Construction Completion:	1998
Total Construction Cost (1992 US$):	$606 million
Yearly Energy Benefits:	$11 million
Yearly Irrigation Benefits:	$35 million
Yearly Total Benefits:	$46 million
Assumed Eurodollar Interest Rate:	10.00%
Assumed Inflation Rate for Eurodollar:	6.00%
Discount Rate Used for Cashflow:	4.00%

# of Years	Year	Cumulative Energy Cash In In 1992 $	Cumulative Irrigation Cash In In 1992 $	Cumulative Total Cash In In 1992 $	Cumulative Cash Flow In 1992 $
1	1999	$11	$34	$44	($562)
2	2000	$10	$32	$43	($519)
3	2001	$10	$31	$41	($478)
4	2002	$9	$30	$39	($439)
5	2003	$9	$29	$38	($401)
6	2004	$9	$28	$36	($365)
7	2005	$8	$27	$35	($330)
8	2006	$8	$26	$34	($296)
9	2007	$8	$25	$32	($264)
10	2008	$7	$24	$31	($233)
11	2009	$7	$23	$30	($203)
12	2010	$7	$22	$29	($174)
13	2011	$7	$21	$28	($147)
14	2012	$6	$20	$27	($120)
15	2013	$6	$19	$26	($95)
16	2014	$6	$19	$25	($70)
17	2015	$6	$18	$24	($46)
18	2016	$5	$17	$23	($24)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE 2.4i Cashflow Analysis of 11.Garzan Project

Project :	12- Ilisu Project
Construction Start:	1996 (ESTIMATED)
Construction Complete:	2003 (ESTIMATED)
Total Construction Cost (1992 US$):	$786 million
Yearly Energy Benefits:	$162 million
Yearly Irrigation Benefits:	$0 million
Yearly Total Benefits:	$162 million
Assumed Eurodollar Interest Rate:	10.00%
Assumed Inflation Rate for Eurodollar:	6.00%
Discount Rate Used for Cashflow:	4.00%

# of Years	Year	Cumulative Cash In In 1992 $	Cumulative Cashflow In 1992 $
1	2004	$156	($630)
2	2005	$306	($480)
3	2006	$450	($336)
4	2007	$588	($198)
5	2008	$721	($65)
[illegible]	[illegible]	[illegible]	[illegible]

TABLE 2.4j. Cashflow Analysis of 12. Ilisu Project

Project :	13- Cizre Project	
Estimated Construction Completion:	2003	
Total Construction Cost (1992 US$):	$868	million
Yearly Energy Benefits:	$46	million
Yearly Irrigation Benefits:	$105	million
Yearly Total Benefits:	$151	million
Assumed Eurodollar Interest Rate:	10.00%	
Assumed Inflation Rate for Eurodollar:	6.00%	
Discount Rate Used for Cashflow:	4.00%	

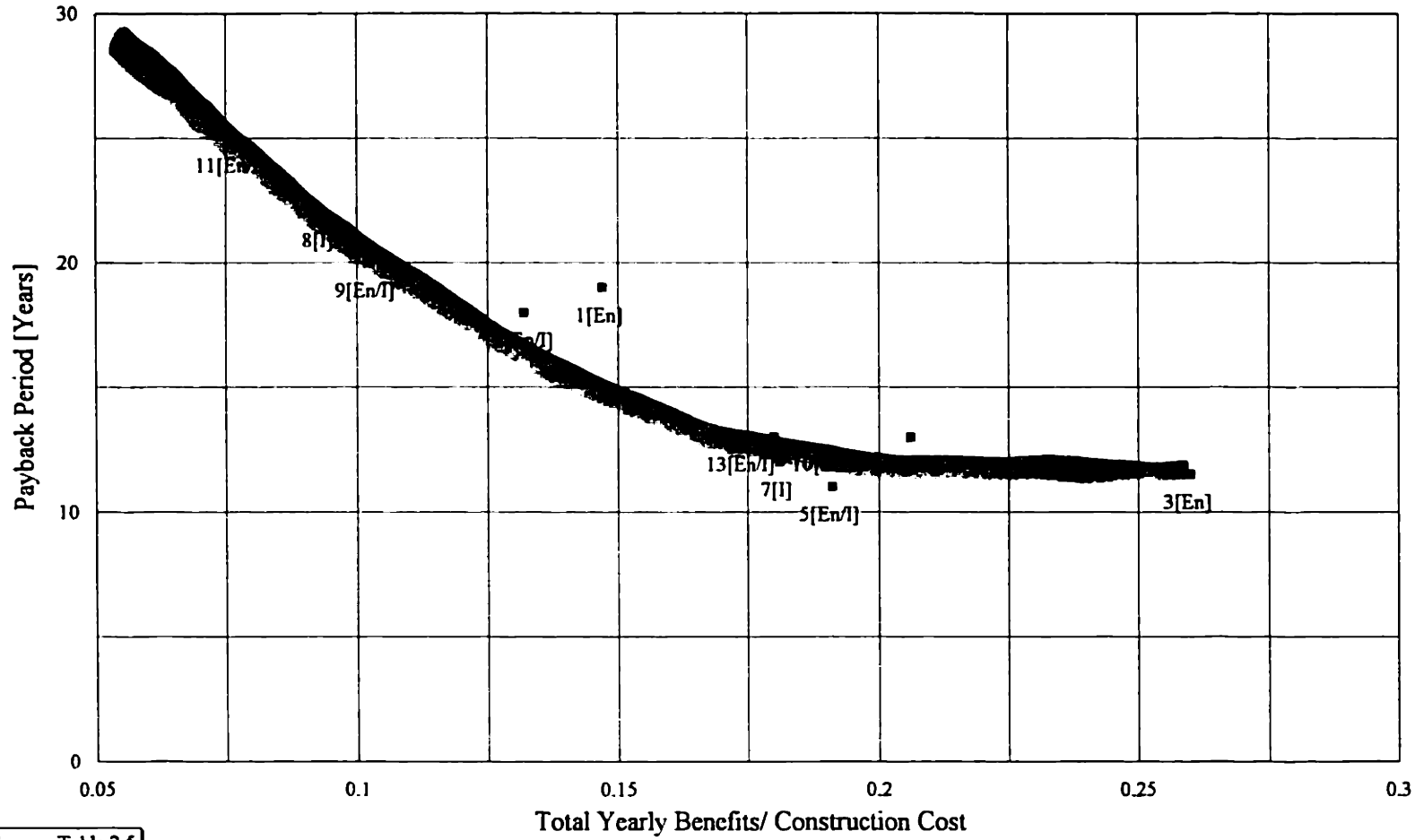
# of Years	Year	Cumulative Energy Cash In In 1992 $	Cumulative Irrigation Cash In In 1992 $	Cumulative Total Cash In In 1992 $	Cumulative Cash Flow In 1992 $
1	2003	$44	$101	$145	($723)
2	2004	$43	$97	$140	($583)
3	2005	$41	$93	$134	($449)
4	2006	$39	$90	$129	($320)
5	2007	$38	$86	$124	($196)
6	2008	$36	$83	$119	($76)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	2010	$34	$77	$110	$149
9	2011	$32	$74	$106	$255
10	2012	$31	$71	$102	$357
11	2013	$30	$68	$98	$455
12	2014	$29	$66	$94	$549
13	2015	$28	$63	$91	$640

TABLE 2.4k Cashflow Analysis of 13.Cizre Project

No:	Project Name	Contruction Period	NPV=0 Period	# Of Payback Years	Yearly Benefits/ Total Constr. Cost	Construction Cost (1992 Mill US$)	Comments
1	Karakaya	12	7	19	0.147	$2,638	Energy Project on Euphrates
2	Lower Euphrates	10	9	19	0.132	$7,188	Energy and Irrigation Project on Euphrates
3	Birecik & Karkamis	5.5	6	11.5	0.260	$450	Energy Project on Euphrates by BOT
5	Adiyaman-Kahta	6	5	11	0.191	$507	Energy and Irrigation Project on Tigris
7	Gaziantep	5	7	12	0.181	$371	Irrigation Project on Tigris
8	Dicle-Kralkizi	5	17	22	0.093	$1,294	96 % Irrigation Project on Tigris
9	Batman	5	15	20	0.102	$482	Energy and Irrigation Project on Tigris
10	Batman-Silvan	6	7	13	0.180	$1,069	87 % Irrigation Project on Tigris
11	Garzan	6	19	25	0.076	$606	Energy and Irrigation Project on Tigris
12	Ilisu	7	6	13	0.206	$786	Energy Project on Tigris by BOT
13	Cizre	7	6	13	0.174	$868	Energy and Irrigation Project on Tigris by BOT
	Weighted Average			17.9	0.144		

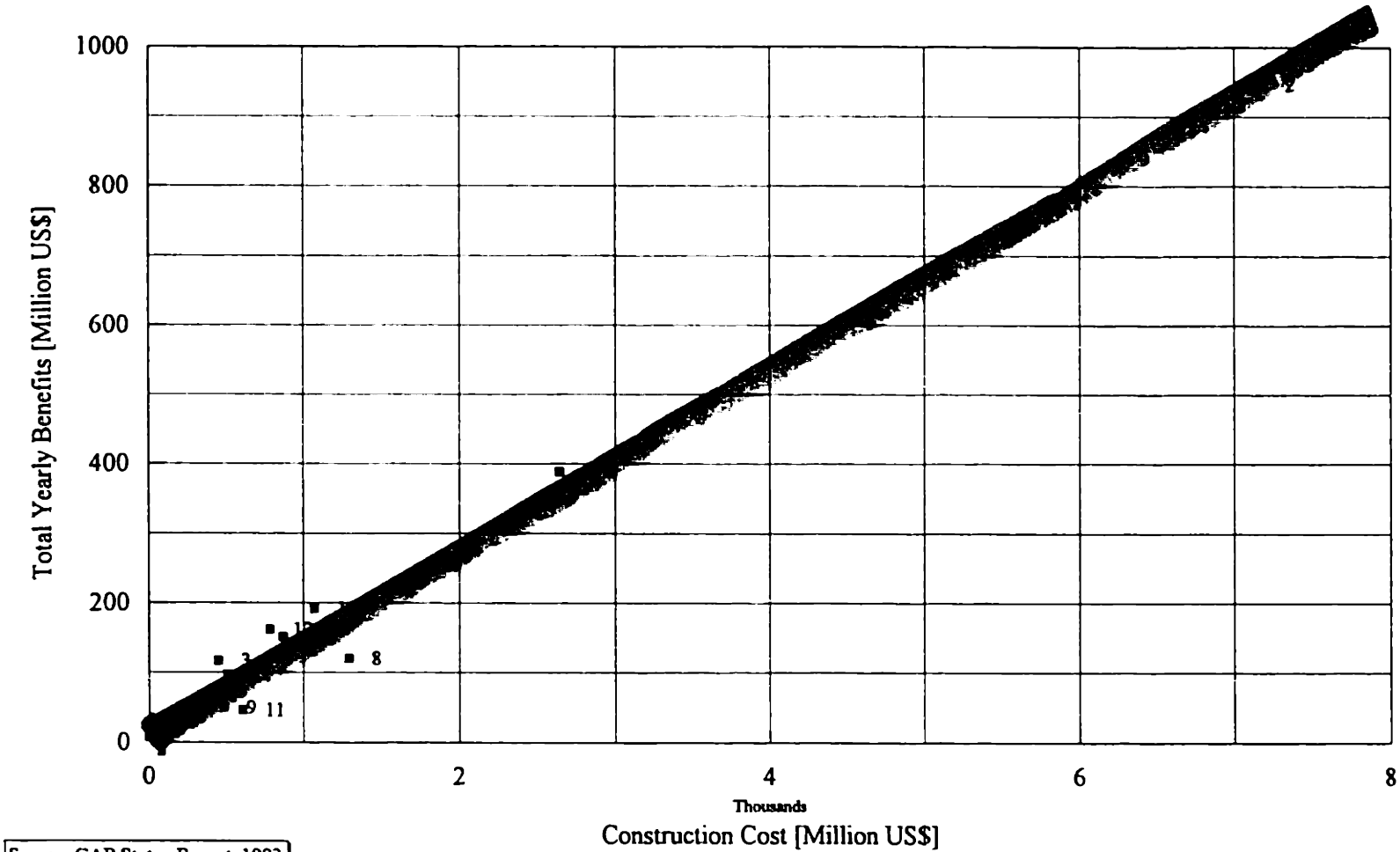
Table 2.5. Summary Data of GAP Projects Collected from Cashflow Projections (Tables 2.4a-k) and to be Used for Figure 2.7

Figure 2.7. Comparison of Payback Periods with Total Yearly Benefits/ Total Construction Cost of each project



Source: Table 2.5

Figure 2.8. Comparison of Construction Cost with Total Yearly Benefits for each project



Source: GAP Status Report, 1993

CHAPTER 3
IMPORTANT ISSUES AT GAP

Benefits of large scale water resources projects are well known all over the world. Dams and irrigation networks can provide economic and social welfare to the people through improving agricultural production capacity and creating clean power to support industrial development. Unfortunately, past experience proves that not many nations, who have invested in large water resources projects, have received the maximum potential benefits. Planning of such large projects involve many aspects other than construction and the calculation of agricultural and energy benefits. There are many problems that large dams have caused in addition to construction problems, before, during, and after construction period. I will explain some of these aspects and problems in this chapter, relating them to GAP.

3.1. Environmental Effects of GAP on the Region

The bunds and tanks of the irrigation works built by the ancient civilizations of Babylonia (Mesopotamia), Egypt, Sumeria, and Ceylon, still survive to prove the engineering skills of those who constructed them. Today, however, advances in concrete technology and the development of vast earth-moving machines (the largest weighing 2,000 tons) have enabled the engineers to build dams of very large size and complexity (Goldsmith and Hildyard, 1984).

