WATER ISSUES IN THE MIDDLE EAST

SYRIA

AMER Report
January 13, 1989

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SYRIA: POLITICAL, ECONOMIC AND STRATEGIC (1989)

Associates for Middle East Research (AMER) Water Project
Thomas Naff, University of Pennsylvania
Project Director

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Chapter 1

IDENTIFICATION OF MAJOR WATER SYSTEMS

Syria is an Asian country of 185,180 square kilometers at the easternmost end of the Mediterranean Sea. The word "Syria" has had different geographic meanings in different historical periods. It has often encompassed most of the western Asian littoral, a much larger region than the modern state. For this study, the name Syria will refer to the territory lying within the official boundaries of the Syrian Arab Republic.

The physical features of Syria begin with a humid coastal zone, segregated from the interior by two north-south mountain ranges which capture most of the precipitation from the sea. These ranges -- the Ansariya and Zawiya, which extend south into the Lebanon and Anti-Lebanon mountains -- are the uplifted edges of two tectonic plates whose juncture runs through the Ghab, Bekaa, Jordan and Araba valleys to the Red Sea and on into the Great Rift Valley of East Africa. East of the mountains, the land slopes into an arid steppe zone down to the Euphrates valley and off to the basalt and sand deserts of the Arabian peninsula. Rainfall varies from a yearly 1,600 mm in the coastal plain and mountains to less than 200 mm/year in the deserts of the east and south.

Most of the 10.9 million inhabitants of Syria reside in the region known to scholars of the ancient world as the Fertile Crescent. This comprises the coast and mountains, the nearer oases, and the Euphrates valley. Today, as always, the primary requisite for prosperity -- and for life itself -- is water.

1.1 Syria's Natural Water Systems

The question of water in Syria is more complicated than in any other Middle Eastern country. Syria has more drainage basins -- both riverine and inland -- than any of its neighbors except Turkey. One of these basins, the Euphrates, is classed among the great river systems of the world. The three most important basins upon which Syria depends comprise international rivers, shared with neighbors whose relations with Syria display serious political disagreements and, in the case of Israel, implacable enmity. In part, Syria also shares groundwater with its neighbors.

For purposes of the study of water, Syria can be divided into seven regions, based on both surface topography and subterranean geomorphology. These regions include the three major rivers together with their tributaries and associated groundwater systems -- the Euphrates, the Orontes, and the Yarmuk; the well-watered

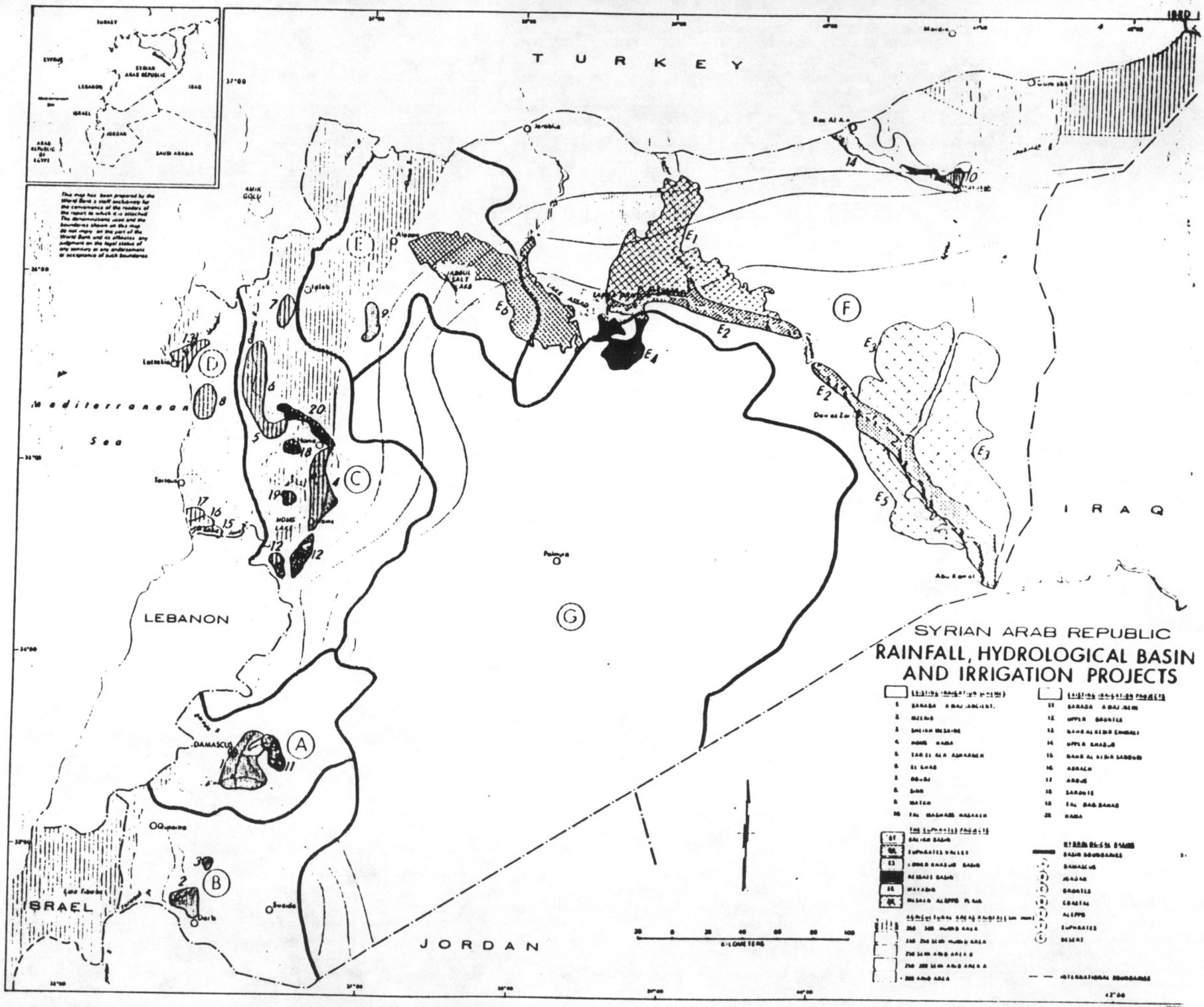


Figure 1.1 -- Syria's Hydrological Basins. Source: World Bank(3099)

Table 1.1

WATER RESOURCES OF SYRIA - 1985

	Mcm		Mcm
Surface Water		*Groundwater*	
Euphrates and tributaries	27,353[1]	TOTAL (est.)	5,400[6,7]
Orontes and tributaries	1,504[1]	Used for Agriculture	2,748[4,5*]
Yarmuk	400[1]	Used for M	258
Barada	235[1]	Used for I	288[4,8**]
Awaj	68[2,3]	Unused	2,106
Qweik	88[1]		
Coastal Rivers	841[2,3]	*Total Water*	
TOTAL	30,489	TOTAL	35,889
Used for Agriculture	3,732[4,5*]	Used for Agriculture	6,480[4]
Used for M	190	Used for M	448[8]
Used for I	-0-	Used for I	288[4]
Unused	26,567	Unused	28,673

---

* Calculated from percentages of groundwater and surface water required in 1982 (see Table - "Syrian Agricultural Water Requirements - 1982"): GW - 42.4%, and SW - 57.6%[5].

** The World Bank states that most industries have their own private wells[8].

Sources:
[1]AMER.
[2]USAID, "Natural Resources Annex", *Syria: Agricultural Sector Assessment*, 1980 (3046).
[3]Syria - Central Bureau of Statistics, *Statistical Abstract 1980*, 1980 (3050).
[4]UNESCWA, "Ch. 12: Syrian Arab Republic", *Desalination of Brackish Waters*, 1987 (4053).
[5]Syria - Ministry of Agriculture and Agrarian Reform, *The Annual Agricultural Statistical Abstract*, 1982 (3220).
[6]Article on Groundwater translated from Arabic (no Ref#).
[7]UNESCWA, "Ch. 6: Water Situation in the ECWA Semi-Arid Countries (Group 3)", *Development Guidelines for the Economic Use of Water in the ESCWA Region*, 1986 (4106).
[8]World Bank, "Background Annexes", *Syrian Arab Republic Development Prospects and Policies*, 1980 (3101).

coastal plain with several rivers and local aquifers; the inland basins of Damascus and Aleppo; and the desert steppes. Most of these major divisions have significant subdivisions (see map, Fig. 1.1).

Only Damascus and the coastal plain are free of international complications. The Euphrates is shared upstream with Turkey and downstream with Iraq; the Orontes is shared upstream with Lebanon and downstream with Turkey (the latter is a politically sensitive point); and the Yarmuk is shared downstream with Jordan and Israel. The sources for the Aleppo basin derive from Turkey. The major aquifers underlying the desert-steppe region are shared with Jordan, Iraq, and Saudi Arabia.

The usual estimate for the amount of water available to Syria each year is an average 35 billion cubic meters. Of this, 85% or 30 billion cubic meters is surface water, and 90% of the surface water is in the Euphrates (see Table 1.1 for rivers and flows). Groundwater from various sources is cited at 5 billion cubic meters, but this is only the crudest estimate. Survey work on Syrian groundwater is still ongoing. While scientists have in recent years done much work on the hydrogeology of Syria, the state of knowledge is still rudimentary and any attempt to quantify the amount of water safely extractable from underground sources is impressionistic at best.

Except for the piping of drinking water to Aleppo from Lake Assad, there are at present no significant interbasin transfers of water in Syria.

1.2 The Euphrates Basin

By far the largest of the Syrian water systems is the Euphrates basin. The river rises in the mountains of eastern Turkey at a height of more than 3,000 meters where annual precipitation exceeds 1,000 mm. The Euphrates and its tributaries drain an area of 444,000 sq km, of which 28% lies in Turkey, 17% in Syria, 40% in Iraq, and 15% in Saudi Arabia[3235].

Within Syria there are three tributaries. The Sajur, the last stream to enter the Euphrates from the right bank, crosses from Turkey to a confluence with the larger river just below the Turkish-Syrian border. The Balikh rises in Turkey, gains its major perennial flow from the Tel Abyad springs just south of the Turkish-Syrian border, and enters the Euphrates from the left bank at Raqqa after draining the western half of the Syrian Jezireh region. The Khabur, by far the most significant of all the Euphrates tributaries, receives the better part of its flow from the prolific Ras al-Ain springs and drains the eastern part of the Syrian Jezireh to enter the Euphrates between Deir ez-Zor and Abu

Kemal. After the Khabur, the river is exotic; there are no further natural tributaries until it meets with the Tigris to form the Shatt al-Arab in southern Iraq. The total length of the Euphrates is 2,230 kilometers, of which 675 km is in Syria[4383].

Most of the water in the Euphrates falls on the mountains of eastern Turkey as winter snow, and does not melt until spring and early summer. The period of the river's maximum flow is April-May; minimum flows occur during August-September. Flow depending on the vagaries of climate is highly variable. The highest annual flow on record exceeded 63,000 million cubic meters (Mcm) in 1968-69, the lowest was less than 11,000 Mcm in 1929-30. The average total flow is 33,700 Mcm per annum, of which slightly more than 27,000 Mcm enters Syria[4637] (see Table 1.1). This flow is expected to be more stable -- but considerably diminished -- after Turkey completes its Ataturk Dam and Southeast Anatolia Project (see Fig. 1.2).

The tributaries of the Euphrates in Syria add a further 2,000 Mcm to the water in the river's main stream that flows over the frontier below Birecik (see Table 1.2). This water is available for use in Syria, especially in the Jezireh region (Hassakah and Raqqa provinces). Recent analysis indicates that these tributary waters also derive from recharge areas in eastern Turkey[4637], and the discharge patterns may be expected to change as the Southeastern Anatolia Project nears completion. It remains to be seen how much of the water that Turkey transfers from the main Euphrates stream to its eastern provinces will find its way back to the Euphrates basin via recharge of the springs feeding the Khabur and Balikh rivers. An issue to be monitored carefully will be the quality of those return flows.

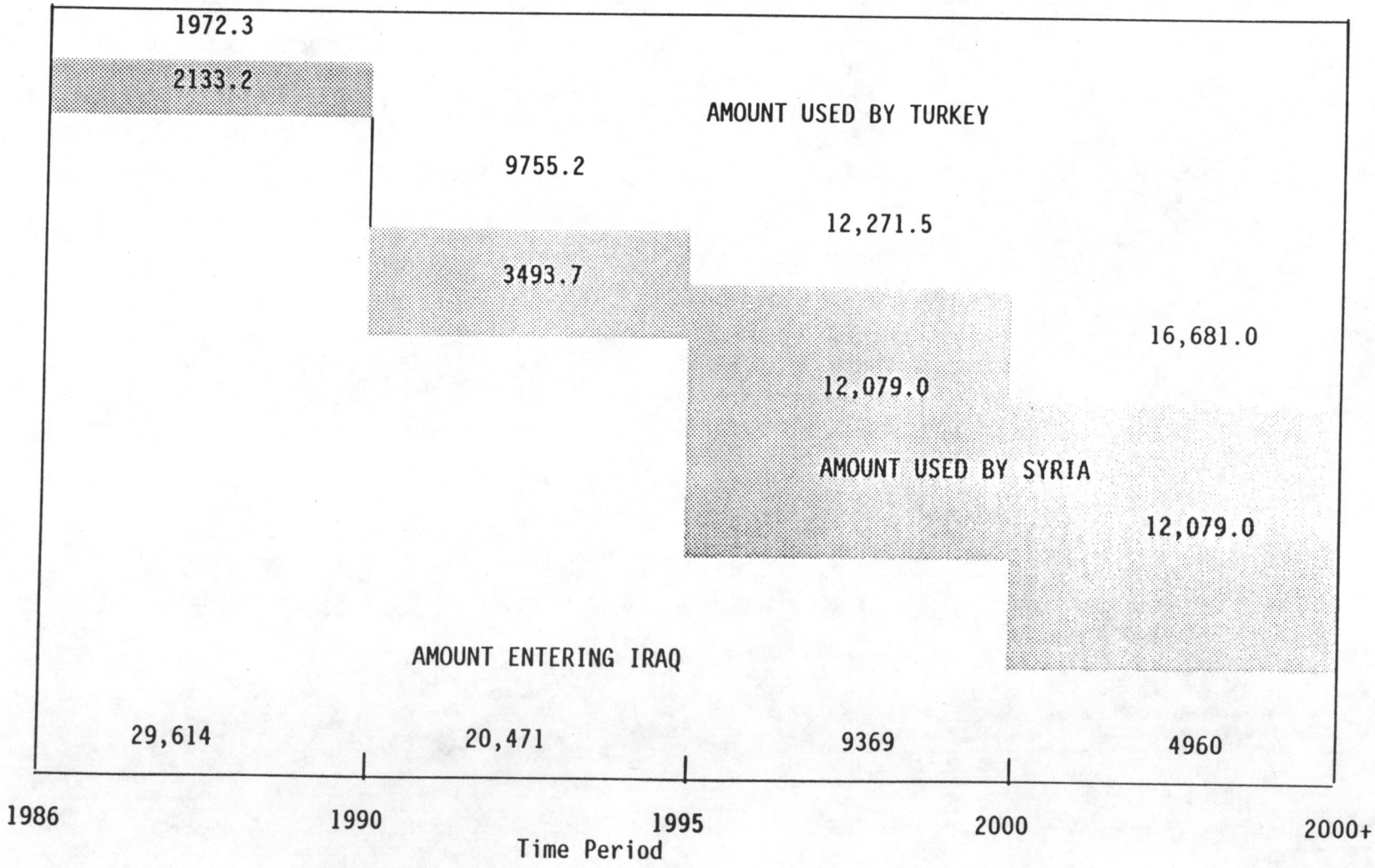
Alluvial aquifers of varying quality underlie much of the Euphrates valley. They are in part connected with regional deep groundwater systems, some sweet and some saline. The nature of these interconnections is as yet insufficiently known, as is the quantity of fresh water that may safely be withdrawn from boreholes. Numerous wells have already been drilled at Deir ez-Zor and in the Jezireh.