Two major benefits of water resources development projects are, as mentioned in previous chapters: 1. increase in the energy production capacity of a country, and being able to provide this energy to the people and the industry with relatively less cost (compared with importing the same amount of energy); 2. increase in agricultural production capacity of a region or country. However, there are different opinions on the environmental effects of such projects:

"Water resource projects have many positive environment effects. When water management practices regulate and augment low flows of rivers and streams, decrease erosion, prevent floods, eliminate waste of water, and in many instances change deserts into gardens where man can comfortably live and prosper, the result is betterment of environmental conditions" (Gilber G. Stamm, the former commissioner of the US Bureau of Reclamation, told to a congressional committee, 19[illegible] (Goldsmith and Hildyard, 1984).

3.1.1. Environmental Effects of Water Resources Projects

Recent research in the past decade has identified some of the environmental disadvantages of dams. One of these negative environmental effects is loss of agricultural land to flooding during the filling of reservoir lakes, since in many cases the flooded area contains good agricultural land. Dams have also caused the loss of forests, through drowning them in the reservoirs. Usually the loss of forests is considered in the feasibility studies, in terms of actual market value of timber, but what planners sometimes ignore is the intangible ecological value of forests: soil preservation, water replenishment, climatic stabilization, air purification, and wild life shelter. It is also known that rivers carry silt, which generally contains large quantities of feldspar, clay, and organic matter, therefore having a high nutrient value for soil. By disturbing the ecological balance of the rivers, a dam can have serious effects on fish life. Dr. David Tolmazin, former head of the Marine Economy Department at the Economics Institute of the Ukrainian Academy of Sciences states (Goldsmith and Hildyard, 1984):

"Rivers sectioned off by dams, are no longer single ecosystems, the flow of suspended material and dissolved gases, which previously sustained the life of a river population (fish), is interrupted"

3.1.2. Environmental Effects of GAP

In Turkey, as in many other developing countries, large scale dam projects were traditionally regarded as one of the best means of initiating regional development. In the past decades however, it has become increasingly clear to the planners, that environmental costs of this type of projects also exist, and thus environmentalists and sociologists are criticizing engineers for constructing concrete structures with insufficient attention to the background (Stephenson & Peterson, 1991).

DSI's (State Water Works) reputation for building, planning, designing, and controlling hydroelectric and irrigation projects was mentioned in the previous chapters. Since the 1950's, a large part of Turkey's national development strategy was related to the construction of dams and irrigation networks. This policy has partly caused damage to sensitive environments and the loss of ecosystems in some locations. Most of these costs (damages) were not taken into consideration during feasibility studies, like in many other developing countries. According to one opinion, most of the damages occurred because the irrigation projects have been brought into service before the main distribution and drainage networks were complete, resulting in changes in water and soil regimes (Water Resources Planning and Development in Turkey, 1992). As explained, that large dams can effect the environment in many ways and at various levels. The planners have learnt from their mistakes in the past (which is mainly: a failure to consider the environmental effects of large scale water resources projects in the planning phase) and a new policy concerning the environmental effects of hydroelectric-irrigation projects (dams) was established by the DPT (State Planning Agency). This policy is briefly stated in the GAP Final Master Plan Report as:

> *" A sustained development cannot be obtained without managing and controlling the environment effectively, especially in Regions with harsh weather conditions. There are no conflicts between environmental protection and economic development, instead, an effective environmental protection plan is needed in order to*

coordinate the economic development of any region".

In other words, planning methods of DSI have changed: today, the project formulation involves environmental and social studies in addition to economic studies. The above mentioned statement is not easy to apply, because it implies that pursuing economic development through industrialization and protecting the environment at the same time can be achieved easily. This has not been the case in most of today's developed nations. They had to go back and repair the damage after having completed development. It is common in developing countries to see economic growth, increase in employment, and improvement of public services and infrastructure as government priorities over protection of environment.

GAP is the most serious effort to date to reduce the high out-migration rate and increase the economic and social standards of the people living in the Region. In terms of increase in agricultural productivity; officials are expecting successful outputs, especially from completion of the Harran Plain part of the project (which was ~90% finished in November 1994). Therefore, a study called "GAP Regional Environment Study" has been completed by a regional university in order to determine environmental effects of GAP on the Region (especially Harran Plain) in 1993.

The study has been conducted by a team consisting of eight sub-teams, namely: Leadership Team, Water Pollution, Air Pollution, Soil Pollution, Solid Waste Pollution, Noise Pollution, Study for Flora and Study for Fauna. All of these sub-groups consist of several professors, doctors, assistant professors and experts. It is their common opinion that GAP, being a very large project with relationships with multiple industries, is going to effect the environment in the Region in many ways. Especially, big changes in water and soil regimes (due to silt level carried by the water and salinisation of the soil) are expected because of damming and intensive irrigation in a relatively large area. These changes might effect the plant and animal species (flora and fauna), and the people living in the Region. An increase in environmental pollution is also expected due to population growth, urbanization and industrialization in the cities.

Some effort has been made by the Turkish Government in order to include the

environmental issues into the GAP Final Master Plan for a sustainable development of the Region. Expected environmental problems can be separated into two groups (GAP Final Master Plan Report):

(i) Environmental problems related to development and construction: industrial wastes, urban sewage waters, solid waste, water and air pollution due to mining, industrialization, and thermic energy production, sedimentation of dam lakes, erosion around dam lakes, changes in living environments of fish species because of dams and its effects on the fish migration times and routes, changes in the river flow regimes and therefore erosion on the river sides, etc.

(ii) Environmental problems that require a more general approach in the Region: soil erosion and underground water problems related to insufficient drainage, loss of forest areas, water pollution due to fertilizers and other chemicals used in farming.

The main difference between the two groups of problems is GAP. The first group lists problems that are mainly caused by GAP and the second group names environmental problems that would exist even without GAP. It is possible to say that GAP will increase environmental problems in the Region as the price for development. It can be argued whether or not this is a fair bargain.

Following is a list of the potential pollution types indicated in the GAP Regional Environment Study (the Study):

1. Water Pollution due to:
   - Industrialization
   - Urbanization
   - Population growth
   - Large use of fertilizer and pesticides
2. Air Pollution due to:
   - Industrial installations
   - Atmospheric characteristics
   - Heating of buildings (Use of fuel with high sulphur ratio, fuel wasting, building heat loss, lack of heating knowledge, topography, meteorological occurrences, urban tissue, etc.)
   - Motorized vehicles

3. Soil Pollution due to:
- Erosion
- Utilization of land for other than agricultural purposes
- Land losses due to pollution based on:
    a. air pollution
    b. polluted waters
    c. fertilizer and pesticides
    d. solid wastes

4. Noise Pollution due to:
- Traffic
- Industry and Equipment

Most of these problems are not caused directly by GAP, but by the development that GAP is expected to provide to the Region and the people. Therefore it is not logical to blame GAP for all of the environmental pollution. The argument to support this opinion would be: if development in the Region was provided through another project, or happened suddenly by itself because the private sector decided to invest into the Region, the same problems would occur.

Environmental problems identified both in the Master Plan and the Study are similar. Following is a list of suggested precautions that might be effective to prevent and/or solve some of those problems:

- To reduce erosion through afforestation,
- To minimize the industrial and municipal waste through intensive control and strict regulations,
- To control cultivation methods used by the farmers and to prevent improper usage of fertilizer and chemicals.

The environmental plan and precautions adopted in the GAP Final Master Plan Report are based on the regulations by the European Union published in 1985. This plan mainly concentrates on "control" of all activities that might have an effect on the environment of the Region.

3.1.3. Conclusion

Having reviewed the general environmental effects of large water resources management projects and the ones expected to happen in the GAP region, it is possible to say that they are similar. Knowing what is going to happen is a big advantage in preventing the effects. It is obvious that environmental issues have been integrated into the overall GAP Final Master Plan Report successfully, and that the planners have also suggested changes in regulations, and other actions to be taken (especially massive control) as precautions. The issue that is creating a conflict within the overall GAP objective is; whether these regulations and massive control over industrial development would scare away the private sector from the Region. These regulations and tight control of industrial activities might disturb the atmosphere that the government is trying to create to attract the private sector into the Region through various incentives. A logical conclusion would be to meet somewhere in the middle and offer incentives partly based on the "compliance with the environmental regulations". This way, the private sector would have to comply with all the environmental protection laws in order to qualify for incentives.

3.2. GAP, Industry and Expectations of the Private Sector

Completion of GAP, both in terms of construction and the development plan, is expected to increase agricultural production by 117%, manufacturing production by 418%, construction activities by 213%, and service sector activities by 276%, in the Region (Chamber of Commerce of Turkey, 1989). As can be seen from the above percentages, GAP's largest impact is expected to be on the manufacturing industry and the people in the Region are relying on these projections of the State Planning Agency (DPT) and keeping their hopes up for new employment opportunities.

3.2.1. Agricultural and Industrial Development

The Region has much to offer to the private sector: low cost labor, low cost land, and natural resources. What it cannot promise, at least for the next half decade is "demand". Most of the goods produced in the Region will still have to be sold in other regions of Turkey with an additional cost of transportation. Therefore, a compromise is expected from the private sector (how the private sector should react to this request is arguable) to start the development era in the Region and private companies are aware of this request of the people and of the government. How the private sector sees the situation is explained in Chapter 3.2.2. Another important fact is that, thousands of local people have already worked for as long as ten years on the construction of GAP projects. Now that all projects are planned to be completed in about 10 years from now, unemployment is expected to increase in the Region. Therefore, investments are highly necessary to provide employment to these people in the Region. Otherwise, this area can become a social tinderbox full of unemployed people, most of which will have forgotten how to cultivate the land by then. These people will have to move to other parts of Turkey to find jobs which may cause unemployment there, as well. Table 3.1 explains Turkey's civilian employment structure and its sectoral division for the last several years.

According to another opinion, a high increase is expected in construction activities as a result of the investments in all sectors. Mr. Nurhan Motugan, general coordinator of ATA Construction Corporation which built the Ataturk Dam, stated in an interview with Hilton Turkey Magazine:

> *" If the project is brought to its logical conclusions, it can be expected to transform the economic and social life of southeastern Turkey-- indeed, the entire country. GAP is without doubt the most ambitious project undertaken in the nation's history. The plans and the impressive amount of progress made so far has captured the attention of the entire world, particularly [city] planners, builders, and [material] suppliers seeking to do business in Turkey. "*

Among the public investments already accomplished and planned until 1997 in the Region (10.65 billion US$), agriculture represents the biggest portion (25.81%), followed by energy (25.2%), and transportation (22.2%). Other sectors that have a share of the public investments are education (9.2%), infrastructure (6.5%), housing (4.8%), mining and manufacturing (3.1%), health (2.4 %), and tourism (0.4 %) (Status Report 1992).

As mentioned in 2.2. Development Objectives and Strategy, GAP is expected to cause some major structural changes, both economic and social, in the Region due to these public investments. Employment opportunities and population are expected to grow. Quality level of the technical work force is expected to increase. The improvement in the economic condition and level of income in the Region will cause an increase in consumption. But still, all of the above mentioned projections depend on the private sector and the level of investments accomplished by the private sector rather than public, since they are the ones with the entrepreneurial mentality and the highest interest in profit in a democratic-capitalist country. Economic success stories such as the United States, post-World War II Japan and West Germany, modern Taiwan, South Korea, Hong Kong, and Singapore all have a common factor: reliance on private enterprise to organize most economic activity (Shapiro, 1992).

It is a part of the development strategy (explained in 2.2. Development Objectives and Strategy, section F.) to encourage the local entrepreneurs through the provision of credit, information and technical support. The Master Plan suggests establishing an organization (a public or private agency) to provide this support. This agency would also coordinate the investments done by the private sector in the Region and help solve problems. Problems that currently face the private sector include:

- Private sector has to find out which strategy they will follow. A thorough study of the markets and company weaknesses/strengths is necessary. A detailed analysis using Porter's strategy tools (five forces analysis, market segmentation matrix, generic strategies matrix, firm value chain and industry value system) would be helpful to decide in which areas (both market and geographic-wise) to pursue profit. Five forces analysis, market segmentation matrix and industry value system can be used to assess the attractiveness of various industries in the Region. Generic strategies matrix and the firm value chain can

be used to identify strengths and weaknesses of companies, and decide on broad strategies.

- How much do they need to borrow? An accurate strategy will point out the markets and geographic areas to focus on whether it would be narrow or broad. Narrow and broad, generally, means both market-wise and geographically. In the GAP case though, it only means market-wise because the area is not very large (1/10 of California). A thorough feasibility analysis (cost/benefit and sensitivity analysis taking the inflation and political forecasts into consideration) on a project-by-project basis (an investment is considered a project with a scope,schedule, cost and profit) will point out the potential profitable investments.

Coordinated services are a must in the Region due to the size of the area and the investments. Modern financing (eg. involving banks and/or other investors as well as consultants into the procedure) and advanced planning of the activities must be parallel to upgrading of the agricultural system. Therefore, timing is very important. An entrepreneur (a farmer, a factory owner, a corporate etc.) should receive the loans when needed and no later (Chamber of Commerce of Turkey, 1989). Currently, agricultural credit is supplied through the country's largest bank "Ziraat Bank", which offers money to farmers at subsidized interest rates, as well as longer-term money for structural or capital projects (EIU, 1994). Along with agricultural development must come the industrial facilities, marketing strategies, well structured organizations, transportation and communication networks. In order to realize this coordination effort, Turkey's State Planning Agency (DPT), formed the GAP Unit Directorate (the Agency) in Sanliurfa. One of the functions of the Agency is to coordinate between the state and the private sector on the potential projects and investment opportunities. The Agency has also been providing the know-how and experience of other countries through international and domestic firms, to the Region. It was already mentioned that a Japanese firm and a Turkish firm worked closely together on the Master Plan for development of water and manpower resources and planning the public investments. Another example is a French company researching agriculture-based industrial applications in GAP.

Although the expectations in the Region are for sustained industrial development,

and the Region has potential for such development (with GAP completed), there are problems that the private sector and the state will have to deal with together. There are many half-completed facilities in the Region (mostly manufacturing plants), which will have to be completed eventually. Production capacity of some factories is very low, which makes some of them unfeasible to operate. There is a lack of technical personnel in the Region. People in the Region have lost their entrepreneurship mentality throughout the years and the ones that kept it, moved to the west of the country.

Most of the half completed and low capacity factories can be saved by merger and acquisition through a coordination and cooperation operation between the state and the private sector. Large companies, planning to invest in the Region, might prefer to buy an existing plant and restore it, instead of constructing a brand new one. A new salary and employment policy for the state officials can be established to attract well educated technical personnel to the Region. Again, all of these suggestions require cooperation of the private sector and the state.

3.2.2. GAP from Private Sector's Point of View

The general experience in all developing countries is that the agricultural sector's share in export and economic activities decreases over time. Turkey faced the same results (Table 3.2) and had to make a choice. The question was whether to emphasize industrial improvement or agricultural improvement. Turkey has chosen to increase industrial capacity with a lesser emphasis on agriculture. Before 1980, about 2/3 of Turkey's exports were agricultural products. In 1992 83% of exports are industrial products. This does not mean that agriculture should be ignored completely. Agriculture and industry actually complement and support each other's development. If a parallelism in the agriculture and industry sectors during the development phase cannot be accomplished, Turkey will reduce it's competitiveness in the world market. Because, Turkey's competitive advantages are cheap labor for industry (not advanced technology or high variety of industrial products), and less cost and high variety in agricultural products. Industrial improvement has resulted in some variety of industrial production throughout the years, since some of

	1990	1991	1992
Civilian Employment	18,681,000	18,171,000	18,462,000
Agriculture	8,616,000	8,473,000	8,077,000
Industry	2,955,000	2,745,000	2,795,000
Construction	895,000	946,000	943,000
Services	6,215,000	6,007,000	6,647,000
Unemployment	1,482,000	1,618,000	1,611,000
Unemployment %	7.90%	8.90%	8.70%

Table 3.1. Trends in Civilian Employment in Turkey
(Source: EIU, 1994)

INDUSTRY	1960	1970	1980	1992
Agriculture	42%	31%	23%	17%
Manufacturing	16%	19%	25%	25%
Construction	6%	8%	5%	7%
Services	36%	42%	47%	51%
TOTAL	100%	100%	100%	100%

Table 3.2. Sectoral Contribution to Turkey's GDP
(Source: EIU, 1994)

Turkey's export products today are textiles, iron and steel, chemicals, machinery, glass and ceramics, and electrical equipment (EIU, 1994). Still most experts think that it is too early to emphasize industrial development only, since a sustainable industrial development requires the support of agriculture and agriculture creates demand for industrial products (machinery, production plants etc.) and at the same time offers raw material to the industry. Therefore, industry and agriculture should not be considered competitors.

> *"It is more profitable to export agriculture products, after having processed them in a plant, than directly from the farm" (Dunya, November 1994).*

The Turkish government has completed detailed research that points out the following industries as prospective manufacturing industries: wheat related, cotton related, livestock, construction materials, and others (printing and publishing, packaging materials, and packaging). The following industries have been identified as industries of strategic importance in the Final Master Plan Report: tourism related, edible oils, meat processing, leather, textile. These industries already exist in the Region, but they need to be improved and strengthened. First three of the prospective industries are expected to support the industrial development in the Region. The construction materials industry, on the other hand, is closely tied to the results of the initial development process (1993-1997 period). It will most probably grow following the general growth trend in the Region, which is income increase and urbanization (Chamber of Commerce of Turkey, 1989).

Another issue related to investments in the Region is funding. It is essential to have both national and international support in this matter. Government's role would be to create attractiveness through incentives (lower income tax, ease of import and export in terms of lower custom taxes and less bureaucracy). These incentives should be limited to the Region only, otherwise the private sector will choose to invest in already developed regions, where there is less risk (market trends are obvious), less cost (due to better transportation network and lower construction materials cost), and more profit (due to higher income level that leads to higher demand). Foreign investment should bring

advanced technology and experience and therefore cause competition within Turkey. Joint ventures with Turkish companies should not be considered as foreign investment where only foreign capital is provided without advanced technology and experience. The biggest need for funding is for agriculture and forest sectors (Chamber of Commerce of Turkey, 1989). Energy, transportation and communication, education, infrastructure, residential and health sectors follow in order of need. One way to finance the planned projects could be BOT. A successful example of "operating" large projects by the private sector in Turkey, is the energy industry. The main electricity producer in Turkey is the Turkish State Electricity Authority (TEK), but in Adana (a province neighboring the GAP region), the Cukurova Electrical Company (a private company) produces some energy as does Kepez Company (another private enterprise) in the southern part of Turkey. Stock prices of these companies have risen at a stable rate in the IMKB (Istanbul Stock Exchange), proving success of private entrepreneurship in heavy industries. Both the state and the private sector could benefit from applications of BOT, especially if financing is a critical issue, as in the GAP region case.

Construction of small and medium size "industrial zones" should be encouraged to save infrastructure (especially transportation) costs. Small companies can manufacture next to each other with lower cost and at the same time provide various material and parts, and services to each other and to larger companies (Chamber of Commerce of Turkey, 1989).

Another important issue in GAP is geotechnical, namely erosion. GAP is a chain of dams and erosion can cause structural damage to dams. Solution to this problem would be to afforest the Region. Several attempts by the previous governments to afforest the Region in the past have been unsuccessful. It might be a better solution to contract out this task to those in the private sector, who have the proper know-how. Turkey's forest area totalled 26% of the total land area in 1991, proving a need for afforesting and reforesting, not only in the GAP region, but in all parts of the country.

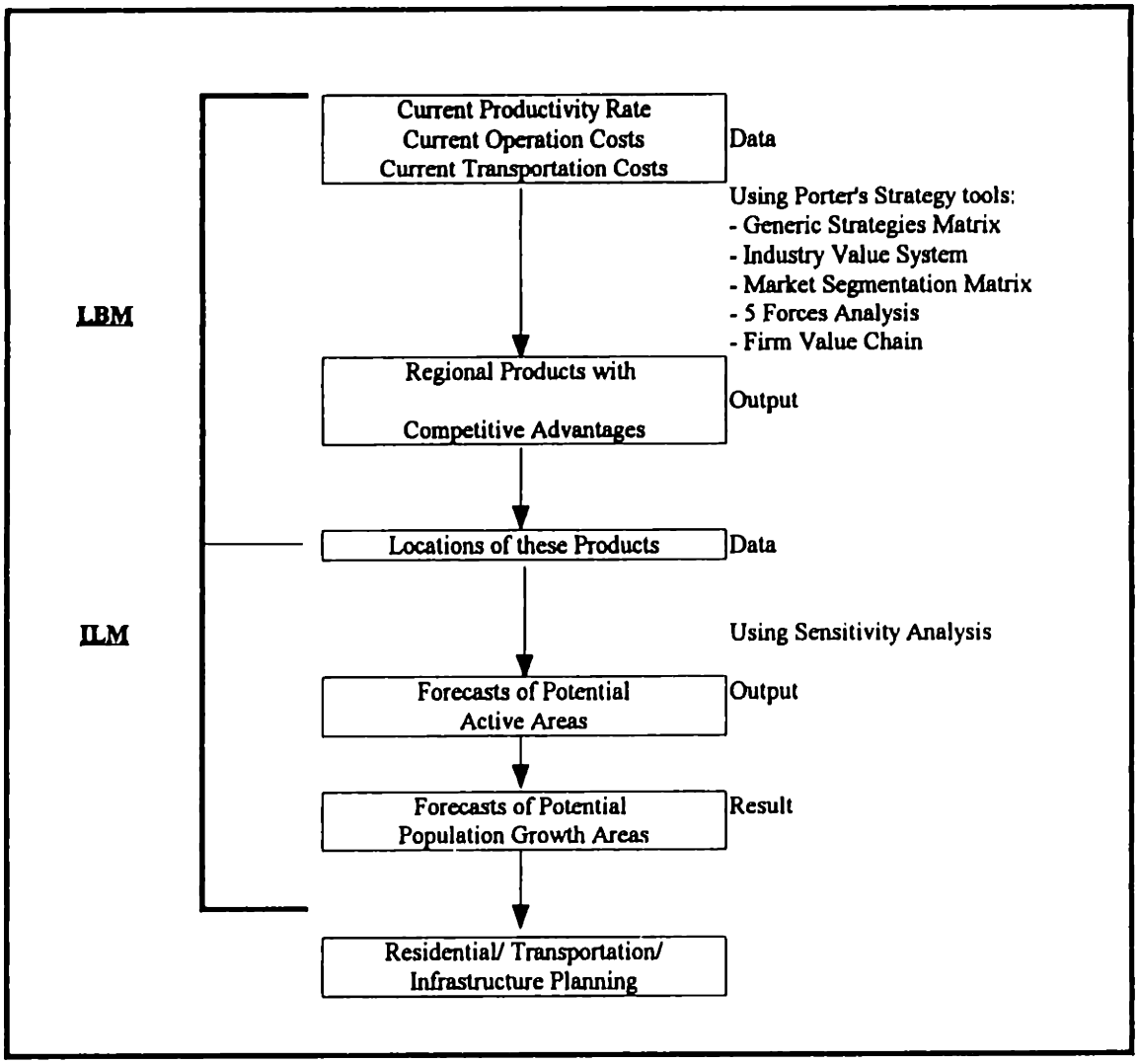


Figure 3.1: Infrastructural and Transportation Planning Process for Public Investments in the GAP Region (Source: GAP Transportion and Infrastructure Development Study, 1992)

3.3 Transportation and Infrastructure Development in the Region

The importance of investments (both public and private) on the development of a region cannot be denied. One way to attract foreign and domestic capital to the Region is to offer easy mobilization for natural resources (efficient transportation network) and an advanced infrastructure to support operations. A study was completed by the GAP Transportation and Infrastructure Consulting Cooperation in 1993: GAP Regional Transportation and Infrastructural Development Study- Final Report. The methodology used for this study was a combination of two models: Locational Balance Model (LBM) and Industrial Location Model (ILM). The LBM, using product and transportation costs as data, highlighted the Region's products which have competitive advantages over other regions' products. The ILM, using this output, pointed out the possible optimum geographical distribution of the agricultural and industrial activities. The geographical distribution of these activities also indicate the possible future high population areas, because people will go where the employment opportunities are. The location and size of the infrastructure projects were planned according to these forecasts. A schematic explanation of this methodology, combined with some suggestions of the author of this thesis to improve it, is explained in Figure 3.1. The following industries have been considered the basic sectors in the Region while forecasting the employment opportunities and the population: agriculture, agro-related industries, manufacturing, and mining.

3.3.1 Residential Development in the Region

The success level of residential development in the Region is closely tied to the infrastructural development. The need to spread the investments over such a large area (1/10 of California) requires intensive coordination and cooperation of infrastructural, residential, and transportation construction. It is necessary to enforce some restrictive regulations on the building type, location, size, and quality level, so that a controlled development of residential areas can be established. A tight control over the residential development activities are needed in order to stay in line with the GAP Regional

Transportation and Infrastructure Development Study-Final Report. Following is a summary of the objectives set forth by this report, and comments and critiques of the author of this thesis on these goals:

> *1. In order to meet a large housing demand, an organization with the following functions must be established: planning, project design, construction, and financing.*

This objective conflicts with the privatization objectives of the Turkish government, if this organization is meant to be a public agency. A sustained development cannot be established without 100% private sector participation. Since they have the highest interest in profit, they will find the most feasible options and apply them with proper know-how. The Government's duty here, would be to control private sector's activities through regulations. Design, financing, and construction should be left completely to the developers/ constructors. Planning can be coordinated through municipalities and/or their consultants, in order to stay in line with the development plan.

The administrative system in Turkey is highly centralized and is based on the 19th century French model. Turkey is divided into 74 provinces subdivided into districts, each under a centrally appointed governor. Municipalities, under elected mayors, are established in the main towns, but the local authorities have limited functions (excluding, for instance, health and education, or the police in rural areas) (EIU, 1994).

There are 110 municipalities in the Region (Zorlu et. al., 1992). In order to have them coordinate the planning of residential/ infrastructure construction, their revenues would have to be increased, so that they can get professional help (consultants), for planning of potential projects. Some ways to increase the funding for municipalities are: (i) increase of funding from the general budget, (ii) access to loans at concessional rates, (iii) find new sources of income (rent, additional municipal taxes etc.).

> *2. Financing models should be established with participation of all sectors and institutions involved in housing production [banks, contractors, material suppliers, engineers, architects, municipalities, developers].*

Residential development in the Region has three major dimensions:

(i) Housing for state officials constructed and financed by the government. These buildings are low-cost/ efficiency or 1-2 bedroom type old buildings, that the state officials live in, paying a symbolic rent. High level technical personnel (engineers, planners, agricultural and financial experts, and consultants) that the government is trying to attract to come to the Region, will not want to live in these buildings. Therefore, new buildings for these officials have to be constructed. In order to have high quality construction , using the limited available funds, the B.O.T. model can be applied. The government would compensate a percentage of the rent (to help the state official, for example 80%) for several years (depending on the development contract) and then own the buildings. An other option would be to contract out for the construction of buildings (the traditional method) but rent some of the units (for example 50%) to non-government employees and charge them regular commercial rent rate. This way these units practically would pay the rents of the government officials. The other option would be: state rents high quality buildings/ units from the developers and places its employees in these units, compensating a big portion of the rent itself. This option is not applicable for the next 5-10 years, since high quality/modern residential buildings are not yet common in the Region.