The Euphrates valley has been a centerpiece of Syrian development plans. The magnificent Euphrates Dam (often referred to as the Tabqa Dam, after the original name of its site, or the Thawra Dam, after the modern city that has grown up around it) was begun by Syria in the 1960s and completed in 1973 with financial and technical help from the Soviet Union. It impounds 11.9 billion cubic meters of water in Lake Assad, and has eight turbines, each of 100 MW capacity. The original plan was to irrigate 640,000 hectares of land in the Euphrates basin -- the valley itself and the plains of the Jezireh -- and to generate 800 MW of hydroelectric power per year[4569]. Subsequent experience has indicated that both these goals may have been too optimistic. The development of new lands for irrigation has been hindered by

Figure 1.2

WATER SUBTRACTIONS EUPHRATES RIVER: UPSTREAM USERS OPTIMUM SCENARIOS -- 1986-2000+
(Amounts in Mcm/yr)

Total Annual Natural Flow = 33,730 Mcm/yr



Source: Kolars[4637].

Table 1.2

EUPHRATES RIVER DISCHARGE
FROM BIRECIK, TURKEY, TO HIT, IRAQ

	Flow Added in Mcm/yr	Cum. Flow in Mcm/yr	Percent of Total
Flow at Birecik (1937-1963)		26,990	91.7%
Added in Turkey	410	27,400	1.3%
Added in Syria			
by Sacir/Sajur	80	27,480	0.4%
by Balikh/Culap	190	27,670	0.6%
by Khabur	1,780	29,450	6.0%
Total added in Syria	2,050		7.0%
Total added Syria/Turkey	2,460		8.3%
Flow at Hit		29,450	

The purpose of this table is to approximate the various shares of water added to the Euphrates between Birecik and Hit. CLA(3088) data were used for their length of coverage and seeming internal consistency. In some instances, FAO(3065) data were used for tributaries because they are the only record available.

The point made here is to show the relative volumes of water each stream contributes. A discharge value of 29,450 Mcm at Hit may be low, but the internal consistency and proportions are more important than the actual value.

Source: Kolars(4637).

inadequate research on soil characteristics; due to unforeseen problems, e.g. gypsiferous subsoils, land reclamation is well behind schedule and revised targets are less than half the original figure[4637]. The Euphrates Dam at first produced more than 70% of Syria's hydroelectric power, but low water levels and mechanical problems in recent years have reduced the generators to less than a third of capacity.

Despite disappointments, the development of the Euphrates region has been visibly impressive. Electrification alone has made a tremendous difference in the quality of life for residents of the area.

1.3 The Orontes Basin

The Orontes River (Nahr al-Aasi in Arabic) rises near Baalbek in Lebanon's Bekaa Valley not far from the headwaters of the Litani. The Orontes flows northward through the Bekaa, into the plain of Homs and Hama, swings into the Ghab graben (the northernmost extension of the Great Rift Valley), and then meanders west across the plain of Antioch to meet the sea[3235]. Of its total length of 571 km, the first 35 km are in Lebanon and 325 km are in Syria[4383].

In its lower reaches, the Orontes forms the border between Syria and Turkey before crossing into Turkey's Hatay Province on its way to the Mediterranean. Hatay is a matter of some contention since Syria has never accepted the alienation of the district, which Syrians call Alexandretta (*Iskandariya*) and which was ceded to Turkey by the French Mandate authorities in 1939. Alexandretta had served as the principal port of Aleppo and its interior market region for many hundreds of years.

One of the major tributaries of the Orontes is the Afrine, which rises in Turkey, passes into Syria in the Amuq valley west of Aleppo, and then out into the Hatay-Alexandretta district to join the Orontes. Syria plans major agricultural developments on the Afrine[3046].

The average discharge of the Orontes and its tributaries is approximately 1,500 Mcm/year[4637]. This discharge is irregular throughout the year and varies greatly from year to year depending on rains, but half the flow is perennial due to annually recharged groundwater sources. The Afrine contributes an annual 250 Mcm[3235].

Numerous natural springs flow from the karstic formations at the edges of the Ghab depression, from elevations as high as 495 m above sea level[4262]. The discharge from these springs is on the order of 800 Mcm/year[4383].

Human utilization of the Orontes dates from prehistoric times, when a string of settlements followed the line of the springs up the Orontes valley. The city of Antioch, renowned for its gardens, was one of the pre-eminent cities of the Roman Empire. The Qattineh Dam south of Homs was also Roman, along with associated aquaducts, and the great wooden waterwheels (*norias*) of Hama are almost as old.

In modern times, the Syrian government chose the Ghab Valley as the first of its major development projects. Following plans first begun during the French Mandate, Syria has drained the malarial swamps of the Ghab, built two new dams to contain the winter floods, store water, and generate power, and installed a complex system of primary, secondary and tertiary canals to provide water for irrigation. Since the project's completion in the late 1960s, the population of the region has quintupled and the originally agrarian economy of the project area is diversifying rapidly[3235)(4255)].

1.4 The Yarmuk Basin

The Yarmuk is one of the major contributors to the Jordan River system. It rises at Jebel esh-Sheikh (Mount Hermon), the highest point of the Anti-Lebanon range, and drains nearly 7,000 sq km in southern Syria and northern Jordan before joining the Jordan just south of Lake Tiberias. Its slope is steep, dropping to more than 200 m below sea level at its confluence with the Jordan, and it cuts a deep gorge between Syria's Jaulan plateau (the Golan Heights) and Jordan's northern highlands to form the international frontier between the two countries[4383)(1741)]. The Yarmuk's main tributaries are the Wadi Raqqad and the Wadi Allan on the Syrian side, and some seasonal watercourses on the Jordanian side. The Yarmuk traverses or abuts Syrian territory for 47 km of its 57 km length.

The discharge of the Yarmuk has dropped by some 20% over the past half century. Estimates of the river's flow from the 1950s cited an annual average of 490 Mcm[0099)(3157)]. More recent readings indicate an average flow which is closer to 400 Mcm/year[4220)]. A decrease in precipitation of between 12% and 25% has been observed over this period in various parts of the region, but it is not yet clear whether this represents a cyclical fluctuation or a permanent change[4220)].

The waters of the Yarmuk have been utilized by all three riparians. The springs of the watershed are used locally by Syria for both domestic and agricultural purposes, and a series of small dams are under construction to increase this yield. No actual data have been published, but a crude estimate of the amount of water abstracted by Syria in the mid 1980s was 63 Mcm/year[4220)]. Jordan

uses 125 Mcm/yr of Yarmuk water in its East Ghor Canal system[4092]. In the American mediated -- albeit unratified -- Johnston Plan of the 1950s, Israel was guaranteed 25 Mcm/yr for the Yarmuk Triangle, the area between the Yarmuk River and Lake Tiberias[1171], but more recently it has been extracting on the order of 70-100 Mcm/year[YYYY].

In September 1987, Syria and Jordan signed an agreement for the construction of a major dam on the Yarmuk at or near the site of Maqarin. The Unity (Wahdeh) Dam is expected to impound 220 Mcm of water and to regulate up to an additional 120 Mcm/year. Syria will get three quarters of the dam's hydroelectric power, but additional water for southern Syria will come mainly from a series of seven smaller dams on side wadis that are also foreseen in the 1987 agreement[4092]. The Israeli government has so far maintained an uncharacteristic silence on these proposals, perhaps as a result of the secret negotiations that are reliably reported to be taking place in 1988 with American mediation[C.I.].

1.5 The Coastal Plain

The coastal plain of Syria west of the Ansariya Mountains has several perennial rivers and numerous natural springs. These latter include the submarine springs of fresh water that have provided sustenance for the island fortress of Arwad (a.k.a. Rouad) for several millennia. The principal rivers include the Kebir Shemaliya, with an annual discharge of 95 Mcm, and the Sinn, with a discharge of 380 Mcm. Annual discharge from springs has been estimated at 375 Mcm, although it is reported that some wells have recently gone salty from overpumping[4383].

Development in the area has included numerous projects for both drinking water and irrigation. The Sixteenth of Tishrin Dam is under construction on the Kebir Shemaliya; its major purposes will be power generation and irrigation[1875][4182].

1.6 Inland Basins

The two great cities of the Syrian hinterland -- Damascus and Aleppo -- are both essentially oases. They are green islands in the midst of a barren desert, with man, beast and vegetation drawing sustenance from capacious underground water basins. These basins are characterized by high water tables and rapid seasonal recharge from disappearing streams that come down from the adjacent mountain ranges.

Damascus, the capital of Syria and reputedly the oldest continuously inhabited city in the world, is set in the rich Ghouta plain. The underlying phreatic gravel aquifer is highly permeable, and is fed by the Barada and Awaj rivers and by underground recharge from the karstic-fissured outcrops of the Anti-Lebanon mountains[4274]. The average annual flow of the two rivers is 220 and 78 Mcm respectively, but the annual recharge of the aquifer is estimated to be 500 Mcm[4383]. The single most important outlet from this aquifer is the prolific Ain Fijeh, the average natural discharge of which is approximately 235 Mcm/year[4262]. This is 20% of the safe yield for Damascus groundwater, which has been estimated at 1,200 Mcm/year[4274]. Because of the close association of the aquifer system with surface flows, pollution is a problem to be monitored carefully. Syria has recently begun installing new pumps to increase the flow from the Fijeh springs.

Aleppo is Syria's second city and a rival claimant to the title of "oldest inhabited city". Until the end of nineteenth century, Aleppo was an international entrepot, a transit point for east-west trading caravans. Within living memory, Aleppo acquired its water from the Qweik River which comes down from the mountains of southern Turkey and passes through the center of Aleppo's old town before disappearing into the Madekh marshes south of the city. These marshes percolated to a multilayered series of limestone aquifers above a base of impervious marl. The natural outlets of these aquifers were in springs to the west, north, and southwest of Aleppo[4383]. By the 1950s it was reported that the Qweik River, whose average annual flow is approximately 80 Mcm[4383], was being totally utilized upstream from Aleppo and very little water reached the city[4556]. Most recent reports complain of the unbearable stench rising from the channel of the Qweik in Aleppo, which now runs mainly with raw sewage. Water for Aleppo and its environs comes from the 334 Mcm/year in groundwater discharge[4383], and from the piping of 80 Mcm/year from Lake Assad[4637]. This latter constitutes the only significant interbasin transfer of water in Syria today.

1.7 Regional Aquifers and Deep Groundwater

For hydrological consideration, the Syrian steppe can be subdivided into three main zones. The northwestern zone comprises the Tadmar (Palmyra) oasis and Dawwa depression. The western zone begins at Damascus and slopes south and southeast through the basaltic Hauran, down into Jordan and the Azraq oasis, and on into the Wadi Sirhan of Saudi Arabia. The eastern zone comprises the Hammad basin, sloping from the central steppe east of the Euphrates south across the Jordanian panhandle to Rutbah in southeastern Iraq and Hail in northern Saudi Arabia and perhaps as far as western Kuwait[4274].

Each of these zones sits astride its own regional aquifers of volcanic or sedimentary formation. Each receives substantial but as yet uncharted flows from the karstic outcrops of the western mountain ranges. And each is underlain by reservoirs of deep fossil waters -- sweet, salt, or sulphur -- which sometimes find their way upward into the regional aquifers and which may themselves sometimes be mined for use.

Only the Palmyrian zone is exclusive to Syria. It is divided by the Dawwa aquitard into two flow systems that mix near Palmyra. The limestone-dolomite aquifers are recharged by a northeastern flow from the Anti-Lebanon range. Preliminary estimates indicate a yearly recharge to these systems on the order of 16 Mcm[4274]. Deeper water-bearing strata in this region yield mildly salty waters (ca. 800 ppm) at a depth of 1500 m below sea level[4573].

The western basin encompasses the Hauran, Jebel el-Arab, Azraq, Wadi Sirhan regions in Syria, Jordan, and Saudi Arabia. The principal aquifer is the Rijam formation consisting of basaltic flows over alternating limestones and marls. Recharge to this aquifer falls on the Jebel el-Arab in amounts in excess of 300 Mcm/year[4383][4274]. The water is used both in Syria's Hauran and in Jordan, with Syria on the upgradient of the aquifer. Increasing withdrawals in Syria may limit the amount of water available for Jordan, which is already using more water than the safe yield at the Azraq oasis. Present Jordanian extractions average 30 Mcm/year[4072]; Syrian usage is not reported.

The Hamad basin covers a region of 70,000 sq km extending from the Palmyrian mountains to the plateau of central Arabia. Rainfall on the basin is minimal -- 70-150 mm per annum. Recharge rates are unknown. Fresh water lenses in the neighborhood of major wadis bear evidence of local recharge, and water may infiltrate from as far away as the Anti-Lebanon mountains. The aquifer consists of a combination of carbonate and sandstone water-bearing strata. It is believed that the southern reaches of this flow system may influence groundwater systems in the Great Nefud and parts of the Wadi Sirhan. Some springs in the Euphrates flood plain may also be interconnected with it[4274]. Within Syria, little is reported regarding the recharge or discharge of this system[4383].

In addition to these local regional aquifers, Syria shares with the rest of the Arabian Peninsula a much deeper system of fossil waters. These have been found in the course of oil drilling at depths of 1,500 m or more at such places as Tenf, Didi, and Russafa. Some of these finds have been sweet and others highly mineralized. At places, a layer of sweet water is contained between two layers of salty water. Upward movement of water under pressure from these underlying reservoirs may feed some of the regional aquifers closer to the surface. There is as yet no reliable assessment of the magnitude of this reserve, but temperature gradients and other indicators give evidence of undiscovered aquifers at even lower levels[4573].

Chapter 2

ISSUES IN THE USE OF WATER IN SYRIA

Syria is considerably better endowed with water than its neighbors in the Arabian Peninsula. Although it has already experienced some local shortages, at present the country enjoys a significant surplus. Seasonal rationing notwithstanding, e.g., in Damascus, in the 1980s only Aleppo faced a present and long-term systemic shortage, a deficit which is presently being eased, but not solved, by the transfer of 80 or more million cubic meters of water per year from Lake Assad.

This surplus, however, is no cause for complacency. By our estimates and those of other authors, the amount of water available to Syria is actually diminishing. Turkey's ambitious Southeast Anatolia Project may extract over 12.3 billion cubic meters from the annual flow of the Euphrates before it reaches Syria[4637]; this would reduce the amount of water available to Syria by some 40% by the end of the century -- or sometime thereafter, if Turkish schedules are delayed. At the same time, Syria's population is growing, its people's standard of living and water consumption expectations are rising, and the development of irrigation projects continues in various regions. Our approximation is that Syria's consumptive use of water will increase by 250% by the year 2000 and continue to grow at a reduced rate over the subsequent fifteen years. As with Turkey, these usage projections will be lower, if development requires more time than scheduled. Nevertheless, Syria's surplus, by our calculations, could be reduced to as low as one eighth of its current level by the year 2015.

To derive these approximations we first looked at demographic trends. Based on statistics from the 1981 census, we considered growth rates and momentum, age structures, and migration patterns in order to project the population of the country and the seven basins to the year 2015. These, together with projected changes in per capita usage rates, yielded estimates for domestic consumption in the seven basins and in the country as a whole.

We then looked at various predictable changes in water use. The most important of these involves the inauguration of new irrigation schemes, many of which are now planned or even under construction. We have also examined the possibility of achieving efficiencies both in municipal systems and in agricultural use and have made assumptions regarding the realization of reasonable goals. The results of these calculations are presented in a series of water balances for each basin and, finally, in a balance for Syria to the year 2015. It is this balance that supports the observation of current, but diminishing surplus with problems of absolute scarcity looming only for the more distant future. These

problems are given more immediate significance in view of Syria's vulnerability to the water needs of its upstream and downstream neighbors.