(ii) Affordable housing/ residential complexes in urban areas. The existing apartment buildings in the Region are enough to fulfill the needs of today's population. But the populations in the cities are expected to grow because of industrial development. A study by Zorlu, Keskin, and Korkmaz indicates that it is more feasible to construct atrium type condominium high rise buildings in the cities in the Region in future, because the land cost is expected to increase also. The existing regulations provide incentives for construction of apartments smaller than $75m^2$ (700 SF).

(iii) Housing in rural areas does not need to be planned and coordinated in terms of type, size, price etc. Families usually build their farm houses according to their individual needs. But there is still a need for cooperation and coordination because of infrastructural development.

"The wide-spread rural residential areas in the country should be collected around large villages and small towns in order to save on infrastructure investments" (Zorlu et. al., 1992).

This goal is almost impossible to reach for the existing farms, since the houses will be where the cultivated land is. Therefore, infrastructural development in the existing rural areas will be very costly. But for the newly available irrigation areas (for example Harran Plain, which has started receiving water from the Ataturk Dam, through the Sanliurfa Tunnel T1, on November 11, 1994), it is possible to save on infrastructure costs through good planning, at this point.

3. Stocks of land should be reserved for public housing and incentives should be provided for the development of their infrastructure.

This action would be against the privatization policy of the Turkish government. Reserving land for public housing would result in keeping the more valuable land for official use, which endangers the development efforts in the Region. The private sector would not want to be involved in such a development plan. The basis of the sustained development plan in the Region is to attract the private sector to invest in the GAP region.

4. Investments should be programmed and incentives should be provided in an order related to the promising industries.

It is logical to expect the highest investments and incentives to be provided to the most promising industry. But again, the private sector should be involved in determining the promising industries, and planning of the investments (feasibility studies etc.). The state should act as a coordinator.

5. Special attention should be paid to the above issues in large and medium size cities.

It should not be forgotten that "GAP is an integrated regional development project, which includes dams and hydroelectric powerplants, irrigation facilities, agriculture and transportation infrastructure facilities, urban and rural infrastructures, investments in industry, commerce, health, education, housing and services" (same report: GAP Regional

No:	Project Type	Province	# of Projects	Total Cost
1	Potable Water	Adiyaman	4	173 mill US$
	Sewage Network	Batman	2	
	Treatment Facilities	Diyarbakir	6	
		Gaziantep	6	
		Mardin	4	
		Siirt	3	
		Sanliurfa	3	
		Sirnak	1	
2	Water Supply	Sanliurfa	1	103 mill US$
3	Waste Water Treatment	Batman	1	191 mill US$
		Diyarbakir	1	
		Gaziantep	1	
		Mardin	2	
		Sanliurfa	2	
		Sirnak	2	
4	Solid Waste	Batman	1	9 mill US$
		Diyarbakir	1	
		Gaziantep	1	
		Sanliurfa	1	
5	Electric Networks	Adiyaman	1	27 mill US$
		Diyarbakir	1	
		Gaziantep	6	
		Mardin	3	
		Sanliurfa	4	
		Sirnak	2	
6	Telecommunication	Adiyaman	4	1,010 mill US$
		Batman	3	
		Diyarbakir	7	
		Gaziantep	8	
		Mardin	7	
		Siirt	3	
		Sanliurfa	9	
		Sirnak	4	

Table 3.3: Planned Infrastructure Investments into the Region until 2005.
(Source: GAP Regional Transportation and Infrastructure Development Study-Final Report, 1992)

Transportation and Infrastructure Development Study- Final Report). Housing in urban areas is only a part of the development plan. GAP's main issues are development of agriculture and manufacturing industries. Agricultural development relies mostly on the rural areas, therefore same attention should be paid to infrastructural development of rural and urban areas.

6. Organized industrial zones and small scale industry sites should be established.

It is essential to organize the production plants by keeping them together in order to save on construction (especially infrastructure) and transportation costs. Table 3.3 shows the planned infrastructure investments in the Region until 2005.

3.3.2 Existing Transportation Network Status in the GAP Region

Transportation networks play an important role in a Region's development, being directly related to transfer of raw material from the land to the factory, and from the factory to the markets, in time; and with low cost and transfer and/or sharing of vital services such as education and health.

The existing transportation system in the GAP region in 1992 is as following (GAP Transport and Infrastructure Consulting Corporation, 1992):

- Total length of highways: 35,537 km (22,083 miles) of which 15% are state and provincial roads and the rest are rural roads. A motor way between Adana and Gaziantep is under construction, of which 50 km (31 miles) is completed.
- There are two main railway lines in the Region: (i) southern line along the southern national border; (ii) northern line, connecting Malatya to Kurtalan via Diyarbakir-Batman. The total length of these two single-track lines is 805 km (500 miles).
- There are five airports serving the Region. Three of them in the Region (Diyarbakir, Batman, Gaziantep) and two of them just outside of the Region. Additionally, there are four STOL type (short take-off and landing) airports.
- There is one main pipeline to transfer oil from Iraq to the Mediterranean Sea through the GAP region, that is 1297 km (806 miles) long. There are also five secondary oil

pipelines and one main natural gas pipeline. The oil pipeline has been idle since 1991, as a part of the UN sanctions against Iraq. Turkey's decision to comply with UN sanctions against Iraq has decreased its foreign trade income significantly.

The major factors to consider during a transportation study are: the current population and the expected growth rate, unemployment rate within this population, GDP of the Region, car ownership rate of the population, current freight and transportation costs and patterns, inflation (especially for BOT type construction), and the physical characteristics and capacities of the existing transportation systems. Using these data, a transportation model that shows where the main traffic flow is can be established. This model is an indicator of where the congested sections are and/or will be. This way, a strategy with several alternatives can be formulated to relieve the existing congestions or take precautions for the expected ones. At the same time, an expansion of the existing network can be considered to satisfy the expected freight and passenger transportation demand in the future. The path followed in the GAP Regional Transportation Study is the same as mentioned above (GAP Transport and Infrastructure Consulting Corporation, 1992).

The transportation demand for 2005 was examined regarding the following principal groups:

- transportation matrices for the products of agriculture and agro-related industries,
- transportation of industrial raw materials and finished products,
- transit traffic, which could not be forecasted for the year 2005, due to economic and political uncertainties in Iraq, was assumed to increase 4% per year,
- the passenger transportation demand was expected to be met by roads, railways, and highways.

In GAP case, the so-called "Improvement Alternative" was chosen, requiring an investment amount of US$ 810 million(1992 prices). 96.6 % of this investment was planned to be spent on roads and the rest on railways. The planned improvement for the Region's transportation network is explained in Table 3.4.

NO	PROJECT	LENGTH (km)	LENGTH (mile)	CURRENT STANDARD	PROPOSED STANDARD	COST (1992 Million US$)
1	Gaziantep-Sanliurfa Motorway	139	86	Motorway	Motorway	$330.0
2	Sanliurfa-Silopi	346	215	First Class State Highway	Expressway (2*2)	$192.5
3	Sanliurfa-Siverek-Diyarbakir	182	113	First Class State Highway	Expressway (2*2)	$110.5
4	Diyarbakir-Cinar	33	21	First Class State Highway	Expressway (2*2)	$20.0
5	Gaziantep-Kahramanmaras	42	26	Third Class State Highway	First Class State Highway	$15.0
6	Adiyaman-Celikhan	29	18	Second Class State Highway	First Class State Highway	$13.0
7	(Adiyaman-Golbasi)Jnc.-Besni	12	7	Third Class State Highway	First Class State Highway+Climbing Lane	$6.5
8	Batman-(Hasankeyf-Kurtalan)Jnc.	4	2	Second Class State Highway	First Class State Highway+Climbing Lane	$1.5
9	Mardin-Kiziltepe	20	12	First Class State Highway	Expressway	$13.0
10	Sanliurfa-Akcakale	51	32	Second Class State Highway	Expressway	$28.0
11	Viranschir-Ceylanpinar	51	32	Third Class State Highway	Expressway	$31.0
12	Viranschir-Demirci-Ovabag-Diyarbakir	93	58		Third Class State Highway	$21.5
	TOTAL HIGHWAY INVESTMENTS	**1002**	**623**			**$782.5**
13	Maden-Diyarbakir	83	52	Single Railway	3 Siding and Signalization	$8.0
14	Yolcati-Maden	76	47	Single Railway	4 Siding and Signalization	$8.0
15	Malatya-Yolcati	95	59	Single Railway	7 Siding and Signalization	$12.0
	TOTAL RAILWAY INVESTMENTS	**254**	**158**			**$28.0**
	TOTAL	**1256**	**781**			**$810.5**

Table 3.4. Planned Public Investments to Improve the GAP Transportation Network
(Source: GAP Transpotation and Infrastructure Development Study, 1992)

3.4. Social Changes in the GAP Region

A study conducted by the Chamber of Agricultural Engineers of Turkey explains the existing social structure and the problems in the GAP Region, and suggests solutions to these problems. The major social problems, obtained through a survey in the Region, as stated in the study called "Trends of Social Change in the GAP Region", are summarized below, followed by suggestions of the author of this thesis:

a. Problems related to settlement: As explained before in the previous chapters, it is not easy to improve services (especially infrastructure) in the existing rural living areas, because of too many settlements each having a small population. Therefore, this aspect of settlement and advantages of relatively tight settlement should be taken into consideration when resettling the former inhabitants of the villages, which already have been or will be flooded under reservoir lakes of GAP dams.

The model used to settle the immigrants who came from former communist Bulgaria in the late 1980s, can be used as an example for the GAP region, although the satellite cities created for these immigrants (approximately 200,000 people) were in the western parts of the country, where the infrastructural development is already completed. These residential complexes were partly financed publicly and partly through the European Settlement Fund (EBRD). The construction was contracted out to the private sector, which completed them in a very short time including the infrastructure. A similar model was used to rapidly resettle the victims of the big earthquake in Erzincan (a province in eastern Turkey, close to the GAP region). Central rural residential areas, collecting the small settlements relatively together would be a partial solution to the above mentioned problems. The word "relatively" is used here, because most of the people living in these small settlements are farmers cultivating the land nearby. An intensive coordination, communication, and cooperation effort by the state will be needed to arrange the planning of these new residential areas, either offering new land and/or other values to these people to leave their current homes. One of the most important issues within the resettlement concept is fair compensation for lands and timely relocation of the people.

Past experience has proven that, a resettlement plan should be integrated into every water resources development plan (Goldsmith and Hildyard, 1984).

These residential complexes can also be used to help settle the small population which leads a semi-nomadic way of life because of their profession, namely animal husbandry. In that case, the state will have to create a means of subsistence, upon which they can make a living wherever they are located (Chamber of Agricultural Engineers). This subsistence heavily relies on the industrial development of the Region and the investments by the private sector into the Region.

b. Problems related to population growth: As mentioned in Chapter 2, the population growth in the Region is above the national average, causing difficulty for the state to create employment and public services for the people there. This tradition of having many children is created by the manpower need to cultivate the land or take care of the farm animals.

One solution to this problem would be to reduce the need for labor (in other words children) by introducing machinery into farming. Another solution could be to encourage larger organizations like farmers' unions (cooperations) to allow agricultural practice at a larger scale than individual family enterprises (Chamber of Agricultural Engineers). Both of these suggestions require programs to educate the population in the rural areas.

"... the basic instrument for the transformation of extended family into a contemporary nuclear family is to generate job differentiation, which will, ... , encourage young people (new generations) to acquire new skills and cut out their dependency to family enterprises" (Chamber of Agricultural Engineers)

c. Problems related to health and education-training: As mentioned in the overall GAP objectives and strategy, one of the goals of the Project is to attract well educated personnel of all professions to the Region. The existing settlement structure of the residential areas and the harsh geographic conditions in the Region are the most important handicaps preventing transfer of these vital health and educational services to the people

living in the rural areas.

Life in the Region is mainly agriculture based, therefore the demand for technical education has always been very low. The low level of education in the Region cannot be blamed on lack of educational services in the Region anymore, since the schooling opportunities have now reached all settlements of the Region down to the village level (Chamber of Agricultural Engineers). The word now is underlined in the previous sentence because, the results of this improvement will be first seen in about 10 years. The distance of the sub-village settlements to villages plays an important role in the enrollment ratio of the students in schools. Although, being a part of the general GAP objectives, accomplishing a boarding school system in the Region does not seem very promising, since the major industry is still agriculture, which requires manpower. Therefore, most families will not want to send their children away for eight months per year. Manufacturing industry is expected to improve and attract young people as the private sector enters the Region more within the GAP development project scope. The goal of increasing the number of technical personnel in the Region can be reached in two levels: 1. in short term, by offering incentives to personnel from other parts of the country, to come and work in the GAP region; 2. in long term, by educating and training the skilled young people in the Region and utilizing their skills in the future.

> *"... first of all weight should be given to occupational and technical training which will enable young people to gain skills and be economically active within a relatively short period of time. Schools of this character must be increased and their training fields must be diversified" (Chamber of Agricultural Engineers).*

CHAPTER 4

IMPLEMENTATION OF GAP- CONSTRUCTION

GAP is an integrated regional development project and its characteristics are:
(1) it is a very large project consisting of 13 different major construction parts currently at various stages,
(2) it is a public project with national and international political dimensions,
(3) it is a long term project involving many companies from various countries,
(4) its updated budget in 1994 is US$ 30 billion and construction of the irrigation schemes, dams, and hydroelectric power plants constitutes US$ 17 billion, which is approximately 60% of the total budget.

The remaining 40% of the planned investments are allocated to development of education, transportation, health, agriculture, urbanization, and manufacturing sectors in the Region. Development of these sectors often requires physical buildings, and infrastructure and the construction industry is required to provide these facilities in order to reach a sustained development in a particular region. Therefore, the actual amount of investments, that are related to construction industry in GAP is much more than 60%.

Having indicated the high involvement of the construction sector in any regional development program as well as in GAP in the previous chapters, the overall management of construction of the 13 main parts are being examined in this chapter. A general definition and the author's ideas on each aspect are explained first, followed by whether and/or how it applies to GAP.

4.1. Organizational Structure of GAP

Construction of the dams and the irrigation facilities within the GAP scope involves multiple parties from various sectors and countries with different interests, tasks, and expertise. The overall scope has been divided into 13 major parts and many smaller ones and each one of these 13 main parts consist of several subprojects. Each of these

subprojects are awarded to different contractors, engineers, controllers and consultants. Most of the parties are international joint ventures by companies who are sharing each others expertise, labor, funds, knowledge, and equipment. Therefore, this thesis will only handle the major parties managing the overall irrigation-energy part of the program.

Following is a list of the main parties that are involved in management and control of GAP, their positions within the overall GAP organization, and how and by whom the requirements and needs of management are being fulfilled in GAP. Figure 4.1 is a graphical explanation of the existing GAP organizational structure derived from the author's interviews with representatives of these parties and publications of the GAP Administration of the Prime Ministry of Turkey.

1. DSI (State Water Works): DSI is the owner on behalf of the Ministry of Construction and Settlement[1] and therefore of the Turkish Government. DSI is one of the six general directorates of the Ministry of Construction and Settlement and at the same time the major public works owner in Turkey (Tavakoli & Tulumen, 1990). As mentioned in the previous chapters, DSI has overseen construction of 334 dams, design of 132 dams, and planning of 24 more dams including completed parts of GAP until 1990 (Statistical Year Book of Turkey, 1990). Therefore DSI, with its engineering and construction departments, can be considered a sophisticated owner. The contracting, consulting, and engineering contracts are directly between the parties and DSI. All kinds of approvals related to construction and control of schedule/cost on single project basis are responsibilities of DSI, making use of the services provided by the consulting agencies. In terms of management and financial control of all construction activities, DSI is the most active representative of state on the project (others are TEK, TUMAS, and the GAP Administration).

It was mentioned in the previous chapters that GAP is an integrated development

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1 This ministry is called "The Ministry of Construction and Settlement" in EIU, Country Report, 1994, and "The Ministry of Public Works and Resettlement" in Construction Management and Economics, Construction Industry in Turkey, 1990. This thesis will refer to it as "The Ministry of Construction and Settlement".

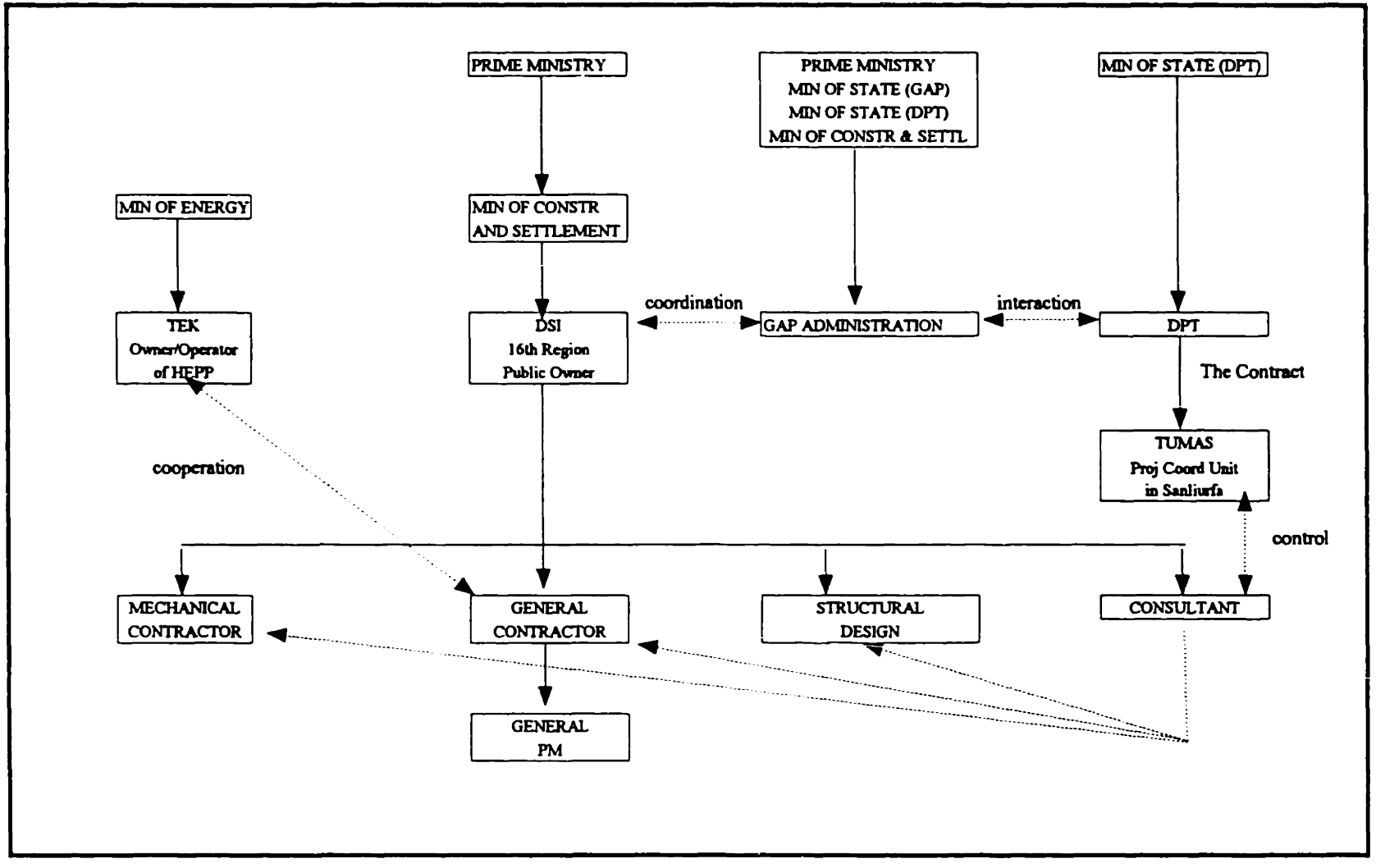

Figure 4.1. Existing Organizational Structure of GAP
(Source: Mutlu, 1994, The GAP Management Contract, Aykut, 1994)

project and involves many sectors such as education, health, agriculture, urbanization, energy etc. in addition to construction. Therefore, one of the major functions of DSI is to cooperate with the GAP Administration for coordination on all issues with construction activities.

2. GAP Administration (Prime Ministry Southeastern Anatolian Project Regional Development Administration): GAP administration was founded by the Turkish Government in 1989 to, in terms of time and location, provide general coordination, direction, and monitoring of all activities within the GAP scope of work (Mutlu, 1994) until the year 2005 (Official Newspaper, 1989). It is also the Administration's duty to conduct research on all areas that are mentioned in the GAP Final Master Plan Report (e.g. environmental effects of GAP, residential, transportation, education, and industrial development etc.). The GAP Administration Directorate consists of the Prime Minister, Minister of State in charge of GAP, Minister of State in charge of DPT (State Planning Agency), Minister of Construction and Settlement and other ministers if needed (Official Newspaper, 1989). The management team of the Administration meets every two months under the leadership of this directorate. The Administration also performs intensive information exchange with the DPT (State Planning Agency) in addition to DSI, in order to stay consistent with the Master Plan, since the Master Plan was prepared by DPT.

3. TUMAS (Turkish Engineering, Consulting and Contracting Ltd): DPT (State Planning Agency) employed TUMAS in 1986, to manage and monitor all activities within the overall GAP scope of work. It is a majorly state owned enterprise, which DPT (State Planning Agency) has been using to control some government funded projects without having to hire additional overhead. TUMAS controls and works with the consulting companies on each individual project and acts as the overall manager for GAP through its Project Coordination Unit (PCU) in Sanliurfa province. The management contract between TUMAS and DPT, and functions of TUMAS will be explained in detail in Section 4.2. GAP Works Management and Coordination Contract.

4. TEK (Turkish Electricity Authority): TEK is directly related to the Ministry of Energy and is the dominating power distributor throughout the country (ENR 2/1/90). One of the main purposes of GAP, just like most other water resources projects, is energy production. Therefore, TEK is very much involved in the project, since it will be the owner and distributor of the energy produced by GAP. TEK acts as the operator of the hydro electric power plants within the GAP organization. Usually, it is not enough to have the owner's (who is most of the time the operator, too) input during the preconstruction phase only (design, bids, budgeting, scheduling etc.) for very large projects. Cooperation during construction would help to recognize mistakes early enough, so that they can be corrected with relative lower cost and effort. Cooperation during the construction phase should not be limited to "with GC" only. For example, for the Ataturk Dam, TEK coordinated with the general contractor (ATA Construction Company) for construction, and with the mechanical contractor (Consortium Ataturk[2] lead by Escher Wyss Ltd.) on generators, turbines, transformers, steel pipes, and the power house.

5. General Contractors: The GAP general contracting contracts are between the GC and DSI directly and all project management functions for a particular project are undertaken by the GC. For large projects like GAP, a team consisting of a project manager for the owner, designer, and contractor form a group of people who work together to manage design, procurement, and construction activities (Oberlender, 1993). In most cases, however, the project manager of the general contractor is the major responsible person for coordination of activities, cooperation and communication between the parties, and the overall results. Table 4.1 briefly describes the different responsible parties within a GC organization, the documents they produce (which are used by others as data), and the data they need in order to produce these documents.

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2 Consortium Ataturk consisted of the following companies: 1. Escher Wyss Ltd, 2. BBC Brown Boveri and Co. Ltd., 3. George Wimpey International Ltd., Hochtief Aktiengesellschaft

As can be seen in Table 4.1, the Project Team lead by the Project Manager uses all of the final reports created by support staff and interprets them. The results of this implementation are the decisions that effect the overall results of a project.

Having indicated functions of major parties that are involved in GAP at various levels, it is possible to say that the management/control of GAP is not allocated to a single party. This duty is being shared by five main parties.

4.2. GAP Works Management and Coordination Contract[3]

A brief description of the agreement conditions (between TUMAS and DPT) would be: coordination, monitoring, and management of GAP in the preconstruction and construction phases, as explained in the third clause of The Contract.

The major tasks, allocated to TUMAS for GAP are as following (Okutan, 1994):

(1) Assessment of present situation in the Region (in terms of progress of GAP) ,

(2) Identification of the parts of the work program and regional projects,

(3) Development of resource mobilization (mainly human resources for technical duties),

(4) Some administrative duties,

(5) Development of a control system (for progress of GAP),

(6) Development of detailed work programs and coordination for the ongoing and future investment projects,

(7) Management and coordination of consulting services for GAP.

TUMAS is to establish a project coordination unit (PCU) in the Sanliurfa province, so that all activities can be coordinated and monitored effectively in place. One of the

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3 This agreement, hereinafter called The Contract, is made between the Turkish State Planning Agency (DPT) and Turkish Engineering Consulting and Contracting Company LTD (TUMAS). The Contract is also indicated in Figure 4.1.

RESPONSIBLE PARTY	PRODUCES	USING THE DATA IN
Estimator PM Involved	Estimate	Construction Drawings Specifications Contract Material Unit Prices Labor Costs Subcontractor Bids Availability of Labor and Material Productivity Ratio of the Workforce Equipment Costs Possible Value Engineering Items Company (Contractor) Inventory Overhead Costs Lead times Potential contingency factors Own experience/ historical data
Purchaser PM Involved	Purchase Order	Material Prices Lead Times Availability Company Inventory Estimate Specifications Schedule Supplier Information
Accountant PM Involved	Job Cost Report Transaction Journal	Invoices Bills Timesheets Activities within theScope of Work Transmittal Letters Accounts Receivable Accounts Payable
Scheduler PM Involved Super Intendent Involved Estimator Involved	Schedule	Contract Construction Drawings Specifications Subcontractor Schedules Estimate Possible Value Engineering Items Logic Diagram of the Work Leadtimes Productivity Ratio of the Workforce Availability of Labor and Material Potential Contingency Factors Own Experience/ Historical Data
Project Team - Project Manager (Leader) - Project Enginers - Superintendents	Daily Activities Log Order Forms Monthly Progress Report Monthly Cost Report Meeting Reports Change Order Request Subcontract Change Order Payment Approval Payment Request	Contract Estimate Schedule Job Cost Report Construction Meetings Activities on the Site Test Reports Field Engineering Reports Subcontractor Change Order Proposals

Table 4.1. The Documents Produced by the Project Team and the Support Staff During Construction
(Source: Mondini, 1993, Russel & Triassi, 1982, Project Management Journal, 1987, Lodger, 1994)

major functions allocated to TUMAS through this agreement is recommendation and monitoring of the consulting companies that will be working on various parts of GAP. The amount to be paid to TUMAS by the employer (DPT) is a lumpsum price (US$ 4,600,000), based on expenses such as: 1. personnel[4], 2. travel, 3. office, and 4. communication.