In the later sections of this chapter we will examine some of the water issues which are currently claiming the attention of the Damascus government and others which we believe they will need to consider in the coming years.

2.1 Demographic Data and Trends

The most recent head count in Syria was the census of 1981, the data of which is presented by Samman[4421] in terms of total population, population by province, and population by major city. According to this source, the total population of Syria was 9.172 million, although the United Nations[4398] records the total as 9.05 million. Samman alao reports that in 1981 the Syrian population was 48% urban.

Previous analyses projecting the population of Syria to the year 2000 (al-Alawi[4412], Williams[4624]) were based on the census of 1970. We have therefore recalculated these projections based on the 1981 census, but taking into account the arguments which were elaborated in the earlier projections regarding population growth rates, the relationship of age structure to population momentum, and the rate of urbanization. The discussion of these indicators by Williams[4624] is particularly cogent; we have adapted his arguments and applied them to the 1981 data. A projection of Syria's population to the year 2015, together with the chosen parameters, appears in Table 2.1.

It is true, in these as in all projections, that the accuracy of the prediction is indirectly proportional to the length of time covered. Up to the year 2000, the predictions are probably fairly accurate; beyond that point they become increasingly speculative. We have posited that the annual growth rate will level off at 3% after 2000 for essentially political, rather than demographic, reasons. Since there is no present evidence of public concern with the high fertility rate, we expect that it will continue to be high into the foreseeable future. It is often claimed that fertility rates fall off as populations become more urban[4624]. Urban migration is expected to continue in Syria (see the percent urban column in Table 2.1). However, there is no evidence of significantly reduced fertility rates in neighboring Jordan, which is already 70% urban. In the absence of effective educational policy to the contrary, it is expected that Syria's population growth rate will remain high. Indeed, there may be an increase in the growth rate after 2010, when the bulge of children born in the 1980s comes to child-bearing age.

Table 2.1

SYRIAN POPULATION PROJECTIONS TO 2015
(starting with actual census of 1981)

Year	Population millions	Annual Growth Rate	Urban percent	Urban million	Rural million
1981 actual	9.172	3.4	47.9	4.391	4.781
1985	10.484	3.8	49.6	5.200	5.284
1990	12.633	3.7	51.4	6.493	6.140
1995	15.150	3.1	53.2	8.060	7.090
2000	17.649	3.0	55.0	9.710	7.939
2005	20.460	3.0	57.0	11.662	8.798
2010	23.716	3.0	60.0	14.230	9.486
2015	27.493	3.0	63.0	17.321	10.172

Sources:

For 1981 census see Samman(4421).

For demographic indicators, see al-Alawi(4412), Williams(4624), and Population Reference Bureau(4375). Also see US Bureau of Census, 1986 Report of the Center for International Research, and United Nations: Demographic Indicators Estimates and Assessments 1984.

Calculations by the author.

With these caveats we predict that the population of Syria will almost double by the year 2000 and will treble by 2015.

In order to translate these population figures into water consumption figures, we have estimated the 1981 population by hydrological basin and divided it into urban and rural segments (see Table 2.2). The population figures are converted to domestic water use estimates using the projections for per capita urban and rural water use posited by the World Bank in its 1980 report on Syria[3101]. The results for domestic water use by basin in 1981 are given in Table 2.3. These figures reflect estimates for actual consumption and do not account for systemic loss. (Figures which take account of systemic loss and of the savings able to be realized by reduction of systemic loss are given in Section 2.2.)

Actual Syria-wide domestic consumption up to the year 2015 is predicted in Table 2.4. By these calculations, consumption by domestic users will more than quadruple by the year 2015. It should be mentioned that we are assuming the rate of growth to be relatively constant throughout the country. On the surface, such an assumption might appear unreasonable since three cities in the Euphrates basin -- Raqqa, Hassaka, and Qamishli -- have registered growth rates of more than twice the national average. However, the growth rates of the provinces in which these cities are located were at, or even below, the national average[4421]. This appears to reflect a phenomenon of migration within the province with rural populations gravitating to their nearest market town, rather than an overall periphery to center movement[4624]. At all events, the numbers involved are small; the three towns each had populations of less than 100,000 in 1981 and should not skew the calculations too badly.

More serious is the growth rate of Damascus Province, which was more than a percentage point above the national average growth rate and which, together with Damascus City, contained almost a quarter of the population of the country. However, the government seems to be applying economic disincentives to migration toward Damascus[4362]. This question will be kept in mind when considering the overall usage predictions for the Damascus basin.

2.2 Water Balance

The above analysis gives some measure of the increasing water needs of Syria over the next thirty years. However, it is only the least of the elements to be considered, for domestic and industrial uses together account for less than 10% of Syria's water needs. By far the largest user of water is irrigated agriculture.

Table 2.2
ESTIMATED 1981 POPULATION BY BASIN ('000s)
Based on reports of 1981 census

Basin	Total pop.	Urban SW	Urban GW	Rural SW	Rural GW
Euphrates	1418	345	---	1073	---
Aleppo	1869	1177	---	692	---
Orontes	1625	177	390	234	824
Damascus	1996	---	1996	---	---
Coast	998	---	250	---	748
Yarmuk	389	---	28	---	361
Steppe	875	21	22	---	832
TOTAL	**9170**	**1720**	**2686**	**1999**	**2765**

Population serviced by: SW = surface water; GW = groundwater.

Source: Samman[4421], calculations by author.

Table 2.3
DOMESTIC WATER USE BY BASIN (Mcm/a)*
Based on population in 1981 census

Basin	Total	Urban SW	Urban GW	Rural SW	Rural GW
Euphrates	125.3	78.9	---	46.4	---
of which					
Euphrates	*[46.1]*	*[17.9]*	---	*[28.2]*	---
*Aleppo***	*[79.2]*	*[61.0]*	---	*[18.2]*	---
Aleppo	---	---	---	---	---
Orontes	57.2	9.2	20.2	6.1	21.7
Damascus	103.5	---	103.5	---	---
Coast	32.7	---	13.0	---	19.7
Yarmuk	13.2	1.1	2.6	---	9.5
of which					
Yarmuk	*[11.0]*	---	*[1.5]*	---	*[9.5]*
*Steppe***	*[2.2]*	*[1.1]*	*[1.1]*	---	---
Steppe	21.9	---	---	---	21.9
TOTAL	**353.8**	**89.2**	**139.3**	**52.5**	**72.8**

* Assumes usage of 142 lcd for urban populations, 72 lcd for rural populations, per World Bank[3101].
** Interbasin transfer

Source: AMER, calculations by author.

Table 2.14

WATER BALANCE FOR SYRIA PROJECTED TO THE YEAR 2015 BY BASIN
(in Mcm)

	1981/82	1990	1995	2000	2005	2010	2015
Water Available							
Euphrates	26,500	24,500	16,700	14,200	14,200	14,200	14,200
Orontes	1,420	1,420	1,420	1,420	1,420	1,420	1,420
Damascus	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Coastal Plain	1,110	1,110	1,110	1,110	1,110	1,110	1,110
Yarmuk	317	317	317	317	317	317	317
Aleppo	750	750	750	750	750	750	750
Steppe	330	330	330	330	330	330	330
TOTAL Available	**31,927**	**29,927**	**22,127**	**19,627**	**19,627**	**19,627**	**19,627**
Water Withdrawn							
Euphrates	2,981	5,206	8,871	10,928	10,963	11,017	11,106
Orontes	1,329	1,382	1,401	1,424	1,438	1,468	1,500
Damascus	1,155	1,246	1,291	1,348	1,387	1,436	1,511
Coastal Plain	462	671	686	829	841	856	880
Yarmuk	159	185	194	198	200	206	213
Aleppo	807	857	907	957	1,005	1,040	1,040
Steppe	48	70	86	101	113	127	144
TOTAL Withdrawn	**6,941**	**9,617**	**13,346**	**15,785**	**15,947**	**16,150**	**16,394**
Residue							
Euphrates	23,519	19,294	7,919	3,272	3,237	3,183	3,094
Orontes	91	38	19	-4	-18	-48	-80
Damascus	345	254	209	152	113	64	-11
Coastal Plain	648	439	424	281	269	254	230
Yarmuk	158	132	123	119	117	111	104
Aleppo	-57	-107	-157	-207	-255	-290	-290
Steppe	282	260	244	229	217	203	186
TOTAL Residue	**24,986**	**20,310**	**8,781**	**3,842**	**3,680**	**3,477**	**3,233**

Source: Tables 2.7-2.13, calculations by author.

Table 3.6
SYRIAN WATER USE BY ECONOMIC SECTOR PROJECTED TO YEAR 2015
(in Mcm)

	1981/82	1990	1995	2000	2005	2010	2015
Domestic							
Euphrates	175	300	388	446	492	556	655
Orontes	80	128	158	191	215	253	299
Damascus	145	236	291	357	405	462	545
Coastal Plain	46	79	96	116	130	147	173
Yarmuk	18	32	41	49	55	62	69
Aleppo	--	--	--	--	--	--	--
Steppe	31	53	69	84	96	110	127
TOTAL Domestic	495	828	1,043	1,243	1,393	1,590	1,868
Agricultural							
Euphrates	2,800	4,900	8,387	10,476	10,465	10,455	10,445
Orontes	1,191	1,196	1,185	1,175	1,165	1,157	1,143
Damascus	935	935	925	916	907	899	891
Coastal Plain	364	540	538	661	659	657	655
Yarmuk	141	153	153	149	145	144	144
Aleppo	727	777	827	877	925	960	960
Steppe	--	--	--	--	--	--	--
TOTAL Agricultural	6,158	8,501	12,015	14,254	14,266	14,272	14,238
Industrial							
Euphrates	6	6	6	6	6	6	6
Orontes	58	58	58	58	58	58	58
Damascus	75	75	75	75	75	75	75
Coastal Plain	52	52	52	52	52	52	52
Yarmuk	--	--	--	--	--	--	--
Aleppo	80	80	80	80	80	80	80
Steppe	17	17	17	17	17	17	17
TOTAL Industrial	288	288	288	288	288	288	288
TOTAL							
Euphrates	2,981	5,206	8,781	10,928	10,963	11,017	11,106
Orontes	1,329	1,382	1,401	1,424	1,438	1,468	1,500
Damascus	1,155	1,246	1,291	1,348	1,387	1,436	1,511
Coastal Plain	462	671	686	829	841	856	880
Yarmuk	159	185	194	198	200	206	213
Aleppo	807	857	907	957	1,005	1,040	1,040
Steppe	48	70	86	101	113	127	144
TOTAL	6,941	9,617	13,346	15,785	15,947	16,150	16,394

Source: Tables 2.7-2.13, calculations by author.

Table 2.1

SYRIAN POPULATION PROJECTIONS TO 2015
(starting with actual census of 1981)

Year	Population millions	Annual Growth Rate	Urban percent	Urban million	Rural million
1981 actual	9.172	3.4	47.9	4.391	4.781
1985	10.484	3.8	49.6	5.200	5.284
1990	12.633	3.7	51.4	6.493	6.140
1995	15.150	3.1	53.2	8.060	7.090
2000	17.649	3.0	55.0	9.710	7.939
2005	20.460	3.0	57.0	11.662	8.798
2010	23.716	3.0	60.0	14.230	9.486
2015	27.493	3.0	63.0	17.321	10.172

Sources:

For 1981 census see Samman[4421].

For demographic indicators, see al-Alawi[4412], Williams[4624], and Population Reference Bureau[4375]. Also see US Bureau of Census, 1986 Report of the Center for International Research, and United Nations: Demographic Indicators Estimates and Assessments 1984.

Calculations by the author.

Fig. 1

Table 2.4

DOMESTIC WATER CONSUMPTION 1981 TO 2015

	1981	1985	1990	1995	2000	2005	2010	2015
Total pop. (mn.)	9.17	10.5	12.6	15.0	17.7	20.5	23.7	27.5
Urban population	4.39	5.20	6.49	8.06	9.71	11.6	14.2	17.3
Per Capita (lcd)	142	155	170	183	200	200	200	200
Consump. (Mcm/a)	228	294	403	538	709	851	1039	1264
Rural Population	4.78	5.28	6.14	7.09	7.94	8.80	9.49	10.2
Per Capita (lcd)	72	80	90	95	100	100	100	100
Consump. (Mcm/a)	126	154	202	246	290	321	346	371
TOTAL CONSUMPTION (Mcm/a)	354	448	605	784	999	1172	1385	1635

Sources:

AMER population projections by author, see Table 2.1 ~~X.X~~.
Per Capita use assumptions from World Bank[3101], p. 284.
Calculations by the author.

To provide the basis for an analysis of the agricultural uses of water, we have calculated water use by province based on the statistics reported for land use in the 1981-82 agricultural year[3220]. Water usage is calculated using crop irrigation requirements that vary with season, climate, and categories of crops. The CIR figures include consideration of plant evapotranspiration, but do not include losses in the system itself. Systemic losses are calculated in the column headed Estimated Water Loss. The results are shown in Table 2.5, with a total water use for irrigation of 6,158 Mcm per year countrywide.

In Table 2.6 we collate by basin the results of Tables 2.3 and 2.5 and add estimates of the water use for industry. Industrial water use is not recorded in statistical reports on Syria. A total figure nationwide of 288 Mcm/year was cited by the World Bank report of 1980[3101], but was not designated to particular areas. The allocation of this usage figure to basins was done in proportion to the number of industrial workers in each locale. This is a dubious procedure, since not all industries consume water at the same rate. Impressionistically one can say that the petroleum extraction industries of the Euphrates basin are not highly water consumptive, while the textile and food processing industries of Damascus, Aleppo, and the Orontes basin are heavy consumers. Thus a result that allocates the major portion of industrial water use to these three areas is qualitatively correct. The numbers are small in any event.

The use, loss, and withdrawal figures of Table 2.6 form the basis for the projection of water use in Syria by basin over the next 30 years. Since the assumptions about economic development and attendant water usage vary from region to region, each basin will be discussed separately. The discussion amplifies only certain parts of each table, which should be examined concurrently.

2.2.1 The Euphrates

The water balance on the Syrian stretch of the Euphrates is expected to change dramatically by the end of the century (see Table 2.7). Both Turkey and Syria are engaged in major development projects that will significantly change the quantity and quality of Euphrates water. A 1987 study by John Kolars[4637] estimated that Turkey's drawdown could increase by more than 12 billion cubic meters by the year 2000. Up to 1,600 Mcm are lost each year through evaporation from Lake Assad.

The amount of water entering Syria on the main stem of the Euphrates varies considerably from year to year. For purposes of the present analysis, we have adopted the Syrian estimate of an average flow of 830 cubic meters per second[4383], which yields an annual figure of slightly more than 26 billion cubic meters.