This agreement between DPT (State Planning Agency) and TUMAS contains clauses that refer to overall management of GAP construction activities, rather than construction management of the whole project or a particular part of it. Therefore, The Contract cannot be considered a Construction Management contract. The CM functions in GAP are mostly being shared by the five major parties, namely: DSI, The GAP Administration, TUMAS, TEK and the GC. Regarding the characteristics of The Contract, it is possible to say that it is a "pure" management agreement, since there is no mention of hard construction work in the clauses, which is also obvious from the organization chart in Figure 4.1. But again, it is not a "pure" construction management agreement, because TUMAS is not liable of fulfilling all of the traditional CM tasks.

A comparison of the tasks to be usually performed by a CM (Column 1), a GC (Column 2), and the ones being performed by TUMAS in GAP (Column 3) is demonstrated in Table 4.2. As a conclusion of this table, it is possible to say that responsibilities of TUMAS do not fulfill all of the management/control tasks. Therefore, some management duties remain open to be performed by the other four parties. Column 4 of the Table 4.2. shows the results of the author's analysis on the overall GAP organizational structure about which parties are performing or should be performing these remaining responsibilities. Following is the explanation of these task allocations.

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4 Project Manager, Public Relations Officer, Training Experts, Accountant/ Financial Analyst, Accounting System Expert, Sociologist, Economist, Real Estate Expert, Urban Planner, Architect, Civil Engineer, Environmental Engineer, Geotechnical Engineer, Hydrology Engineer, Mechanical Engineer, Electrical Engineer, Structural Engineer, Agricultural Engineer, Telecommunication Engineer, Lawyer, Designer, Technician, Driver.

PHASE	TASK	CM	GC	TUMAS	
		1	2	3	4
Pre-Construction	Prepare preliminary budget	√		√ (propose)	GAP/TUMAS
Phase	Environmental impact studies assist.	√			GAP
	Site selection studies	√			DSI
	Advise on design team selection	√		√	DSI/TUMAS
	Advise on scope definition	√		√	DSI/TUMAS
	Begin value engineering	√			GC/DSI/CONSULTANT
	Prepare master schedule	√		√ (monitor)	DSI/GAP/TUMAS
	Propose alternate methodologies	√		√ (general)	DSI/TUMAS/GC
	Identify long-lead materials	√			GC/DSI
	Devise contract strategy	√		√	DSI/TUMAS
	Prepare bid packages	√			DSI
	Manage technical consultants	√		√	TUMAS
	Review specification criteria	√		√	DSI/TUMAS
	Prepare general conditions	√			GC
Bid Phase	Prequalification of bidders	√		√ (consultants)	DSI/TUMAS
	Cash flow projections	√	√		GC/DSI/TUMAS/GAP
	Survey labor market	√	√		GC
	Propose value engineering options	√	√		GC/CONSULTANTS/DSI
	Analyze bids	√	√ (subs only)	√ (consultants only)	DSI
	Recommend contract awards	√	√	√ (consultants only)	DSI/TUMAS
	Develop site logistics plan	√	√		GC
Construction	Conduct project meetings	√	√	√ (with the top mngt.)	GC/TUMAS
Phase	Obtain permits	√	√ (constr only)		GC
	Administer contracts	√	√ (subs only)	√	DSI/TUMAS
	Control cost and schedule	√	√	√ (overall)	DSI/GC/TUMAS
	Administer submittals	√	√		GC/DSI
	Negotiate change orders	√	√		GC/DSI
	Coordinate and inspect work	√	√ (subs only)	√	DSI/TUMAS
	Arrange for inspections and testing	√			GC
	Construction with own forces		√		GC
	Closeout contracts	√	√		GC/DSI

Table 4.2: Comparison of Tasks that are usually Performed by CM and GC and Tasks being Performed by TUMAS.
(Source: Tishman, 1988, The GAP Management Contract, Interviews with PMs, 1994)
Note: GAP refers to GAP Administration in this chart.

1. DSI : As the owner and the most sophisticated managing party in terms of construction, DSI is the main responsible organization for overseeing all three main parts of the system, which are scope, budget, and schedule. DSI is to be involved in inspecting, controlling, and approving all activities on project basis and in single project detail. It was mentioned in the previous chapters, that all site selection studies and engineering projections for GAP were completed by DSI in 1960s, with the help of some consultants. Since the contracts are directly between DSI and the GC, the administrative, analysis and control duties related to the contract and bidding are also allocated to DSI.

2. TUMAS: As the prime responsible party for monitoring and managing the different consulting companies and one of the four responsible parties for controlling the construction companies working in GAP, TUMAS is to cooperate mainly with DSI, the GAP Administration and the consulting companies on the overall scope (quality) and schedule. TUMAS should be directly working as consultant to DSI on the overall GAP basis, instead of the DPT, since DSI is the owner and the end user of the end product. Some administrative duties that are main responsibilities of DSI are to be shared by TUMAS, since it is the management company that has been hired by the state to perform most of the management duties.

3. GAP Administration: As the responsible party for coordination of all other activities with construction activities within the GAP scope of work, the Administration is to cooperate with DSI and TUMAS mainly on the overall schedule, cost, and scope parts of the system. The GAP Administration, shortly referred to as GAP in Table 4.2, is to be involved in general policies and objectives, general budget, overall construction schedule of GAP, payment plans, and contracts with major parties not directly, but through DSI and TUMAS. The main responsibility of the Administration should be to help DSI for coordination between construction and all other activities, and at the same time control actions of DSI.

All of the above suggested changes propose a new organizational structure that is based on centralization of information in DSI. Time, that is lost during complicated communication, coordination, and cooperation is very valuable considering the expected benefits of the project. DSI is the center where all information should arrive and be evaluated first. If DSI and TUMAS as its consultant cannot reach a decision within a given time frame or do not possess the authorization to make a decision, other parties according to their authority level and responsibility area should get involved.

4.3. Scheduling in GAP

There seems to be a confusion in the construction industry between the terms "planning" and "scheduling", since they are often used synonymously (Callahan et. al., 1992). But scheduling is actually only a part of the planning process and one of the most important tools in the control of the construction progress.

It is not very likely to be able to follow the initial schedule on a construction project precisely, since there are always unpredictable contingency factors, which cause changes either in the sequencing or the durations of the tasks. Therefore, the initial schedule is usually updated (revised) at least once during the progress.

Although a major part of GAP's construction funds are spent on dam building, it is not a pure dam construction project. GAP is a development project, therefore it would not be possible to compare the initial master schedule (the Schedule) shown in Appendix 1 with a typical dam construction schedule. The Schedule has been prepared by the Turkish Government in order to determine the sequencing of 13 different parts of GAP and coordinate other activities and expenditures with construction of the dam/ irrigation systems. Responsible parties of each project (GC, DSI, TUMAS, and the consultant) are liable for preparing a detailed construction schedule and for following it.

Using the information on each one of the 13 major parts of the project explained in Chapter 2, the author of this thesis has updated the initial master schedule (the

Schedule) shown in Appendix 1. Although the revised schedule (the Revised) in Appendix 2 does not show each part in detail, it is possible to derive some conclusions on how much on track the project is and what the reasons for the delays could be.

The Karakaya Project is shown to be completed on the same date on both schedules, because the construction was ongoing during the preparation of the 1985-Master Plan Schedule.

As explained in the previous chapters the Lower Euphrates Project consists of two main parts: The Ataturk Dam and the Sanliurfa Tunnels. The Ataturk Dam is completed on schedule as planned, but the completion of the tunnels is delayed for 6 years. One of the reasons for this delay could be the funding problems that the Turkish government has faced during and after the Gulf War because of the UN sanctions against Iraq, resulting in foreign trade loss, since a main oil pipeline between Iraq and Turkey had to be shut down. The other reason that has slowed the construction activities in the Region in general is the safety precautions taken by the Turkish government during the war, since the geographic location of the Region is very close to the Gulf. Finally the management and planning factors play an important role in the delay. Not all of the delay is related to the Gulf War and its effects on the Turkish economy, because the Gulf War started in 1991 and its effects have lasted during a maximum duration of 3 years.

Birecik and Karkamis Dams were both planned to be constructed simultaneously and be finished by the end of 1992. The Turkish government decided to finance the project through BOT. However, the risky economic situation in Turkey and the Gulf War have caused problems in convincing companies to undertake the project. Finally, in 1993 a joint venture of 9 European and Turkish companies was awarded the contract on a BOT basis to construct the dam in 5 years and operate it for 15 years. One of the main reasons for bidding as a joint venture could have been in order to spread and minimize the risk factor. The Karkamis Dam will also be built on a BOT basis, but no tender has been issued yet. A successful completion of Birecik Dam will probably result in higher participation for the Karkamis Dam bid.

Adiyaman- Kahta Project is one year behind schedule currently. One of the main reasons for this delay would be the Gulf War since the construction of the project started just before the War.

Gaziantep Project is behind schedule although it is shown on time on the revised schedule. The revised schedule does not reflect the whole project, since the Gaziantep Project consists of two dams.

Dicle- Kiralkizi Project consists of two dams and both of them are delayed. This delay is not in the construction duration, therefore it is not possible to say that project management on this specific project has been unsuccessful. The delays occurred because bidding and the construction started 5 years later than expected, most probably due to cancellation of bids and/or delays in the feasibility studies and planning, indicating lack of efficient management in the preconstruction phase.

Batman, Batman- Silvan, and Garzan Project are also behind schedule due to delays in the issue of tender, which were probably caused by delays in planning and feasibility studies.

No tender has been issued for Ilisu and Cizre Projects yet. Both of them are planned to be built on BOT basis. A tender is expected to be issued for Ilisu Dam within 1995. One of the reasons for this delay is the critical location of the Dam being very close to the Syrian border and currently a trouble spot subject to terrorism. Cizre Dam has been rescheduled to start after completion of the Ilisu Dam.

As a conclusion, it is not possible to decide on one single reason for the overall delay of 7 years in the whole GAP schedule. Some of these delays have been caused by unpredictable factors such as the Gulf War and the April 1994 economic crises of the Turkish Government. Both of these incidents have forced the government to delay the construction progress although Mrs. Tansu Ciller, the prime minister, has announced many times that GAP was the only investment that would not be effected by these crises (Media, 1994). These statements were followed by efforts to accelerate the construction, that have resulted in completion of the T1 Sanliurfa irrigation tunnel in 1994. Other

factors that have delayed parts of the project are related to planning, since there were delays in issuing tenders on most of the projects, probably because of lack of management/ control and funds in the preconstruction phases. One of the most important factors causing delays could be the following: As explained in the organizational structure and management contract of GAP (Table 4.2), most of the management tasks are not clearly allocated to one party, resulting in a management and control gap in the overall program. The situation for BOT projects is related to the economic and political risk factors in Turkey, successful completion of the first BOT project in GAP: the Birecik Dam, would probably encourage other companies to participate in the overall GAP program.

CHAPTER 5
CONCLUSION

The first main conclusion that can be derived from this thesis is that construction plays a vital role in a regional socio-economic development project such as GAP. GAP is an integrated regional development program and not a construction project, it includes construction and operation of dams and hydroelectric powerplants, irrigation facilities, agriculture and transportation infrastructure facilities, urban and rural infrastructures, finance and coordination of investments in various industries, commerce, health, education, housing, and other public and private services. Most of these facilities that are necessary for a sustained development require physical buildings and infrastructure that are provided by the construction sector.

The second main conclusion is that the modern planning methodology used for GAP, as well as other major "water resources utilization and regional development" projects around the world, includes environmental studies as well as social studies, in addition to economic studies and engineering. Therefore, inputs of expertise in management (project and development), and planning (economic, environmental, construction, and social) fields are also necessary.

The following derivations of this thesis support the above mentioned two main conclusions.

The expected impacts of the GAP on the Region and on all parts of Turkey are very high, since both the area and the population are approximately 10% of Turkey as a whole. Every investment made in the Region will reduce the available financial resources for investments in other parts of Turkey. But, at the same time, every bit of increase in the Region's GDP will increase the GDP of all Turkey and will contribute to the national development.

The largest investments in Turkey's history are being made in the Region, affecting the economy of the country, by being one of the reasons that cause temporary economic crisis every now and then (last one in April 1994), due to heavy payments made to

contractors and equipment/material suppliers, and other activities such as protection of the Project and the population from terrorism. The Region is currently economically and socially underdeveloped, because government efforts to link the private sector investments into this region have been unsuccessful in the past decades. The private sector has preferred to invest in the western parts of Turkey because the geographic conditions, weather, infrastructure (transportation), the distance to Europe (ease of export and import) are more suitable, and most important of all: the demand for consumer goods is higher there.

GAP facilities were planned mainly for two purposes: Irrigation and Energy. These two factors actually create competition in benefitting from the available water capacity. If the government decides to increase the benefits of irrigation, keeping the same project scope and budget, it will automatically decrease the benefits from energy, since the available resources (water) are limited. Research by DSI has resulted in the yearly benefit estimations. I took this a little bit further and defined a 'yearly benefit/ total construction cost' ratio, to be used for comparison. The conclusions that have been achieved using the data derived from the summary of cashflow projections (Table 2.5) and the charts that compare: (i) Payback Periods with Total Yearly Benefits/Construction Cost (the I curve in Figure 2.7); and (ii) Construction Cost with Total Yearly Benefits (Figure 2.8) are:

A. An additional 14th project in GAP would also lay on the I curve (with 5% variation), because the I curve reflects the existing characteristics for the Region and the Project.

B. GAP can be considered a feasible project, with some risk of delays in the schedule due to the size and the political nature of the Project (the Project concept here, includes not only construction, but also the development of the Region), because characteristics of the Project fulfill the foreign loan requirements of most of the main international development banks such as the World Bank Group.

The following quotation is taken from the GAP Final Master Plan Report:

"... There are no conflicts between environmental protection and

economic development, instead, an effective environmental protection plan is needed in order to coordinate the economic development of any region".

This statement is not easy to apply, because it implies that pursuing economic development through industrialization and protecting the environment at the same time can be achieved easily. This has not been the case in most of today's developed nations. They had to go back and repair the damage after having completed development. Therefore, it is common in developing countries to see economic growth, increase in employment, and improvement of public services and infrastructure as government priorities over protection of environment.

There are two main groups of environmental problems in the Region.

(1) Problems that are mainly caused by GAP.

(2) Problems that would exist even without GAP.

It is possible to say that GAP will increase environmental problems in the Region as the price for development. It can be argued whether this is a fair bargain or not.

The issue that is creating a conflict within the overall GAP objective is; whether some environmental regulations and massive control over industrial development would scare away the private sector from the Region. These regulations and tight control of industrial activities might disturb the atmosphere that the government is trying to create to attract the private sector into the Region through various incentives. A logical conclusion would be to meet somewhere in the middle and offer incentives partly based on the "compliance with the environmental regulations". Thus, the private sector would have to comply with all the environmental protection laws in order to qualify for incentives.

Although the Region has much to offer to the private sector (low cost labor, low cost land, and natural resources), it cannot promise "demand", at least for the next half decade. Most of the goods produced in the Region will still have to be sold in other regions of Turkey with an additional cost of transportation. Therefore, a compromise is expected from the private sector (how the private sector should react to this request is

arguable) to start the development era in the Region and private companies are aware of this request of the people and of the government.

Another important fact is that, thousands of local people have already worked for as long as ten years on the construction of GAP projects. Now that all projects are planned to be completed in about 10 years from now, unemployment is expected to increase in the Region. Therefore, investments are highly necessary to provide employment to these people in the Region. Otherwise, this area can become a social tinderbox full of unemployed people, most of which will have forgotten how to cultivate the land by then. These people will have to move to other parts of Turkey to find jobs which may cause unemployment there, as well.

Most of the half completed and low capacity factories in the Region can be saved by merger and acquisition through a coordination and cooperation operation between the state and the private sector. Large companies, planning to invest in the Region, might prefer to buy an existing plant and restore it, instead of constructing a brand new one. A new salary and employment policy for the state officials can be established to attract well educated technical personnel to the Region.

Government's role, in terms of funding of the planned investments, would be to create attractiveness through incentives limited to the Region only, otherwise the private sector will choose to invest in already developed regions, where there is less risk, less cost, and more profit. Foreign investment should bring advanced technology and experience and therefore cause competition within Turkey. Joint ventures with Turkish companies should not be considered as foreign investment where only foreign capital is provided without advanced technology and experience.

There are three main social problems in the GAP region. The first one, namely problems related to settlement is caused partly by GAP. This problem includes issues related to infrastructural situation and improvement of the rural and urban areas in the Region and at the same time resettlement because of former living areas that have or will be flooded under reservoir lakes of GAP projects. Several models to create new efficient residential areas are suggested in this thesis.

Approximately 60% of all investments within the GAP program are directly related

to construction of dams, hydroelectric powerplants, and irrigation systems, in other words development of agriculture and energy sectors. The remaining 40% of the planned investments are allocated to development of other fields such as manufacturing, health, education, and infrastructure, which require intensive input of the construction sector. Therefore, the actual involvement of the construction industry in the GAP program can be considered much more than 60%.

The most important parts of implementation of a large construction project are planning and control. These two important functions of management are usually shared by several parties involved in the project, as has been the case in GAP. There are five main parties that share the management responsibilities of GAP, but as a result of Table 4.2, which explains the typical tasks performed by a GC, a GM, and the ones being performed by TUMAS-the management contractor, allocation of most of the management tasks are unclear. Therefore, each of these tasks have been allocated to one or more of the five main parties involved in GAP by the author of this thesis, in order to fill the management gap.

The delays in the schedule are results of several factors in addition to this gap in the control of the construction part of the program. Other main reasons are the Gulf War and its effects on the Turkish economy, and the late issue of many of the tenders, again related to problems in management and planning of the overall GAP program.

Successful completion of every project in every industry also depends on the performance of the people who work on the project and how much they believe in it. Millions of personnel and laborers of all levels working in GAP believe that it will change the fate of the long forgotten people of the underdeveloped Southeastern Anatolia. This has been the biggest factor to keep the project going, although often slowed down by delays.

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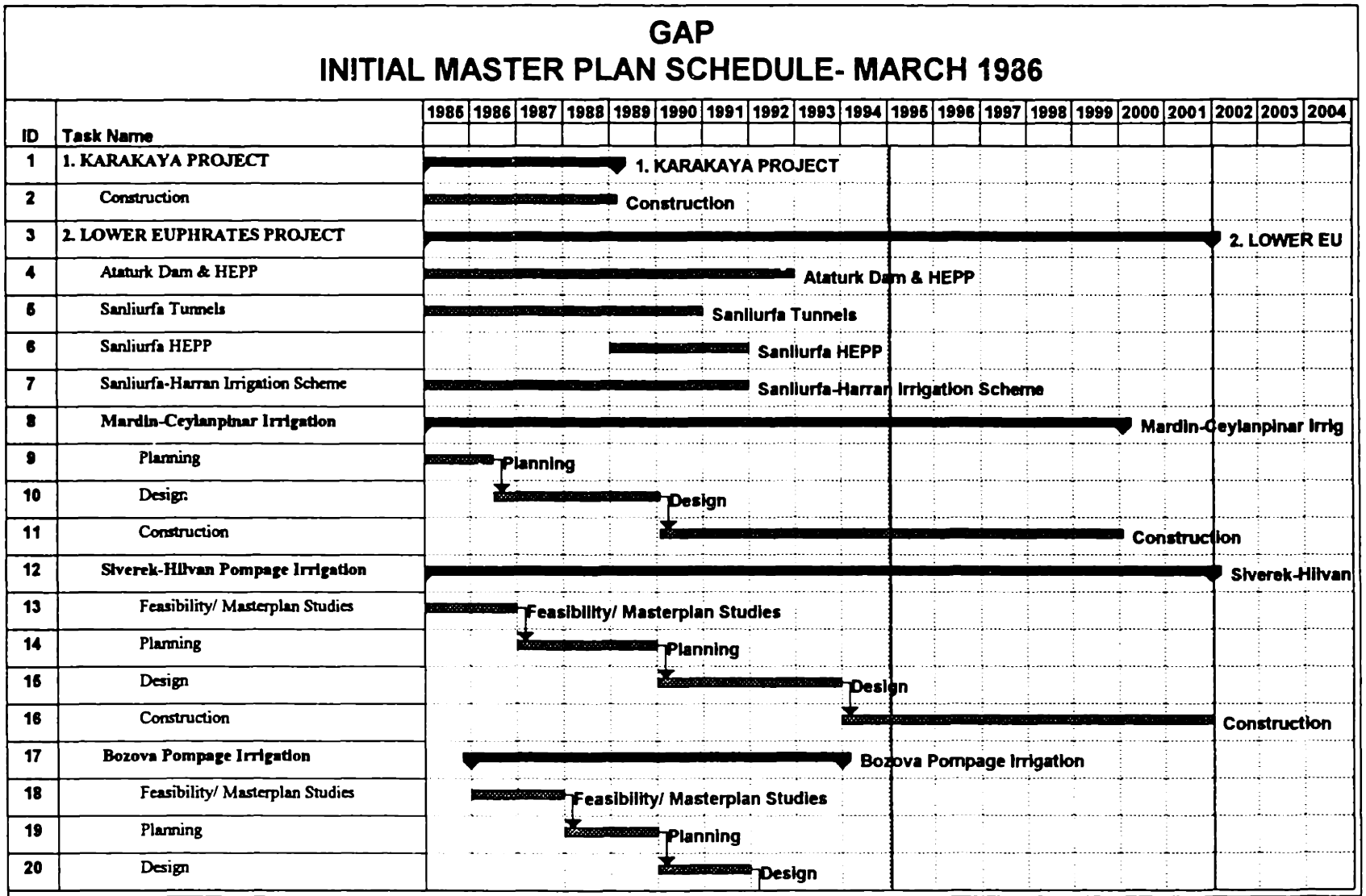
APPENDIX 1

GAP INITIAL MASTER PLAN SCHEDULE- MARCH 1984

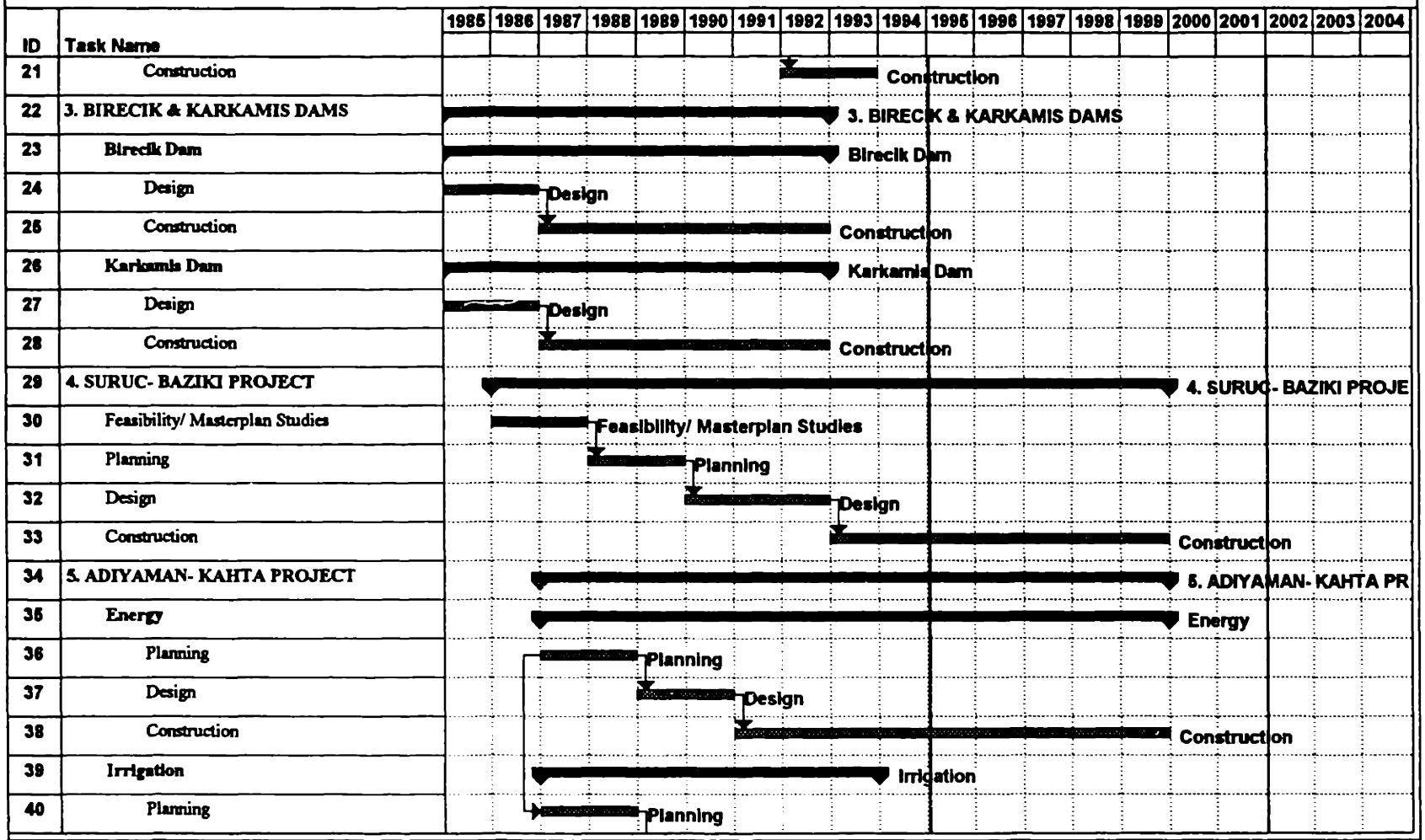
GAP
INITIAL MASTER PLAN SCHEDULE- MARCH 1986



(Source: DSI, 1985)