Table 2.5

SYRIAN AGRICULTURAL WATER REQUIREMENTS - 1982

MOHAFAZAT	Irrigated Area(1) (ha)	Water Required(2) (cu m/ha)	Water Required (Mcm)	Source of Water	Source by Area(3) (% of ha)	Water Required (Mcm)	Estimated Water Loss(4) (Mcm)	Total Water Needed (Mcm)
Damascus								
Fruit Trees	31,575	15,161	478.7	Pumped (GW)	66.1%	490.8	86.6	577.4
Summer Crops & Vegs	26,002	7,480	194.5	Pumped (SW)	0.8%	5.9	1.0	6.9
Winter Crops & Vegs	33,820	2,048	69.3	Gravity (SW)	33.1%	245.8	105.3	351.1
TOTAL	91,397	8,124	742.5	TOTAL	100.0%	742.5	192.9	935.4
Dar'a								
Fruit Trees	1,959	13,489	26.4	Pumped (GW)	17.2%	16.3	2.9	19.2
Summer Crops & Vegs	5,336	9,560	51.0	Pumped (SW)	31.7%	30.1	5.3	35.4
Winter Crops & Vegs	5,296	3,317	17.6	Gravity (SW)	51.1%	48.5	20.8	69.3
TOTAL	12,591	7,545	95.0	TOTAL	100.0%	94.9	29.0	123.9
Sweida								
	N O I R R I G A T E D A G R I C U L T U R E							
Quneitra								
Fruit Trees	180	13,228	2.4	Pumped (GW)	0.0%	0.0	0.0	0.0
Summer Crops & Vegs	898	9,123	8.2	Pumped (SW)	0.0%	0.0	0.0	0.0
Winter Crops & Vegs	673	1,802	1.2	Gravity (SW)	100.0%	11.8	5.1	16.9
TOTAL	1,751	6,739	11.8	TOTAL	100.0%	11.8	5.1	16.9
Homs								
Fruit Trees	5,019	14,506	72.8	Pumped (GW)	41.7%	153.4	27.1	180.5
Summer Crops & Vegs	29,148	8,748	255.0	Pumped (SW)	1.9%	7.0	1.2	8.2
Winter Crops & Vegs	14,596	2,748	40.1	Gravity (SW)	56.4%	207.5	88.9	296.4
TOTAL	48,763	7,545	367.9	TOTAL	100.0%	367.9	117.2	485.1

[1] Area double-cropped = 2 ha. [2] Based on calculations of similar climate regions in Jordan (2820).
[3] Area double-cropped = 1 ha. [4] Estimated losses: pumped GW = 15%; pumped SW = 15%; gravity SW = 30%.

MOHAFAZAT	Irrigated Area(1) (ha)	Water Required(2) (cu m/ha)	Water Required (Mcm)	Source of Water	Source by Area(3) (% of ha)	Water Required (Mcm)	Estimated Water Loss(4) (Mcm)	Total Water Needed (Mcm)
Hama								
Fruit Trees	2,384	14,506	34.6	Pumped (GW)	67.2%	167.7	29.6	197.3
Summer Crops & Vegs	20,711	8,487	175.8	Pumped (SW)	6.4%	16.0	2.8	18.8
Winter Crops & Vegs	16,442	2,387	39.2	Gravity (SW)	26.4%	65.9	28.2	94.1
TOTAL	39,537	6,313	249.6	TOTAL	100.0%	249.6	60.6	310.2
Ghab								
Fruit Trees	240	8,504	1.7	Pumped (GW)	32.3%	66.3	11.7	78.0
Summer Crops & Vegs	42,970	4,618	198.4	Pumped (SW)	0.0%	0.0	0.0	0.0
Winter Crops & Vegs	5,439	957	5.2	Gravity (SW)	67.7%	139.0	59.6	198.6
TOTAL	48,649	4,220	205.3	TOTAL	100.0%	205.3	71.3	276.6
Lattakia								
Fruit Trees	7,123	8,504	60.6	Pumped (GW)	28.4%	46.5	8.2	54.7
Summer Crops & Vegs	20,029	5,102	102.2	Pumped (SW)	50.8%	83.3	14.7	98.0
Winter Crops & Vegs	649	1,673	1.1	Gravity (SW)	20.7%	33.9	14.5	48.4
TOTAL	27,801	5,895	163.9	TOTAL	99.9%	163.7	37.4	201.1
Tartous								
Fruit Trees	4,494	8,504	38.2	Pumped (GW)	68.9%	91.1	16.1	107.2
Summer Crops & Vegs	18,928	4,843	91.7	Pumped (SW)	10.7%	14.1	2.5	16.6
Winter Crops & Vegs	1,368	1,673	2.3	Gravity (SW)	20.4%	27.0	11.6	38.6
TOTAL	24,790	5,333	132.2	TOTAL	100.0%	132.2	30.2	162.4
Idleb								
Fruit Trees	1,353	13,228	17.9	Pumped (GW)	55.6%	53.5	9.4	62.9
Summer Crops & Vegs	9,102	7,859	71.5	Pumped (SW)	20.8%	20.0	3.5	23.5
Winter Crops & Vegs	3,423	1,972	6.8	Gravity (SW)	23.6%	22.7	9.7	32.4
TOTAL	13,878	6,928	96.2	TOTAL	100.0%	96.2	22.6	118.8

[1] Area double-cropped = 2 ha. [2] Based on calculations of similar climate regions in Jordan (2820).
[3] Area double-cropped = 1 ha. [4] Estimated losses: pumped GW = 15%; pumped SW = 15%; gravity SW = 30%.

Table 2.5 continued

MOHAFAZAT	Irrigated Area(1) (ha)	Water Required(2) (cu m/ha)	Water Required (Mcm)	Source of Water	Source by Area(3) (% of ha)	Water Required (Mcm)	Estimated Water Loss(4) (Mcm)	Total Water Needed (Mcm)
Aleppo								
Fruit Trees	5,665	13,489	76.4	Pumped (GW)	84.4%	521.8	92.1	613.9
Summer Crops & Vegs	42,765	9,890	422.9	Pumped (SW)	15.6%	96.5	17.0	113.5
Winter Crops & Vegs	34,007	3,499	119.0	Gravity (SW)	0.0%	0.0	0.0	0.0
TOTAL	82,437	7,500	618.3	TOTAL	100.0%	618.3	109.1	727.4
Hassakah								
Fruit Trees	2,556	19,098	48.8	Pumped (GW)	43.4%	318.5	56.2	374.7
Summer Crops & Vegs	44,952	9,923	446.1	Pumped (SW)	53.1%	389.7	68.8	458.5
Winter Crops & Vegs	43,247	5,529	239.1	Gravity (SW)	3.5%	25.7	11.0	36.7
TOTAL	90,755	8,087	734.0	TOTAL	100.0%	733.9	136.0	869.9
Raqqa								
Fruit Trees	179	19,098	3.4	Pumped (GW)	48.7%	176.7	31.2	207.9
Summer Crops & Vegs	25,411	9,843	250.1	Pumped (SW)	43.6%	158.2	27.9	186.1
Winter Crops & Vegs	19,875	5,501	109.3	Gravity (SW)	7.7%	27.9	12.0	39.9
TOTAL	45,465	7,978	362.8	TOTAL	100.0%	362.8	71.1	433.9
Deir ez-Zor								
Fruit Trees	4,177	19,098	79.8	Pumped (GW)	1.8%	17.4	3.1	20.5
Summer Crops & Vegs	65,620	10,191	668.7	Pumped (SW)	98.2%	951.2	167.9	1119.1
Winter Crops & Vegs	38,374	5,736	220.1	Gravity (SW)	0.0%	0.0	0.0	0.0
TOTAL	108,171	8,954	968.6	TOTAL	100.0%	968.6	171.0	1139.6
C.A.D.E.B.								
Fruit Trees	467	19,098	8.9	Pumped (GW)	0.0%	0.0	0.0	0.0
Summer Crops & Vegs	19,159	9,777	187.3	Pumped (SW)	0.0%	0.0	0.0	0.0
Winter Crops & Vegs	9,581	5,499	52.7	Gravity (SW)	100.0%	248.9	106.7	355.6
TOTAL	29,207	8,522	248.9	TOTAL	100.0%	248.9	106.7	355.6

[1] Area double-cropped = 2 ha. [2] Based on calculations of similar climate regions in Jordan (2820).
[3] Area double-cropped = 1 ha. [4] Estimated losses: pumped GW = 15%; pumped SW = 15%; gravity SW = 30%.

Table 2.5

MOHAFAZAT	Irrigated Area(1) (ha)	Water Required(2) (cu m/ha)	Water Required (Mcm)
TOTALS			
Fruit Trees	67,371	14,110	950.6
Summer Crops & Vegs	371,031	8,418	3,123.4
Winter Crops & Vegs	226,790	4,070	923.0
TOTAL	665,192	7,512	4,997.0

Source of Water	Source by Area(3) (% of ha)	Water Required (Mcm)	Estimated Water Loss(4) (Mcm)	Total Water Needed (Mcm)
Pumped (GW)	---*	2,120	374	2,494
Pumped (SW)	---*	1,772	313	2,085
Gravity (SW)	---*	1,105	474	1,579
TOTAL		4,997	1,161	6,158

* Percent of ha irrigated countrywide by each water source is not the same as percent of water used or required countrywide from each water source. The precent of ha figures were used only to approximate the percentage of water sources in each Mohafazat. The countrywide totals for water required were calculated by adding the totals of each Mohafazat. Total percentages for each source per ha are as follows: 46.7% from pumped groundwater; 34.1% from pumped surface water; and 19.1% from gravity surface water. The precentage of water required (before losses) from each source are as follows: 42.4% from pumped groundwater; 35.5% from pumped surface water; and 22.1% from gravity surface water. The discrepancy occurs because groundwater use is more prevalent in Mohafazats with lower crop water requirements.

Source: Syria - Ministry of Agriculture and Agrarian Reform, *The Annual Agricultural Statistical Abstract*, 1982 (3220).

[1] Area double-cropped = 2 ha. [2] Based on calculations of similar climate regions in Jordan (2820).
[3] Area double-cropped = 1 ha. [4] Estimated losses: pumped GW = 15%; pumped SW = 15%; gravity SW = 30%.

Table 2.6

TOTAL WATER PRODUCTION BY BASIN - 1981 (In Mcm/yr)

	Domestic			Agriculture			Industry*		A + D + I		
	Use	Loss	Withdrawal	Use	Loss	Withdrawal	% of employ.	Mcm	SW	GW	TOTAL
Euphrates	125.3	50.2	175.5	2314.2	484.8	2799.0	2%	6	2371.3	609.1	2980.4
Aleppo	--	--	--	618.3	109.1	727.4	28%	80	113.5	693.9	807.4
Orontes	57.2	22.9	80.1	919.0	271.7	1190.7	20%	58	693.4	635.4	1328.8
Damascus	103.5	41.5	145.0	742.5	192.9	935.4	26%	75	358.0	797.4	1155.4
Coast	32.7	13.1	45.8	295.9	67.6	363.5	18%	52	201.6	259.7	461.3
Yarmuk	13.2	5.3	18.5	106.7	34.1	140.8	--	--	123.1	36.2	159.3
Steppe	21.9	8.8	30.7	--	--	--	6%	17	--	47.7	47.7
TOTAL	353.8	141.8	495.6	4996.6	1160.2	6156.8	100%	288	3860.9	3079.4	6940.3

Loss @ 28.6% = 141.7
Total Produced = 495.5

Loss calculated by
AMER - Table 00

* Based on total use of 288 Mcm, allocated in proportion to number of industrial workers in basin. All industries have private wells. World Bank(3101).

Kolars's data from Turkish measurements yields an additional billion cubic meters available for Syria. Nearly half of this flow could disappear within the next two decades. By the turn of the century, the amount of water available for Syrian use from the Euphrates and its tributaries could be as little as 14.2 bcm.

Interestingly, this figure is almost identical to the amount of water allegedly guaranteed Syria by Turkey in a pair of protocols signed in Damascus in July, 1987, valid for two years with annual renewal thereafter. The Turkish newspaper *Cumhuriyet* (July 18, 1987) reported that Turkish Prime Minister Ozal had promised Syrian Prime Minister Kassem to provide Syria with 500 cu m/s from Ataturk Dam (15,768 Mcm/yr). This compares to our estimate of 15,800 Mcm/yr to be available for Syria in the year 2000 before evaporation from Lake Assad, including the flows of the Balikh and Khabur tributaries. The companion protocol was a security agreement whereby the two prime ministers pledged to prevent cross-border strikes and to cooperate through Interpol on counterinsurgency intelligence. Syrian President Assad is reported to have intervened personally to expedite negotiation of these agreements. The protocols apparently took no cognizance of a previous Turkish agreement with Iraq to supply that country with the same amount of water, presumably the same water since there would not be enough water in the system for Turkey to release 500 cu m/s to each downstream riparian and yet divert water to Southeastern Anatolia.

The increase in Syrian usage is detailed in Table 2.7. The calculations on agricultural usage were expounded in detail in Kolars's 1987 report[4637], along with the revision of Syrian expectations from its irrigation projects from a maximum of a million hectares of land down to less than half a million. The figures given in Table 2.7 differ from those of Kolars in that they reflect a later year with a higher reported irrigated hectarage. The water use base is lower, however, since it does not allow for the withdrawal of waters which will ultimately return to the system as return flows. The amounts of these return flows are not insignificant for the Euphrates (compare the predicted residues of Table 2.7 with Kolars's results in Fig. 1.2), but the returned waters will be of dubious quality and problemmatic utility.

The schedule for completion of agricultural projects is that projected by Kolars, although we doubt whether even these diminished expectations will be realized -- in area or time. The Euphrates projects have throughout been plagued by technical problems and inadequate planning. The redesign and reconstruction of canals which collapsed because of dissolving subsurface gypsiferous deposits cost Syria many years of delay, but it has been done. More serious is the need for agricultural planning and training to compensate for the impact of gypsum on plant growth. The choice of crops and the methods to be used in plowing, sowing, and irrigating these crops must all be revised in the light of what is now known about the soils[4328]. These problems have delayed the

Table 2.7

WATER BALANCE IN THE EUPHRATES BASIN: PROJECTIONS TO 2015 (In Mcms)

	1981/82	1990	1995	2000	2005	2010	2015
Water at Border*	26,200	26,200	26,200	26,200	26,200	26,200	26,200
New Turkish depletions	--	2,000	9,800	12,300	12,300	12,300	12,300
Added in Syria	1,900	1,900	1,900	1,900	1,900	1,900	1,900
Available in Syria	**28,100**	**26,100**	**18,300**	**15,800**	**15,800**	**15,800**	**15,800**
Evaporation from Lake Assad	1,600	1,600	1,600	1,600	1,600	1,600	1,600
Available for use	**26,500**	**24,500**	**16,700**	**14,200**	**14,200**	**14,200**	**14,200**
Domestic use	*125*	*214*	*277*	*353*	*414*	*489*	*577*
Rate of loss %	*(28.6)*	*(28.6)*	*(28.6)*	*(21)*	*(16)*	*(12)*	*(12)*
Domestic loss	*50*	*86*	*111*	*93*	*78*	*67*	*78*
Domestic w/d	175	300	388	446	492	556	655
Agriculture w/d	2,800	4,900	8,387	10,476	10,465	10,455	10,445
Industrial w/d	6	6	6	6	6	6	6
TOTAL WITHDRAWAL	**2,981**	**5,206**	**8,781**	**10,928**	**10,963**	**11,017**	**11,106**
Residue	**23,519**	**19,294**	**7,919**	**3,272**	**3,237**	**3,183**	**3,094**

* Water at border reflects the long-term flow measurements at Birecik across the border in Turkey. Note that new Turkish depletions could range as high as 16,000 Mcm in the next century if all Turkey's development schemes are realized(4637).

1. Agricultural figures assume that Turkish and Syrian agricultural development will be complete by the year 2000. This is a very optimistic assumption; developmental delay will delay the depletion rate. See Kolars(4637) for detailed arguments.

2. Domestic loss assumes that repairs in the Euphrates Basin will lag behind the rest of Syria but be complete by the year 2010. Note that the cities in the Euphrates Basin have current loss rates of up to 50% (Tishrin(4410)). Domestic withdrawal includes the transfer of water to the city of Aleppo.

3. Industrial figures assume that water use is held constant. Industrial development has stagnated in the 1980s and is not a high priority in the present Five Year Plan.

Sources: Tables 2.4-2.6, calculations by author, and Kolars(4637).

relocation of peasants displaced by Lake Assad far beyond the term originally forecast. Only in 1986, a dozen years after the flooding of the lake, did the amount of irrigated land reclaimed exceed that which was taken out of use to make room for the dam and lake[4569].

While accepting, with the above reservations, Kolars's projections on the development of irrigated agriculture in the Euphrates basin, we have for the period after 1995 included a small projection for improved efficiency in distribution systems and on-farm use. This would come mainly in the gravity-flow systems of the GADEB (General Administration for the Development of the Euphrates Basin) projects. A loss ratio of 30% is cited for gravity-flow surface irrigation, while pumped irrigation gets by with a 15% loss. Upgrading the surface systems should save at least a major part of that loss. It is unlikely that such efficiencies will be sought while the main emphasis is on land reclamation projects and water is sufficiently plentiful to be delivered free. There is room for improvement, however, and we assume that such improvement will be undertaken when basic infrastructure is in place. Between 1990 and 2015, we calculate a reduction in distributional losses in gravity flow systems from the current 30% to about 20%.

Beyond these efficiencies, of course, would be the widespread conversion to drip irrigation, greenhouses, and plasticulture for appropriate crops -- expensive, but yielding spectacular water savings and impressive increments in productivity. These will no doubt be viewed with favor by Syrian planners and peasants when the diminishing water supply becomes apparent. This perception should come by the turn of the century in the Euphrates basin, but lag time for planning and implementation will probably put the large-scale realization of such schemes beyond the term of our projections.

Domestic use will grow with increased population and improved services. This is projected on the line labeled *Domestic use*. Loss in domestic systems is estimated in accordance with the assumption that improvements in distribution systems will begin by 2000 and be complete by 2010. The use of the nationwide loss rate of 28.6% for the period before 2000 is probably an underestimate. The loss rate for Hassaka City in 1986 was reported to be 50%[4410], and Raqqa and Deir ez-Zor are unlikely to be much better. Total withdrawals for domestic use are projected on the line labeled *Domestic w/d*. This figure includes projections for increased interbasin transfers for domestic use to Aleppo in proportion to its population increment.

Industrial use is not yet significant in the Euphrates basin. There is some food-processing and a still non-functional paper mill to utilize the region's straw. Both of these could, in theory, become major water consumers. However, in view of the region's unfinished business in land reclamation and the exciting new

low-sulphur oil fields that have been discovered, it is assumed that industrial development and industrial water use will remain near their present level.

Between Turkish and Syrian developments, the bottom line for the Euphrates basin in Syria is a projected decrease from a residue of 23.5 billion cubic meters of water in the early 80s to a residue of 3 billion cubic meters in 2015. The augmentation of these flows of fresh water with significant amounts of return flow offers little joy, since the re-used waters will be degraded by pollution, salination, and sedimentation[4637]. These matters should be of concern to Syria and deserve the most urgent consideration in Iraq.

2.2.2 The Orontes

The Orontes River valley was the site of the Ghab Project, the first of Syria's great development schemes and the most advanced in terms of socio-economic benefits and negative ecologic impacts. The flowering of the rift valley after the draining of the malarial swamps in 1969 has been remarkable, and the original agricultural projects have more recently been supplemented by a diversifying economy whereby the profits of agricultural effort have been ploughed back into a burgeoning service sector -- mechanics, machine rental, marketing, inputs for extra between-season crops, and other enterprises[4255]. But, already in the 1970s, the Orontes was in some sectors too polluted for human consumption.

In the upper reaches of the river, the main source of the river's pollution is industrial and domestic. The metropolitan centers of Homs and Hama are badly in need of wastewater treatment. The World Bank[3100] cited this problem and the incidence of related water-borne disease in 1980. By 1988, numerous projects were contracted to provide sewage treatment facilities for these cities (MEED, 1/10/87, 8/8/87, 8/15/87, 10/10/87, 1/23/88). Because of the number of projects underway, we forecast that sewage treatment and ultimately water reclamation will be more rapidly achieved in the cities of the Orontes basin than in many other parts of Syria.

An accelerated schedule for water treatment in the Orontes basin is an urgent necessity. By our calculations (see Table 2.8), the basin will face an absolute deficit by the year 2000, and the situation will worsen steadily thereafter. Syria already uses more than 90% of the water available to it in the Orontes. It already has to pipe in drinking water for Homs from nearby springs, because the surface water is not potable. In view of the basin's impending scarcity, the quality of the water supply in the Orontes must be restored as soon as possible. The region cannot afford the luxury of wasting its water resources through avoidable pollution.

Table 2.8

WATER BALANCE IN THE ORONTES BASIN: PROJECTIONS TO 2015 (In Mcms)

	1981/82	1990	1995	2000	2005	2010	2015
Water in system	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Used in Lebanon*	80	80	80	80	80	80	80
Available in Syria	**1,420**	**1,420**	**1,420**	**1,420**	**1,420**	**1,420**	**1,420**
Domestic use	*57*	*97*	*126*	*161*	*189*	*223*	*263*
Rate of loss %	*(28.6)*	*(24)*	*(20)*	*(16)*	*(12)*	*(12)*	*(12)*
Domestic loss	*23*	*31*	*32*	*30*	*26*	*30*	*36*
Domestic w/d	80	128	158	191	215	253	299
Agriculture w/d	1,191	1,196	1,185	1,175	1,165	1,157	1,143
Industrial w/d	58	58	58	58	58	58	58
TOTAL WITHDRAWAL	**1,329**	**1,382**	**1,401**	**1,424**	**1,438**	**1,468**	**1,500**
Residue	91	38	19	-4	-18	-48	-80

* Per agreement between Syria and Lebanon in 1972.

1. Agricultural figures assume that between 1990 and 2010 there will be a gradual increment of up to 26 Mcms for new projects planned in the neighbourhood of Ain Zerqa. Figures also assume that starting in 1995 the loss from gravity surface water will be reduced over a twenty year period from the present 30% to 20% in 2015.

2. Domestic loss assumes that repairs in the Orontes Basin will reduce the domestic loss ratio to 12% by 2005. Contracts are out for repair and sewage for Hama and Homs, so loss reduction should be well ahead of some other regions.

3. Industrial figures assume that water use is held constant. Industrial development has stagnated in the 1980s and is not a high priority in the present Five Year Plan.

Sources: Tables 2.4-2.6, calculations by author.

The flow of the Orontes in Syria derives in almost equal portions from surface water crossing the border from the Lebanese Bekaa Valley and groundwater from springs within Syria. Although the flow is highly variable depending on each year's rainfall, the average is 1,500 Mcm/year. Of this, 80 Mcm was guaranteed to upstream Lebanon by a 1972 agreement, which leaves 1,420 Mcm/year for Syria. (Note that the Afrine River, which is topographically part of the Orontes basin, will be considered in conjunction with the Aleppo region to which it belongs administratively.) Since the Afrine joins with the Orontes downstream from Syrian-controlled territory, it is, for all Syrian purposes, a self-contained unit.

Usage within the Orontes basin will be a complex of rising and falling variables. Domestic usage will rise steadily, more than doubling by the year 2000 and trebling by 2015. This projection assumes, in the light of perceived urgent need and contracts outstanding, that Homs and Hama will be well ahead of the rest of Syria in upgrading water distribution and treatment systems[4674]. A reduction of the domestic system loss ratio to 12% is posited by the year 2005. We calculate that agricultural water usage will actually diminish slightly through the upgrading of systems, even though some small new irrigation projects are envisioned in the vicinity of the prolific Ain Zerqa. Additional expansion of irrigation will surely be constrained by the declining discharge of springs and artesian wells. This situation is already being reported[4675]. It is assumed that industrial water use remains constant. Industrial development does not have a high priority in the current Syrian Five Year Plan and investment budget[eeee].

The sum of our calculations is shown in Table 2.8. Overall water needs in the Orontes basin will increase by 7% by the year 2000 and by 14% by 2015. Demand will exceed supply by 2000. By 2015, the excess of demand over supply will equal the 80 Mcm/year upstream drawdown allocated to Lebanon.

2.2.3 Damascus Basin

The sources of water for the Damascus basin (see Table 2.9) consist of approximately 300 Mcm/year of surface water -- much of which is used or dissipated before it reaches the plain -- and an estimated safe yield of 1,200 Mcm/year from groundwater[4383][4274]. Recent reports of domestic rationing in Damascus City and its environs[4269] do not clarify whether this shortage is because of overdraft on the available supply, temporary drought, or inadequate pumping and distribution systems; it could be all three.

Table 2.9

WATER BALANCE IN THE DAMASCUS BASIN: PROJECTIONS TO 2015 (In Mcms)

	1981/82	1990	1995	2000	2005	2010	2015
Water Available	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Domestic Use	*104*	*177*	*230*	*293*	*344*	*407*	*480*
Rate of loss %	*(28.6)*	*(24)*	*(21)*	*(18)*	*(15)*	*(12)*	*(12)*
Domestic loss	*41*	*59*	*61*	*64*	*61*	*55*	*65*
Domestic w/d	145	236	291	357	405	462	545
Agricultural w/d	935	935	925	916	907	899	891
Industrial w/d	75	75	75	75	75	75	75
TOTAL WITHDRAWAL	**1,155**	**1,246**	**1,291**	**1,348**	**1,387**	**1,436**	**1,511**
Residue	**345**	**254**	**209**	**152**	**113**	**64**	**-11**

1. Domestic figures assume that repairs in Damascus will reduce loss to 12% by 2010.

2. Agricultural figures assume that starting in 1995 the loss from gravity surface water irrigation will be reduced over a twenty year period from the present 30% to 20% in 2015.

3. Industrial figures assume that water use is held constant. Industrial development has stagnated in the 1980s and is not a high priority in the present Five Year Plan.

Sources: Tables 2.4-2.6, calculations by author.

Projects planned or underway for Damascus include pumps to enhance the flow of Ain Fijeh[4674], a computerized control system to improve management (MEED, 2/20/88), and wastewater treatment (MEED, 11/15/86). Some of these projects have been tendered more than once, presumably because of difficulties in arranging financing.

In computing the water balance for the Damascus basin, the most significant variable is domestic use: the increase in population and in per capita consumption. The population growth rate for Damascus City and Province has been approximated by the countrywide growth rate of 3.46%. In fact, the growth of Damascus City in the 1981 census was only 3.02%, while Damascus Province was significantly higher at 4.65%. Calculating the two segments at their individual growth rates yields an additional 2-3% in population at the end of a decade as compared to the figures derived by applying the countrywide average or an additional 5-6 Mcm/year in domestic usage. This seems relatively insignificant, so the simpler derivation has been used for the sake of countrywide consistency.

Moreover, the differential in growth rates may well be reduced. In the late 1970s and early 1980s, it was reported that the Syrian government was seeking to discourage migration to Damascus. Housing costs in the capital were several times higher than those in provincial centers, while salaries were standard throughout the country for similar jobs and seniority. Thus, a teacher in Raqqa could maintain a higher standard of living for his family than one in Damascus for the same amount and level of work. This imposed a strong disincentive for moving to Damascus in cases where it was not professionally necessary[4362]. It does not, of course, impede migration for individuals who can find higher level and higher paid jobs in the city than in the provinces, but many seem to be able to accomplish their goals by moving from a village to a provincial center rather than to the capital.

Because problems are already apparent and work is underway in Damascus, we assume that the upgrading of networks will proceed on a reasonable schedule. Some reduction in the domestic loss ratio is projected as early as 1990 with upgrading to be complete by 2010. This means by that year an annual saving of some 100 Mcm over what the loss would have been without the upgrading of the systems. Nonetheless, domestic water needs will more than treble by 2015 and will rise thereafter in direct proportion to population growth.

For agriculture, we project a small decline in water use because of the repair and upgrading of surface irrigation systems. It seems unlikely that agriculture, which in this region functions in competition with the spreading urban sprawl, will experience any significant expansion -- and, indeed, no such plans are reported. Thus, the upgrading of existing surface irrigation systems will represent a real saving in water used for agriculture of about 5%.

As in other regions of Syria, we do not assume any significant growth in water use for industry. Industrial growth is not a high priority in present Syrian planning and has been virtually stagnant during the 1980s. While some growth must surely take place over the next thirty years in this major metropolitan area to provide employment for additional population, it will be imperative that new enterprises should not be heavy water consumers and should be equipped with the most water efficient technologies.

The realities of the situation will impose this necessity. For by 2015, we foresee that the Damascus basin -- even with the conservation measures we assume -- will be in a state of absolute annual deficit. If systems are not upgraded or if population grows at an accelerated rate, the basin will pass into deficit several years earlier. The recurrent seasonal shortages should help to focus attention on these needs.

2.2.4 The Coastal Plain

The Coastal Plain in Syria is a semi-humid zone with copious rainfall. The Ansariya mountains, which bound the plain, snare the Mediterranean clouds to drop the major burden of their precipitation on the westward side of the range. This water returns to the sea by way of several major rivers, many small rivulets, and innumerable springs, some of major dimension. Perhaps because of the comparative richness of the resource, the gauging of water flows in the Coastal Plain is very incompletely reported. We have estimated the total water available -- surface water and groundwater -- to be on the order of 1,110 Mcm/year, but this may overlook the product of some of the smaller wadis and wells.

By our calculations (see Table 2.10), about 40% of this water was utilized for domestic, agricultural, and industrial uses in the early 1980s. By 2015, this use ratio will rise to 80%, still leaving a residue of some 200 Mcm/year.

The extension of domestic water services into smaller communities has been a constant theme with Syrian planners and is the target of numerous projects in the coastal region[cccc]. Some observers have charged that Syria's governing elite, most of whose top leaders are Alawites from Latakia Province, are taking care of that region first[xxxx]. But it could as well be said that the relative abundance of water resources in the region makes the provision of such services easier in the Coastal Plain than in other areas. By the same token, we anticipate that the upgrading of existing distribution networks will lag behind that of cities facing immediate scarcities, although some such repairs will have to be undertaken within the next two decades. Combining these considerations along with population growth, we predict that

Table 2.10

WATER BALANCE ON THE COASTAL PLAIN: PROJECTIONS TO 2015 (In Mcms)

	1981/82	1990	1995	2000	2005	2010	2015
Water Available	1,110	1,110	1,110	1,110	1,110	1,110	1,110
Domestic Use	*33*	*56*	*73*	*93*	*109*	*129*	*152*
Rate of Loss %	*(28.6)*	*(28.6)*	*(24)*	*(20)*	*(16)*	*(12)*	*(12)*
Domestic loss	*13*	*23*	*23*	*23*	*21*	*18*	*21*
Total domestic w/d	46	79	96	116	130	147	173
Agriculture w/d	364	540	538	661	659	657	655
Industrial w/d	52	52	52	52	52	52	52
TOTAL WITHDRAWAL	462	671	686	829	841	856	880
Residue	648	439	424	281	269	254	230

1. Domestic figures assume that repairs to urban systems will reduce loss from 28.6% to 12% by 2010.

2. Agricultural figures include an additional 30,000 ha to be irrigated by 1990, and 21,000 ha to be irrigated on Akkar Plain therafter (by 2000?). Figures assume that new irrigation will be designed for maximum efficiency with loss of 15%, and that loss will be reduced on existing gravity flow irrigation from 30% to 20% over the period 1995-2015.

3. Industrial figures assume that water use is held constant. Industrial development has stagnated in the 1980s and is not a high priority in the present Five Year Plan.

Sources: Tables 2.4-2.6, calculations by author.

domestic water use will nearly quadruple by 2015. After the Euphrates, the Coastal Plain has the most potential for agricultural development. There are at least sixteen dams completed, under construction, or planned for the near future in the region, of which ten are intended at least in part to provide water for irrigation[4674)(4677)]. If fully implemented, these projects could bring more than 50,000 new hectares of land under irrigation, almost doubling the use of water for agriculture by 2015.