Appendix 1, Page 1

GAP
INITIAL MASTER PLAN SCHEDULE- MARCH 1986



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Appendix 1, Page 2

GAP
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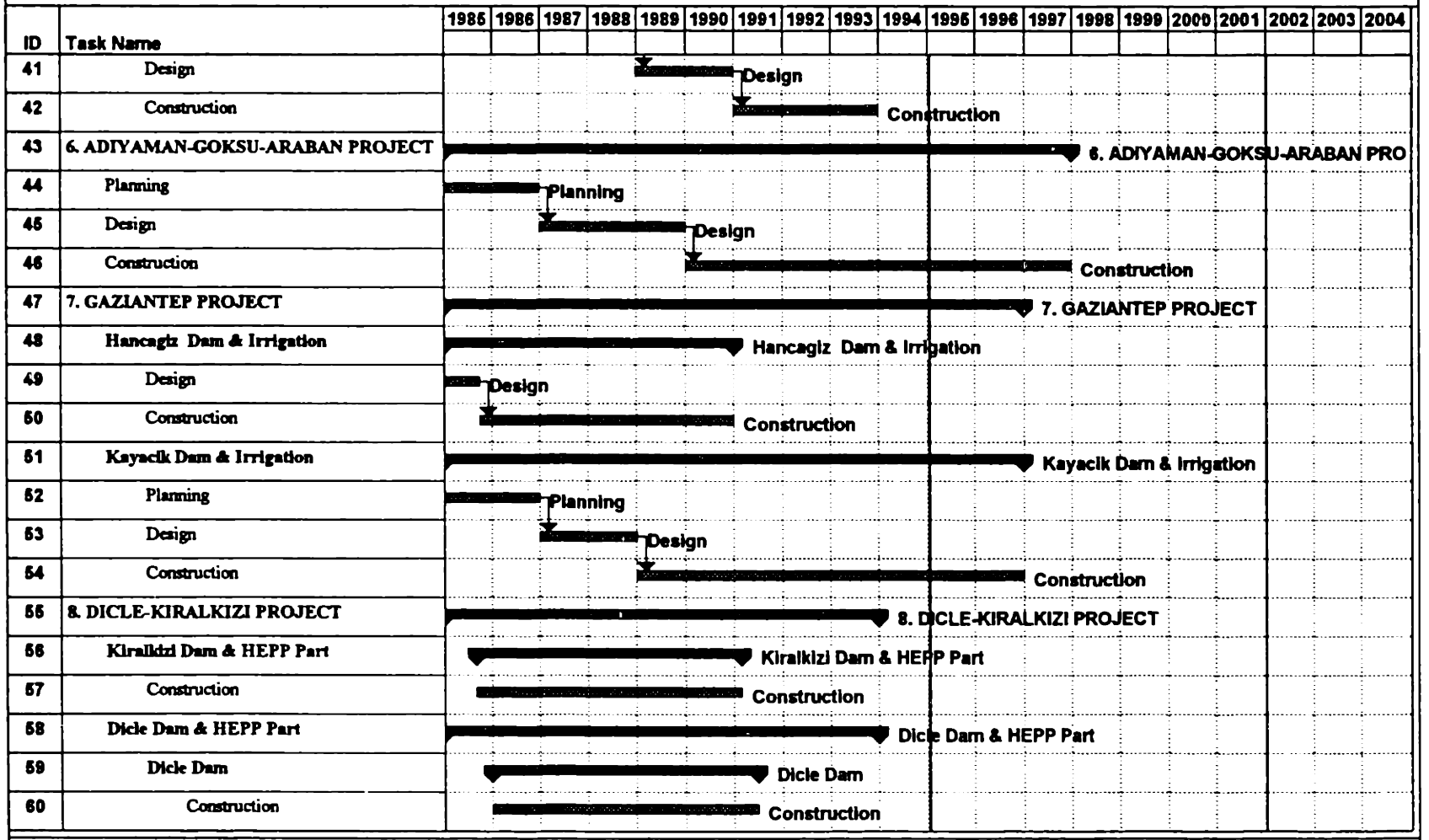

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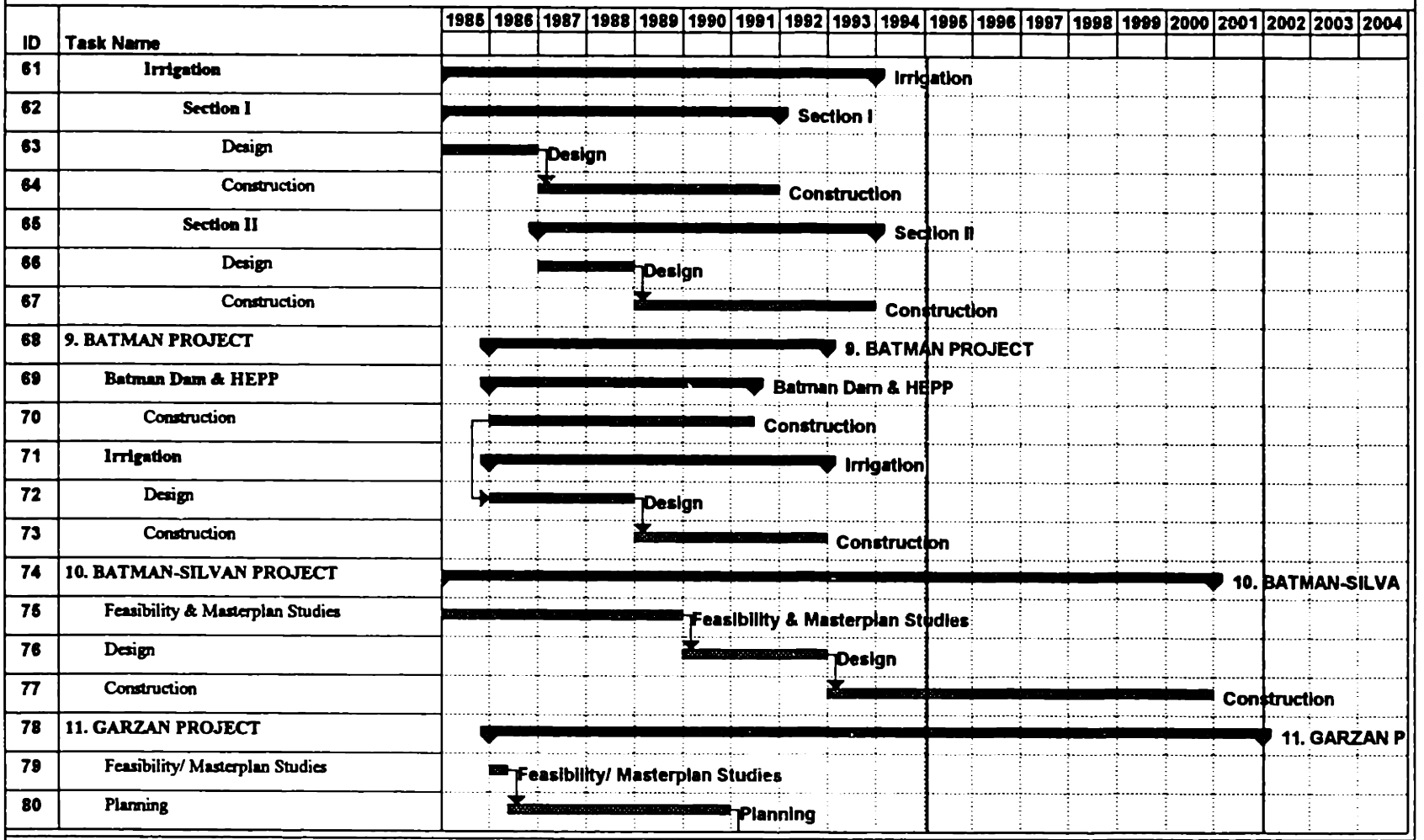

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Appendix 1, Page 4

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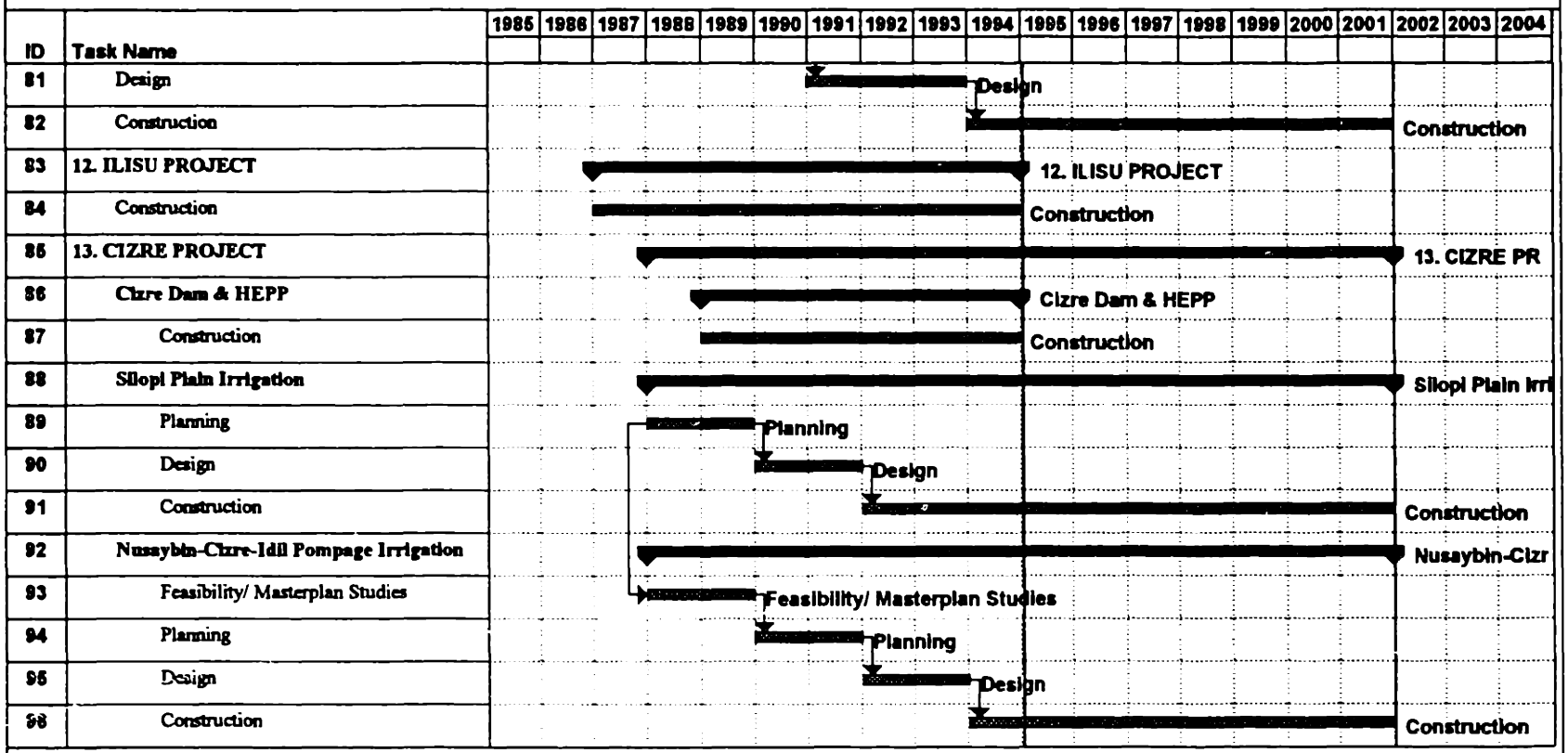

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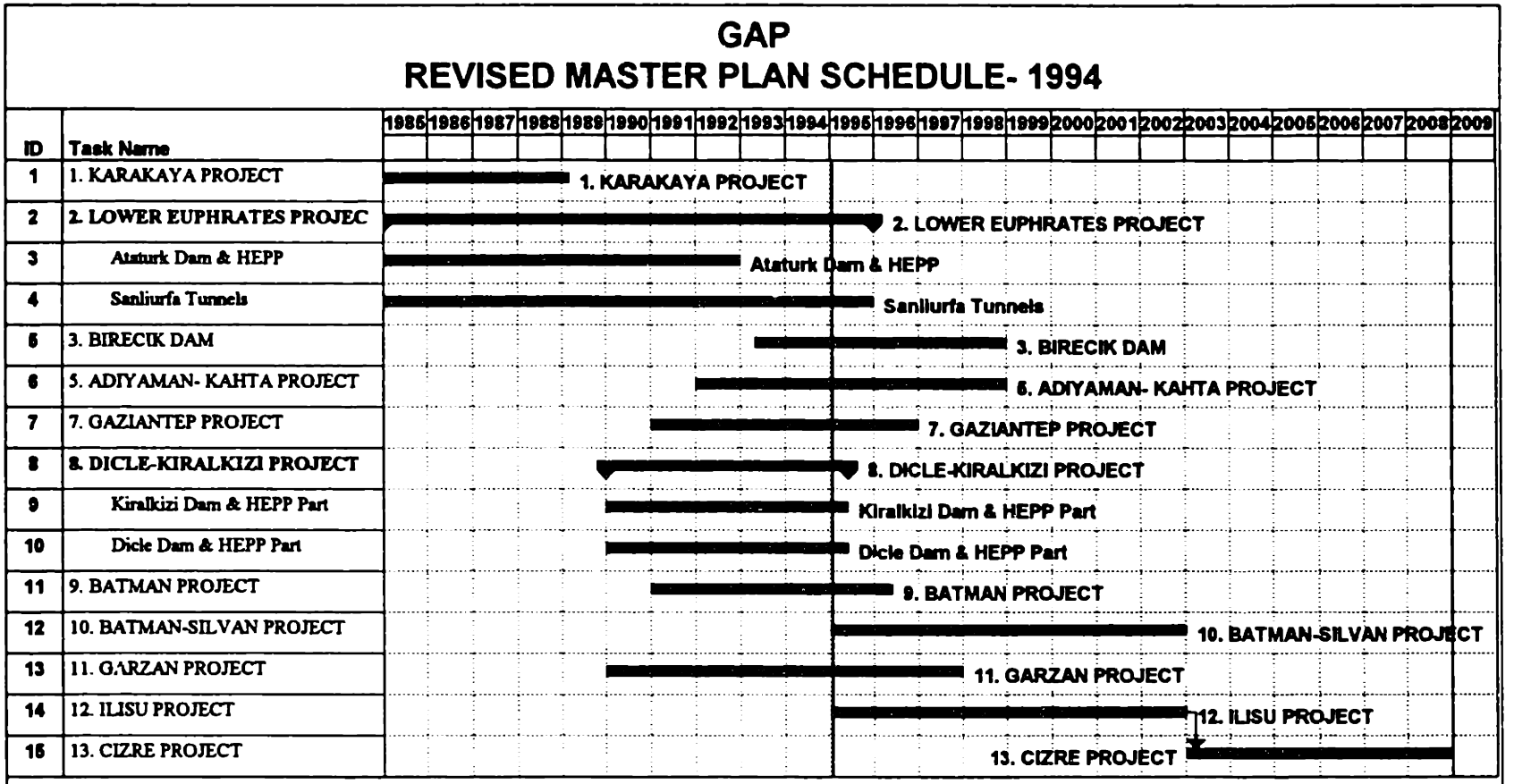
APPENDIX 2

GAP REVISED MASTER PLAN SCHEDULE- 1994

GAP
REVISED MASTER PLAN SCHEDULE- 1994



(Source: CHAPTER 2)

Appendix 2, Page 1