The expansion of port facilities in the coastal cities is one of the exceptions to the observation of stagnation in industrial development. This activity should not, however, represent a major increase in industrial water use, which is posited as remaining constant throughout the period.

Although water quantity in the Coastal Plain seems moderately adequate for the foreseeable future, there is another problem that requires close scrutiny. There have been some scattered reports of wells in the area becoming salty[ssss)]. It is possible, of course, that an individual well or spring may be contaminated through a purely local phenomenon such as infiltration from nearby agricultural return flows or other pollutants. It is also possible, however, that the Syrian coastal aquifer is subject to the same sort of sea-water seepage as the coastal aquifers farther south along the Mediterranean littoral. Syria needs to watch this situation carefully to prevent permanent degradation.

2.2.5 The Yarmuk

The Yarmuk basin has the least water and the hottest politics of all the Syrian hydrologic regions. Unlike the other basins, which provide thousands of million cubic meters of water per year, the Yarmuk in Syria yields an average of just over 300. Yet that 300 Mcms is desperately needed by Jordan, whose total water budget is a small fraction of Syria's residue. Israel, whose big guns overlook Syrian villages from the occupied Golan Heights, has also staked a claim to Yarmuk water because of the serious water scarcities which it faces.

The present and predicted balance on the Yarmuk basin in Syria is shown in Table 2.11. The sources of water in the basin derive from surface flows and from the springs fed by the limestone water-bearing strata of the Anti-Lebanon and Lebanon ranges. The total spring flow of the region is estimated at 145 Mcm/year, but some 120 Mcm of this is contributed to the surface flow of the river. In all, the total flow of the Yarmuk basin can be estimated at an average 433 Mcm/year (down from estimates earlier in the twentieth century of nearly 500 Mcm), of which a quarter of the

Table 2.11

WATER BALANCE IN THE YARMUK BASIN: PROJECTIONS TO 2015 (in Mcm)

	1981/82	1990	1995	2000	2005	2010	2015
Water in system*	433	433	433	433	433	433	433
Enters downstream from Syria	116	116	116	116	116	116	116
Available in Syria	**317**	**317**	**317**	**317**	**317**	**317**	**317**
Domestic use	*13*	*23*	*29*	*37*	*44*	*52*	*61*
Rate of loss %	*(28.6)*	*(28.6)*	*(28.6)*	*(24)*	*(20)*	*(16)*	*(12)*
Domestic loss	*5*	*9*	*12*	*12*	*11*	*10*	*8*
Domestic w/d	18	32	41	49	55	62	69
Agricultural w/d	141	153	153	149	145	144	144
Industrial w/d	--	--	--	--	--	--	--
TOTAL WITHDRAWAL	**159**	**185**	**194**	**198**	**200**	**206**	**213**
Residue	**158**	**132**	**123**	**119**	**117**	**111**	**104**

* Water available in system determined by extrapolation from long-term flow data at Maqarin, Mukheiba, and Adasiya(4220), including water that originates in both Syria and Jordan (no significant Yarmuk flow originates in Israel). Water available to Syria includes associated groundwater but excludes water originating in Jordan.

1. Domestic water includes a very small inter-basin transfer to the city of Suweida. It assumes that upgrading of distribution systems will lag behind the rest of Syria, but that from the year 2000 to 2015 such repairs will be made and the rate of loss will be lowered from 28.6% to 12%.

2. Agricultural water assumes an increase of 3,000 ha of irrigation by 1990. Also assumes that the rate of loss in existing irrigation systems using gravity flow surface water will be reduced from 30% to 20% during the period 1995-2010.

3. Due to scarcity, it is assumed that no heavily water consuming industries will be inaugurated in this region.

Source: Tables 2.4-2.6, calculations by author.

flow (116 Mcm) originates outside Syrian territory in left-bank tributaries from Jordan. The water available in Syria is thus 317 Mcm/year.

In 1981-82, we estimate that Syria utilized 159 Mcm of ground and surface water in the Yarmuk basin. This included a very small (approximately 2 Mcm) transfer of drinking water to Suweida city, but the major consumer was agriculture. We predict a four-fold increase in domestic consumption within the basin by the year 2015, as population grows and domestic systems are extended, with some savings in the latter part of the period from repair of leaky municipal networks. At the same time, we anticipate a small increase in agriculture usage as some 3,000 additional hectares are opened for irrigation, but suggest ample room for improvement in the existing gravity-flow surface irrigation systems, which constitute more than half of the irrigated area in Deraa province. The net result will be a 9% increase in agricultural water use over the next decade, an increase which will shrink almost to 1981 levels in the subsequent fifteen years through conservation. Industrial water use in the area is now essentially nil and will probably remain so.

The population density of southwestern Syria is low. All of Deraa province has a population only slightly greater than the city of Homs, and the potential for agricultural development beyond what is already planned is not great. A major factor for Syria in relation to this area, however, is the supply of power for its overburdened electrical grid. These realities are reflected in the 1987 agreement with Jordan to build (after thirty-five years of talking and planning) the Unity Dam on the Yarmuk. Syria will get 75% of the hydroelectric output, but little additional water; Jordan will get the water it desperately needs[eiux]. The unknown factor in the plan is Israel, whose few miles foothold on one bank above the mouth of the Yarmuk gives it riparian status, although its territory contributes no water to the river's flow. By all indications, discussions are underway[C.I.] to obtain Israeli acquiescence to this project, but the price to be paid is still subject for speculation.

2.2.6 Aleppo and Its Environs

Aleppo is already in trouble. Its surface water -- principally the Qweik -- is either drawn off for use in Syria or neighboring Turkey, north of the city, or polluted beyond hope or prayer. Its groundwater is estimated at 334 Mcm/year safe yield[4383], but is probably being drained for irrigation through unlicensed wells at a much heavier rate and with unforeseeable consequences.

The aggregated statistics for Aleppo province include the verdant Afrine valley, so we have combined the Afrine with Aleppo proper, both for usage and for available supply. The putative flow of the Qweik and groundwater in the Aleppo basin total an average annual supply of 413 Mcm/year[4383]. The Afrine river averages 252 Mcm/year[4106], and some eighteen springs nearby yield an average of 86 Mcm/year[3046], totaling 338 Mcm/year for the Afrine valley. The total supply for Aleppo province is thus on the order of 750 Mcm/year.

In Table 2.12, there is no withdrawal indicated for domestic use. Major municipal needs have for the past decade been supplied by pumping from Lake Assad. Projections on the growth of domestic use in Aleppo province have thus been included in the computations of the water balance for the Euphrates basin (see Tables 2.3 and 2.7) and are not registered on Table 2.12. It is likely that some water, especially for rural domestic use, is still drawn from the waters of the local basin. The assumption that all domestic water is supplied from the interbasin transfer will then represent an underestimate on the amount of water drawn from Aleppo's water budget. In other words, the local situation might be even worse than it looks in Table 2.12.

Agricultural use predicts no expansion of irrigated agriculture for Aleppo itself, but does include the 20-30,000 hectares scheduled for irrigation after the completion of the April-17 Dam on the Afrine[3046][4674]. Since this project will involve pressure-pipe irrigation, the water use has been computed at the more efficient 15% distribution and on-farm loss ratio. Moreover, there is no estimate for savings by routine upgrading of agricultural systems, as all agriculture in Aleppo province is serviced by pumped water. The 1981-82 agricultural water usage for Aleppo, including the Afrine, was calculated at 727 Mcm/year. Over the subsequent thirty years, this withdrawal will grow to 960 Mcm/year according to projections.

Industrial water use is estimated at a constant 80 Mcm/year throughout the period of our projections.

The above assessment shows a system already being rescued by interbasin transfers in 1980 and already significantly overdrawn on its identified supply and with no prospect but to get worse. According to these calculations, by 2015 the province will be consuming almost 40% more water each year than it actually has. This is, of course, a contradiction, since water is not created by a genii with a lamp. People can*not* use something which does not exist. There are several possibilities to account for the current calculation of deficit.

First, the province -- and especially those parts of it that are closest to Lake Assad -- may be getting more water from the lake than is reported in the officially piped interbasin transfer.

Table 2.12

WATER BALANCE IN ALEPPO BASIN(S): PROJECTIONS TO 2015 (in Mcm)

	1981/82	1990	1995	2000	2005	2010	2015
Water available*	750	750	750	750	750	750	750
Domestic w/d	--	--	--	--	--	--	--
Agricultural w/d	727	777	827	877	925	960	960
Industrial w/d	80	80	80	80	80	80	80
TOTAL WITHDRAWAL	807	857	907	957	1,005	1,040	1,040
Residue	-57	-107	-157	-207	-255	-290	-290

* Water available reflects both the waters of the Qweik basin and the Afrine River basin. Hydrologically, the Afrine is a tributary of the Orontes, but present political geography makes it an adjunct of its neighbor Aleppo insofar as Syria is concerned. The aggregation of Syrian statistics includes the Afrine basin with data on the Aleppo Muhafaza of which it is a part.

1. Domestic withdrawals are nil because Aleppo is supplied by interbasin transfer from the Euphrates at Lake Assad.

2. Agricultural withdrawals include, in 1990 and after, a phasing in of the planned new 20,000 ha of sprinkler irrigation in the Afrine(3046).

3. It is assumed that industrial withdrawals will remain constant. Industrial growth is not the highest priority for the current Five Year Plan. Further, in view of the scarcity of water in Aleppo, it is assumed that any industrial expansion will be chosen with a view to water efficiency.

Source: Tables 2.4-2.6, calculations by author.

Second, more water may be pumped from underground aquifers than the safe yield. There are reports of myriad unlicensed wells and of a bureaucracy unable to keep pace with needs, but generating red-tape so daunting as to discourage compliance with reporting requirements and regulations. There are also reports of groundwater degradation [prs]. [4207?]

Third, the other half of the second conjecture, is that the assessment of Syrian groundwater is incomplete. There may be more water available for use in the basin than the estimated safe annual yield. The danger of acting on this assumption is that overdrafts may degrade the remaining resource.

What is certain is that Aleppo does have a serious problem. Whatever expedients may be employed to meet minimum needs at present, the prospect for the future requires serious consideration and major effort. The impact of water scarcity has surely already been felt. Already in the mid-70s, Aleppo's per capita consumption was less than that of several smaller Syrian cities. The World Bank estimated that in 1974, the last date for which full statistics were available to it in 1980, the domestic consumption for Aleppo was 71 cu m/yr (196 lcd). It was exceeded by Damascus, the capital and largest city, with 309 lcd; Raqqa with 407 lcd; Latakia with 335 lcd; and Homs with 233 lcd[3101]. This already represented a constraint on the standard of living for Syria's second city.

2.2.7 The Steppe Region

The Steppe region in Syria is a vast, sparsely populated area encompassing several drainage basins. There is virtually no surface water. The unpredictably occasional flash flood evaporates or percolates into groundwater or may remain ponded for part of a season to serve ephemeral local uses. All reliable water for the region comes from underground aquifers and finds its way to the surface through natural springs or is pumped up in wells and boreholes.

The proven annual discharge of the Steppe region is 330 Mcm. Of this, 16 Mcm wells up in springs in the Tadmar-Palmyra oasis; most of the remainder is in the Hauran (Jebel el-Arab/Jebel Druze) section of southern Syria. Both of these areas have been inhabited since ancient times and bear evidence of the hydrologic efforts of Greco-Roman and Arab engineers. Straight lines of boreholes stretch east across the desert, testifying to the *qanat* structures burrowed beneath the surface.

It is not known just how much water lies beneath the surface of the Syrian Steppe and how much *could* be extracted safely for human use. The safe yield of the regional basalt and carbonate aquifers is unknown, for Syria as well as for Jordan, Iraq, and

Saudi Arabia, with whom it shares those aquifers. Jordan, down gradient from Syria, uses some 30 Mcm/year from the basaltic Rijam formation[4072]. This is already too much usage for that sector; the Azraq oasis is drying up, and increased Syrian use would no doubt hasten the depletion. On the other hand, scattered soundings have found major water-bearing fossil formations at depths of 1500 meters or more. In short, the present constraint in the area is one of lack of knowledge, rather than proven lack of water.

Actual water use in the Syrian Steppe is still limited (see Table 2.13). There is little or no recorded irrigation. The major water use for the region is human consumption with some industrial use also reported. It is estimated that water use for the Steppe (Palmyra, Suweida, and other scattered settlements) will treble by 2015.

The interbasin transfer of water from Ain Muzeirib to Suweida is assumed to be continuing and has been counted with the Yarmuk basin. This 2 Mcm transfer, though small, was significant for hygiene in the region. In 1974, domestic consumption in Suweida was 39 lcd, based on production totals with only 23 lcd actually reaching the consumer[3101]. This compared unfavorably to the international minimum standard of 40 liters per capita per day to maintain health[4673]. By the end of the decade, as a result of the interbasin transfer, Suweida was producing 139 lcd for its residents or, allowing for systemic losses, an actual consumption of 80-100 lcd. This represents a dramatic improvement.

In 1981-82, the use of water in the Syrian Steppe was 15% of the estimated safe yield of its groundwater. By 2015, if no new resources are developed, use will be approaching 50% of the safe yield.

2.2.8 Countrywide Water Balance

Syria over the next thirty years will present a picture of countrywide water surplus, but regional water scarcity. The total balance will dwindle from the massive surplus of 25,000 Mcm in the early 1980s to a much more moderate surplus of 3,000 Mcm by 2015. Yet Aleppo basin is already experiencing a deficit and would, projecting the trends, be using more than half again as much water as it possesses -- if that were possible. The trends for the Orontes basin show a deficit by the year 2000. Damascus will pass into deficit sometime after 2010.

The major change over the period will be the marked decrease in the water available in the Euphrates. The residue in the river will be one eighth what it was in the 1970s. The flow will be far more regular than in the natural regime, but the average monthly

Table 2.13

WATER BALANCE OF STEPPE REGIONS: PROJECTED TO 2015 (in Mcm)

	1981/82	1990	1995	2000	2005	2010	2015
Water available*	330	330	330	330	330	330	330
Domestic use	*22*	*38*	*49*	*62*	*73*	*86*	*102*
Rate of loss %	*(28.6)*	*(28.6)*	*(28.6)*	*(26)*	*(24)*	*(22)*	*(20)*
Domestic loss	*9*	*15*	*20*	*22*	*23*	*24*	*25*
Domestic w/d	31	53	69	84	96	110	127
Agricultural w/d	--	--	--	--	--	--	--
Industrial w/d	17	17	17	17	17	17	17
TOTAL WITHDRAWAL	**48**	**70**	**86**	**101**	**113**	**127**	**144**
Residue	**282**	**260**	**244**	**229**	**217**	**203**	**186**

* Water available includes 16 Mcm/a[4274] in groundwater identified in the Palmyra region and 314 Mcm in the Hauran[4383]. All authors warn of the extremely sketchy nature of these assessments.

1. Domestic use projections assume that these remote small towns and settlements will lag far behind the rest of Syria in repairing their systems and providing better sewerage, but that some progress will be made.

2. There is no irrigated agriculture indicated for these areas. Nearly all the irrigated agriculture in the Douma district of the Damascus Muhafaza lies within the Damascus hydrological basin.

3. Industrial withdrawals project no increment. Industrial growth has been stagnant in the 1980s and is not given high priority in the current Five Year Plan.

Source: Tables 2.4-2.6, calculations by author.

flow will be but a fraction of the river's normal flow for August, its driest month. One wonders if the ecological impact of such a major reduction in a historic river has been assessed. Turkish and Syrian uses will leave little to maintain the ecosystem of the lower river valley, let alone for historic or planned uses by the lowest riparian, Iraq. Syrian concern over Turkey's plans -- and Iraqi concern for Syria's plans -- are both well founded.

These trends point to issues that must be addressed in the near term. Plans must be made now to meet the regional scarcities that will be forthcoming, and the complacency natural to a country that has enjoyed an abundance of water must be overcome. Where possible, water supplies must be augmented by identifying new resources or capturing and upgrading wasted resources. Care must be taken to avoid the degradation of existing supplies.

Fortunately, there are signs that the Syrians are aware of these problems. The final sections of this chapter review some of the issues that are now receiving attention or that, we believe, will require attention by early in the twenty-first century.

2.3 Current Issues

To judge by development plans and projects under construction, Syria is well aware that it faces water problems. Even though its projected annual surplus in the year 2015 is greater than the total water budget of either Jordan or Israel, Syria is giving top priority to water projects in its development (investment) budgets. Concern is evidenced both for water in itself and for water as a source of hydroelectric power, another major priority.

The Euphrates region remains a concentration. Two new dams are under development. The Baath Dam[4677], 26 kilometers downstream from the great Euphrates Dam, will control the outflows from the Euphrates Dam and will work in tandem with it to generate electricity on a rotating schedule: one dam generates, while the other refills its reservoir, using each drop of water twice. The Baath Dam is just about complete. A third dam, Tishreen, has been planned upstream at Yusuf Pasha, at the tip of Lake Assad, also for power production[4674]. These three dams will completely regulate the flow of the river in Syria and considerably augment the supply of electricity -- provided there is enough water in the river to turn the turbines. Careful coordination with Turkey is obviously needed to make sure that the design of these facilities is consonant with the status of the river in coming decades.

Syria has been building and planning dams all over the country[4677]. Some are large, e.g., the dams on the Afrine and the Kebir Shemali, and many are small. Some will produce electric

Table 2.14

WATER BALANCE FOR SYRIA PROJECTED TO THE YEAR 2015 BY BASIN
(in Mcm)

	1981/82	1990	1995	2000	2005	2010	2015
Water Available							
Euphrates	26,500	24,500	16,700	14,200	14,200	14,200	14,200
Orontes	1,420	1,420	1,420	1,420	1,420	1,420	1,420
Damascus	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Coastal Plain	1,110	1,110	1,110	1,110	1,110	1,110	1,110
Yarmuk	317	317	317	317	317	317	317
Aleppo	750	750	750	750	750	750	750
Steppe	330	330	330	330	330	330	330
TOTAL Available	**31,927**	**29,927**	**22,127**	**19,627**	**19,627**	**19,627**	**19,627**
Water Withdrawn							
Euphrates	2,981	5,206	8,871	10,928	10,963	11,017	11,106
Orontes	1,329	1,382	1,401	1,424	1,438	1,468	1,500
Damascus	1,155	1,246	1,291	1,348	1,387	1,436	1,511
Coastal Plain	462	671	686	829	841	856	880
Yarmuk	159	185	194	198	200	206	213
Aleppo	807	857	907	957	1,005	1,040	1,040
Steppe	48	70	86	101	113	127	144
TOTAL Withdrawn	**6,941**	**9,617**	**13,346**	**15,785**	**15,947**	**16,150**	**16,394**
Residue							
Euphrates	23,519	19,294	7,919	3,272	3,237	3,183	3,094
Orontes	91	38	19	-4	-18	-48	-80
Damascus	345	254	209	152	113	64	-11
Coastal Plain	648	439	424	281	269	254	230
Yarmuk	158	132	123	119	117	111	104
Aleppo	-57	-107	-157	-207	-255	-290	-290
Steppe	282	260	244	229	217	203	186
TOTAL Residue	**24,986**	**20,310**	**8,781**	**3,842**	**3,680**	**3,477**	**3,233**

Source: Tables 2.7-2.13, calculations by author.

power, others merely create a small impoundment from which local residents can draw for seasonal crop or animal needs. The functions of these dams reflect the priorities that Syria has set for its development: rural electrification and improved agriculture. Indeed, thermal power plants run a close second to water development in terms of infrastructure work underway in Syria[eiux].

One major area of effort, with several projects contracted, is the development of wastewater treatment for Syria's major cities. Into the 1970s, Syria had virtually no treatment facilities; chemical and biological pollution, with their attendant burden of water-borne disease, were seen as major problems[3094]. Work for sewerage and treatment installations is now under contract for Damascus, Homs, Hama, and Aleppo (MEED, 1986-88 *passim*). A treatment unit for the Orontes at Mehardeh has also been tendered. Water quality treatment is obviously a needed development, not only because it is related to human disease, but also because it is a conservation measure and one directed at precisely those regions -- the Aleppo, Orontes, and Damascus basins -- that face problems of impending scarcity. The computerized water management system, which was tendered in April, 1988, will conserve additional water for Damascus (MEED, 4/2/88).

Finally, in accordance with the agreement of September, 1987, Syria is participating with Jordan in the joint project to build the Wahdeh (Unity) Dam on the Yarmuk. The Mount Kassioun Company of Syria is one of a consortium of three firms (the others are from Jordan and Italy) which have contracted for the first phase of construction, the tunnel to divert the river's water around the dam site while work is going on.

2.4 Emergent Issues

The change in the regime of the Euphrates River is a matter of legitimate concern to Syria. Turkey's massive Southeast Anatolia Project (GAP) will have several sure outcomes vis-a-vis Syria:

(1) There will be much less water in the main stream of the river (down by a factor of eight). This, together with recent droughts, has already affected the functioning of the turbines at Syria's Euphrates Dam, and the impact will worsen as the GAP progresses. Syria must keep this in mind in positioning the facilities at its new dams and in installing pumps for irrigation in the Euphrates Valley, as well as in its forecasts for total water available for use.

(2) There will be at least some increment in the flows of the Euphrates tributaries, the Balikh and Khabur. The amounts of these increments are difficult to predict, but Syria's resettlement of dislocated peasants into the far northeast of the country puts them in position to take advantage of such increments when they occur.

(3) The return flows from Turkish irrigation, when it is developed, will cause water quality problems downstream. This will involve chemical pollution from fertilizers and pesticides, increased mineralization leached from salts in the soil, and increased sedimentation. Which of these will be most serious depends on the as yet undetermined path followed by the return flows, but geography dictates that the Balikh and Khabur tributaries will be the most vulnerable.

Syria has had to rethink its plans for irrigation in the Euphrates region. In part, this is because some of the soils have proven to be inappropriate for irrigated agriculture. As a result some of the areas originally slated for irrigation are being returned to rangeland to prevent a "dust bowl" phenomenon. Current Syrian plans call for development of less than half the hectarage originally intended and are placing more emphasis on rainfed crops. In view of Turkey's schemes, the lowered Syrian expectations may serve to make Syria less vulnerable to upstream changes which alter the regime of the river. However, these more realistic goals make it more difficult for Syria to meet the needs of the people of the region, especially those who were displaced more than a decade ago for dam construction.

Obviously, cooperative planning among the riparians of the Euphrates basin is an urgent priority. Only by working together can the parties have a full base of information to use the resources of the river to best advantage.

Groundwater is Syria's last undeveloped source of water. Some work has been done on assessing groundwater resources, but much more is needed. The Syrian government has undertaken studies, especially in regions where the water table is dropping and springs are drying up. Basic geological studies have been done by scholars at ACSAD (the Arab Center for the Study of Arid Zones and Dry Lands), an Arab League agency headquartered in Damascus. In addition, a number of discoveries, especially of very deep fossil water deposits, have been made incidental to oil drilling.

Syria has two needs with respect to groundwater. *First*, it needs a comprehensive assessment of all the country's aquifers, with conservative estimates of the safe yields of those aquifers and of the steps necessary to prevent contamination from neighboring salt water deposits. *Second*, it needs a better system of monitoring and enforcement on private wells so as to prevent

unregulated overdrafts on local or regional aquifers. This need is not only apparent in the oasis cities, but also in the Orontes Valley and the Coastal Plain.

Looking toward the more distant future, when Syria may join its neighbors in a state of water scarcity, there is a third need. There needs to be a region-wide study of the deep groundwater resources that underlie the Arabian Peninsula and, along with this, multi-lateral agreements allocating usage within the safe yield limits of those resources.

Water quality control is both a health need and a conservation opportunity. Syria is working to install the treatment facilities that are essential to the health of its people and to prevent the degradation of existing water supplies. The health need has been recognized for a decade or more and is one of the stated priorities of Syrian development planners. Despite some regrettable delays (presumably for financial reasons), work is proceeding in this area.

What does not yet seem to be on the Syrian agenda is the large-scale reclamation of sewerage waters for re-use. This is a topic that deserves attention from Syrian planners. Five of Syria's metropolitan areas have a critical mass of population and generate enough wastewater to make water reclamation a viable option. Four of these five cities are in areas that face local shortages within the period of our projections. Two of those four sit astride major groundwater basins that would be prime candidates for artificial recharge; the other two might also offer opportunities for recharge, as well as (and this last has been suggested) opportunity for direct re-use of reclaimed water in industry or agriculture.

Conservation in the more general sense is an urgent need. Syria's urban water distribution systems lose far more through leaking joints and other disrepair than is acceptable even in lands far richer in water resources. In an arid land like Syria, a 30-50% loss ratio is simply not admissable. Irrigation systems also incur higher than acceptable rates of systemic loss. (Let us state for the record, however, that Syria shares these unacceptable loss rates with its neighbors.)

The projections in this study assume a slow, but steady effort on the part of Syria to improve these systems and reduce loss ratios. Consideration was given in casting these projections to the urgency of the need in a particular area, as well as to the magnitude of the task -- which obviously cannot be accomplished overnight. But if these efforts are not undertaken expeditiously, the shortages we foresee will be manifested much sooner than we have predicted.

The corollary of repair, of course, is better monitoring and regulation. The computerized water management network for Damascus is but one of several such upgraded systems that Syria will need to install in the coming decades, if it is to keep proper track of its water and collect the fees needed to keep the systems functioning.

Ultimately, Syria may need to investigate alternative technologies to supplement its water supply. Some experimentation has already been done with mesh walls in wadis to trap flashflood waters for recharge to groundwater[4327]. Small-scale desalination projects might be locally useful in dealing with brackish groundwater. Re new agricultural technologies, better plant strains are being developed by the Syrian Department of Agriculture in cooperation with ICARDA, an international agricultural research agency in Aleppo.

Such creative thinking, as well as careful planning with an eye to water efficiency, will be needed if Syria is to avoid long-term water problems.

Chapter 3

ROLE OF WATER IN THE SYRIAN ECONOMY

In Syria, the relationship between water resources development and economic development is clearly reciprocal. Water development has been constrained by the sluggish economy, the slow rate (indeed, negative in some years) of economic growth, and the lack of access to capital or credit for financing projects. In turn, economic growth is made more difficult by the nonavailability of water resources for irrigation and industry, and by the magnetic attraction of better services -- health care, clean water, superior schools -- that the metropolis offers to rural manpower.

3.1 General Economic Situation

The positive trade balance of early 1988 presents the first glimmer of moderately good economic news to be seen in Syria in the present decade. The general picture has been more one of industrial stagnation, delayed projects, shortages of materials, consumer austerity, and deficits. The difference in 1988 can be defined in two words: "water" and "oil"[4541].

Throughout the 1980s, the rains have come either too little or too late. In 1988 the rains have been plentiful and at the right times. This, plus the introduction of improved strains of wheat, have produced a record grain harvest, with a significant reduction in the need for food imports. Cotton is also expected to yield a bumper crop in early 1989, if 1987's out-of-season cloudbursts are not repeated. Last year's untimely rains helped to raise the level in Lake Assad, which relieved the shortfall in electric power, but they decimated the cotton crop[4541][4485].

At the same time, the coming on stream of light-crude oil fields in the Deir ez-Zor area have reduced Syria's need for oil imports to virtually zero[4541]. When the newly discovered Omar field begins to produce in 1989, Syria will become a net exporter of light crude in addition to the heavy sulphurous crudes from Hassakah province that Syria has been exporting for many years. Thus, the financial burden of importing energy has been lifted and Syria may in future turn a small profit on its oil production. It was estimated in 1985 that the simple replacement of oil imports with local production would save the Syrian treasury some SL 2 billion per year[4388].

This slightly improved situation is reflected in Syria's current budget. The total public expenditure, which had diminished in absolute terms from 1986 to 1987, was up more than 20% from 1987 to 1988 -- although that still represents a reduction when the 50% inflation rate is factored in. The SL 51.5 billion budget (see Table 3.1) is divided into current expenditures, SL 29.7 billion, and investment expenditures, SL 21.9 billion. In the current expenditure budget, the major item as usual is defense (44%), while the largest allocation in the investment budget is for water and power (24%), with agriculture coming second with 20%[4484]. (Water and power constitute a single line in the Syrian budget.) On the revenue side, the increases under exceptional and other do not represent projected real increments in income; rather, they reflect the depreciation in the official rate of the Syrian pound from 3.925 to 11.20 per US dollar.

The allocation for water and power reflects a significant upgrading of the priority of that sector in Syria's planned development. In 1987 the allocation from that year's greatly diminished development budget (down 10% over 1986) had been 43% for water and power. The two year total put water and power at a third of total investment, compared to the average 10% which had been allocated to it in most previous years.

In light of the economic and sectoral performance of the 1980s, this emphasis is obviously needed. The basic indicators for the period 1981-87 are shown in Table 3.2. The steadily increasing figures for gross domestic product are deceptive because of the inflation factor at market prices. In fact, the growth rate was negative in several years. More telling is the balance of trade which has been steadfastly negative until 1988. Exports and imports both reached their nadir in 1986. Exports were down because of stagnation and crop failures. Imports were in part curtailed by official austerity measures, although smuggling -- a major industry -- took up some of the slack in consumer goods. Indeed, the volume of black market trade in goods and currency is so large as to render official statistics incomplete, if not unreliable[4436].

Both import restrictions and credit constraints have taken their toll of Syrian economic and infrastructural development. The private sector has been complaining for years of its difficulties in obtaining the inputs necessary for production[4210]. In summer of 1988 it was reported that many factories had been forced to close through lack of raw materials and spare parts[4571]. By mid-decade, the Syrian government had begun instituting incentive programs for entrepreneurs, including special exchange rates on expatriate capital for private investment, streamlined import procedures for industrial equipment, and legal mechanisms for the export of profits[4211]. The economic sectors open to private investment were expanded, and new categories were established for mixed public-private sector enterprises[4210]. These new inducements to private enterprise were clearly intended to harness one of Syria's

Table 3.1

SYRIA: CURRENT BUDGET REVENUES AND EXPENDITURES
(SL mn)

	1985	1986	1987	1988
Current Expenditure	23,500	24,508	24,195	29,665
of which:				
defense	13,000	13,600	13,200	13,319
elementary education		3,641	3,803	4,894
public debt		1,385	1,747	3,911
price stabilization		1,400	900	900
Investment expenditure	19,448	19,333	17,508	21,880
Total expenditure	42,948	43,841	41,703	51,545
Revenue	42,948	43,841	41,703	51,545
Taxes and Duties	10,400	12,040	14,159	16,790
Services	344	382	594	1,434
State sector surplus	13,200	14,443	15,129	12,071
Exceptional	5,200	4,890	2,379	4,626
of which:				
loans & external		1,749	2,143	4,540
Other	13,804	12,086	14,159	16,623
of which:				
aid		7,682	7,682	7,830
donations		700	519	1,644

Sources: MEED 9/9/88 (4571) ; MEED 3/21/87 (3566) ; MEED 6/19/86 (4430) ; EIU 1987:4 (4484) ; al-Shariqa al-Khalij, 9/24/86 (4247) .

Table 3.2
SYRIA -- BASIC ECONOMIC DATA

	1981	1982	1983	1984	1985	1986	1987 E
GDP at market prices (in SL bn)	66.49	70.53	73.29	75.34	79.55	86.36	-
GDP (% real growth)	10.2	3.2	1.8	-3.6	0.7	-3.0	-1.9
Inflation (%)	18.4	14.3	6.1	9.3	17.2	36.1	50.0
Population (mn)	9.0	9.3	9.6	9.9	10.3	10.7	11.1
Exports (fob $ mn)	2,230	2,032	1,928	1,859	1,640	1,325	1,500
Imports (fob $ mn)	-4,843	-3,703	-4,152	-3,801	-3,591	-2,480	-2,800
Balance of Trade	-2,613	-1,671	-2,224	-1,942	-1,951	-1,155	-1,300
Current Acc. ($ bn)	-0.28	-0.25	-0.82	-0.85	-0.95	-0.43	-0.85
External Debt ($ bn)	2.20	2.24	2.29	2.4	2.73	3.06	3.40
Reserves ($ bn) *	2.29	2.20	0.05	0.27	0.09	-0.01	-
Exchange Rate [Av. LS per US $]	3.925	3.925	3.925	3.925	3.925	3.925	**3.925

E = estimated. * Not including gold. ** SL 11.20 per US$ as of Jan 1988.
Black market exchange rate in 1988: (min) LS 50 - (max) LS 100 per US$.

Sources: EIU 1988 Country Profile 88-89 (4363) ; EIU 1988:1 (4486) ; EIU 1988:3 (4541) ; EIU 1987:4 (4484) ; EIU World Outlook 1986 (4127) .

most valuable resources -- the energy and ingenuity of its people. It remains to be seen how many expatriate Syrians will come forward to reinvest capital and effort in their homeland.

But the lack of international capital does not discriminate between the free enterprise and government sectors. The public sector also suffers delays. News reports throughout the 1980s tell of projects completed but waiting for mechanical equipment[2195], and of small local projects begun in the 1970s and not yet complete in 1986[4284]. Important water projects such as the sewerage schemes for Aleppo, Homs, Hama -- and even Damascus -- have been delayed from year to year due to shortage of funds. Contracts were finally signed in early 1988 for the Homs and Hama plants[3853], after Syria's improving debt service record to the World Bank enabled that institution to release the loans that had been allocated to Syria almost a decade earlier.

In its 1980 report on Syria[1266], the World Bank predicted that Syria's laudable ambition to provide safe drinking water for its rural population had a probability of success "close to zero" because of lack of capital and skills. In part this has been a self-fulfilling prophecy, since the hold the World Bank placed on loans allocated to Syria (a precedent which is customarily followed by many other international lenders) has impeded Syrian development projects and undercut Syria's ability to meet its obligations at home and abroad. It is also true that the complications of Syrian bureaucracy have occasioned delays in projects that were in no way dependent on outside finance. Indeed, there have been completed water projects that could not operate because of jurisdictional disputes over which agency should collect the fees and maintain the systems[2346].

Syria's financial problems are very real, neither a figment of an international banker's imagination nor a construct of domestic red tape. In 1988, its external non-military debt stood at $4 billion, half again as much as the total operating budget for that year, almost 90% of that year's budget for current operations and development investments combined, and more than half of the last reported year's GDP. (That was 1986 since Syrian statistics are published two years late.) Service on that debt constitutes more than 13% of the current expense budget for the most recent year[4571][4754]. It will require several years of favorable external trade balances to translate that surplus into general economic recovery sufficient to pay off interest and import the materials needed for industrial production and infrastructure development.

3.2 The Agricultural Sector

As is true in many Middle Eastern countries, agriculture is by far the most significant consumer of water in Syria. Despite the fact that irrigated farming produces only 10% of Syria's annual harvest, nearly 90% of the water used in Syria in 1981-82 was applied to irrigation, and there is no reason to believe the proportion is any less today. It is therefore important to examine the position of this most thirsty of economic sectors, which provides 20% of Syria's GDP, 13% of its exports, and employs 33% of its workers[1280].

Syria is one of the few countries of the region that is potentially self-sufficient in food[4576]. In normal years, it is estimated that Syria's overall food sufficiency rate is 86%[4211]. Syrian agriculture, however, remains vulnerable to the vicissitudes of the rainfall regime, although this instability should not be allowed to disguise the significant gains in agricultural productivity since 1970[3317]. This improved performance has not kept pace with population growth, and the early 1980s -- a period of drought -- saw Syria compelled to import basic foodstuffs to feed its people. A 1985 report to the Food and Agriculture Organization sets forth Syria's performance at mid decade and projected need to the end of the century.

Table 3.3

Syrian Food Production and Need
(million tons)

Product	Produced 1984	Need 1984	Need 2000
Grain	1.98 mt	4.0 mt	6.8 mt
Meat	0.099 mt	0.42 mt	0.72 mt
Dairy	0.702 mt	2.5 mt	3.9 mt
Eggs	0.856 bn	1.8 bn	3.1 bn
Vegetables	2.2 mt	2.4 mt	4.1 mt
Fruits	0.742 mt	0.9 mt	1.3 mt
Industrial Products	0.651 mt	1.77 mt	3.0 mt

Source: al-Sharq al-Awsat[4160].

Although Syria has not realized its full potential to achieve food self-sufficiency, it has during recent decades registered among the highest growth rates in per capita agricultural productivity for the region. As of 1980, Syria's growth in agricultural value added per capita compared to its neighbors as follows:

Table 3.4

Value Added in Agriculture
($ per capita per year)

	1961	1980	% Change
Egypt	140	393	+181
Iran	189	582	+207
Iraq	142	480	+238
Saudi Arabia	--	391	--
Sudan	134	391	+192
Syria	50	311	+522
Turkey	300	886	+195

Source: McLachlan[4575], p. 35.

After the politically turbulent years of the 1940s and 1950s in Syria, the starting point in 1961 was perhaps understandably low, with a per capita value added less than 40% that of Sudan, the next lowest country on the list, and only one-sixth that of the highest, Turkey. It should be noted that several of the countries to which comparison is made rely heavily on irrigation whereas Syrian agriculture was and still is predominantly rainfed. It is also apparent that Syrian agriculture has in this time period done much to catch up with the productivity of its neighbors.

This improvement is due only in part to the expansion of irrigation, which has consumed 80% of agricultural investment but the results of which have been disappointing at best[3317]. The Ghab project is productive, with both irrigated and dry farming. Peasants work in cooperatives for officially planned crops and then, as private enterprise, plant interim crops for local market between the official cycles[4255]. The costly Euphrates project, on the other hand, has experienced technical problems and crippling delays. Year after year, the area of land Euphrates reclaimed has fallen short of planning goals and only in 1986 did the newly irrigated hectarages exceed the irrigated land flooded by the Euphrates Dam in 1975[4569].

Syria's advances have been registered primarily in dryland crop production during years of adequate rainfall, and can be attributed to improved plant strains and more advanced on-farm technology. Several productive and disease-resistant grains have been developed by the Scientific Agricultural Research Directorate of the Ministry of Agriculture, in cooperation with ICARDA[4437], but the upgrading of technology is perhaps best illustrated by the introduction of machines and fertilizers.

Table 3.5

Technological Change in Agriculture

Year	Irrigation		Mechanization		Fertilizer
	Sprinklers	Pumps	Combines	Tractors	tons applied
1963	205	20,990	1,566	2,093	61,900
1970	1,163	29,042	1,328	2,929	111,780
1975	1,325	40,416	1,607	9,030	189,935
1980	1,081	47,206	2,244	21,145	305,365

Source: Manners[3317], p. 274.

The use of tractors has increased tenfold, the use of fertilizers has gone up five times. The use of sprinklers has also increased significantly, and has been the subject of scientific study on its limitations and feasibilities in Syria[4129]. Unfortunately, little attention seems to have been paid to the water-conserving micro-irrigation (drip) technologies that might solve some of the Euphrates region's gypsum problems as well as save water.

Agriculture is and will continue to be a major employer of Syrian manpower, an important means of livelihood for its citizens, a source of export revenue in good years, and a priority item for Syrian development.

The cotton crop has been a significant earner of foreign exchange in the past and, given the right rainfall at the right seasons, can be in the future. How much the crop earns, of course, fluctuates with world prices. Moreover, in years of good rainfall there is no reason why Syria should not, at present population levels, be a net exporter of grain.

The proportion of the population employed in agriculture is down -- from well over half two decades ago to about a third now -- but those figures need elaboration. It is not always clear whether female family workers are included in the totals or to what extent male breadwinners may be supplementing the family treasury with off-farm income. (The same observation holds true also for city dwellers, who may work in a government office in the day and drive a taxi in the evening to make ends meet.)

Official investment in agricultural development remains high. In recent years, agriculture has received on the order of 20% of Syria's government investment budget, as well as significant amounts of credit for individual peasants through the Agricultural Cooperative Bank and other agencies. Food self-sufficiency is a high priority for the 1986-1990 Five Year Plan[4160].

For these economic reasons, agriculture will continue to be an important productive sector in the Syrian economy. These considerations are reinforced by political goals, which under the ruling Baath Party have emphasized the development of the countryside and the organization of the peasants as a political power base. However, as the gap between water supplies and water usage narrows, it is likely that Syria will have to alter its priorities away from the prestige irrigation projects and concentrate instead on increasing productivity and efficiency in the food sectors of rainfed agriculture.

3.3 The Economics of Water

In Syria as in the rest of the Middle East, the development of water resources is an essential ingredient of national development. Like all of its neighbors, Syria charges the construction of water infrastructure to the national investment budget and does not pass on those costs to consumers. Like some of its neighbors, Syria also provides a considerable subsidy on the operational costs of producing water and maintaining systems, and there is considerable disparity in the application of these subsidies across the spectrum of users.

3.3.1 Use of Water by Sector

In Chapter 2, we presented projections of water use in Syria based on predictions regarding population growth and migration, the realization of development plans in agriculture and industry, and the need to improve the quality of life and health for Syria's citizens. Assumptions were made as to the pace at which development would be implemented, and what efficiencies would be possible and demanded by circumstances. In Tables 2.7 through 2.14, these calculations were presented by hydrologic region. We summarize that information here in Table 3.6 by economic sector.

The figures in Table 3.6 are based on projections from the base-line year of 1981/82, for which we have the latest actual census and actual land-use reports for irrigation. Comparing these projections based on actual statistics with the aggregates offered by UNESCWA[4053] for 1986, we see in Table 3.7:

Table 3.6
SYRIAN WATER USE BY ECONOMIC SECTOR PROJECTED TO YEAR 2015
(in Mcm)

	1981/82	1990	1995	2000	2005	2010	2015
Domestic							
Euphrates	175	300	388	446	492	556	655
Orontes	80	128	158	191	215	253	299
Damascus	145	236	291	357	405	462	545
Coastal Plain	46	79	96	116	130	147	173
Yarmuk	18	32	41	49	55	62	69
Aleppo	--	--	--	--	--	--	--
Steppe	31	53	69	84	96	110	127
TOTAL Domestic	495	828	1,043	1,243	1,393	1,590	1,868
Agricultural							
Euphrates	2,800	4,900	8,387	10,476	10,465	10,455	10,445
Orontes	1,191	1,196	1,185	1,175	1,165	1,157	1,143
Damascus	935	935	925	916	907	899	891
Coastal Plain	364	540	538	661	659	657	655
Yarmuk	141	153	153	149	145	144	144
Aleppo	727	777	827	877	925	960	960
Steppe	--	--	--	--	--	--	--
TOTAL Agricultural	6,158	8,501	12,015	14,254	14,266	14,272	14,238
Industrial							
Euphrates	6	6	6	6	6	6	6
Orontes	58	58	58	58	58	58	58
Damascus	75	75	75	75	75	75	75
Coastal Plain	52	52	52	52	52	52	52
Yarmuk	--	--	--	--	--	--	--
Aleppo	80	80	80	80	80	80	80
Steppe	17	17	17	17	17	17	17
TOTAL Industrial	288	288	288	288	288	288	288
TOTAL							
Euphrates	2,981	5,206	8,781	10,928	10,963	11,017	11,106
Orontes	1,329	1,382	1,401	1,424	1,438	1,468	1,500
Damascus	1,155	1,246	1,291	1,348	1,387	1,436	1,511
Coastal Plain	462	671	686	829	841	856	880
Yarmuk	159	185	194	198	200	206	213
Aleppo	807	857	907	957	1,005	1,040	1,040
Steppe	48	70	86	101	113	127	144
TOTAL	6,941	9,617	13,346	15,785	15,947	16,150	16,394

Source: Tables 2.7-2.13, calculations by author.

Table 3.7
Comparison of Water Use Data by Sector
(in Mcm/year)

This Study:	1981/82	1986	1990	UNESCWA: 1986
Domestic	495	661	828	432
Agricultural	6,158	7,329	8,501	6,480
Industrial	288	288	288	288
Total	6,941	8,278	9,617	7,200

Sources: Table 3.6 and UNESCWA[4053].

This comparison is instructive in two ways. First, it shows the paucity of the information available for the UN agency. The figure for industrial use, identical to our own, is derived from a 1980 World Bank[3101] estimate reflecting surveys done in the late 1970s. Apparently the United Nations has no more recent information than we do, and agrees with our own assessment that industrial use has not increased. Second, it demonstrates points of disparity. The UNESCWA aggregate for domestic use in 1986 is less than our calculations based on the actual census for 1981, and the UNESCWA report on irrigation use is only marginally greater than our calculation based on 1981/82 land use and is considerably -- 850 Mcm -- less than our projection for 1986.

The UNESCWA report does not elaborate on the sources of its figures and may be based on some fairly crude estimates which do not, for example, allow for systemic losses. It does, however, point up the direction in which our own calculations may be expected to err. The financial constraints that have postponed Syrian water projects -- both municipal/domestic and agricultural -- will in the main have the impact of reducing water use below the levels predicted. Improvements in efficiency will be held up along with infrastructure for use, but the increment in use per added hectare of irrigation is far greater than the savings to be realized per hectare through conservation technologies. Hence, delays in irrigation projects translate into significant delays in the net growth of water use.

At all events, our calculations predict a 280% increase in domestic use and a 130% increase in irrigation use between 1981 and 2015. Agriculture is by far the dominant water user (89% in 1981/82), and its share of water use will decrease only slightly (87% in 2015) even though its rate of growth is less. Overall growth in water use, if not constrained by diminishing supplies, will be slightly less than 140% in that time period.

3.3.2 Water Costs, Prices, Subsidies

It has been customary in Syria to charge users only for the operating costs of water supplies, not for capital investment in infrastructure development. In rural areas, drinking water is supplied free from public taps or standpipes but house connections are supposed to be metered. The low income level of rural families imposes constraints on house connections. In urban areas, the proportion of residents served by house connections is well above average for countries in the Middle East and North Africa (70% in 1975). In both rural and outlying urban areas, families not serviced by public water systems acquire water for domestic use either from private wells or by purchase from vendors with tanker trucks[1266)(3101)].

While nearly all of the urban connections are metered, many meters are either broken or malfunctioning. It is estimated that in 1980 only about 54% of urban water production was paid for[3101)]. This reduces the revenue substantially. Indeed, the revenues collected from metered water supplies in Syria cover only half the costs of production. The most recent report on production costs and tariffs (World Resources 1987[4653)]) indicates that urban water in Syria costs about $\$0.25/m^3$ to produce and that the average tariff charged is $\$0.13/m^3$.

Syria's water tariff structure is graduated, depending on amount of use and category of user. Part of the fees are collected as connection costs (i.e., purchase of water rights), part of them are collected against measured usage. Urban usage fees were reported in 1980 by the World Bank[3101)] and in 1983 by UNESCWA[xxxx)]. Rates vary according to city.

Table 3.8
Water Prices in Syria

	SL/m^3	US$/$m^3$
Damascus, first 45 m^3 in three months:	0.20	0.05
Damascus, over 45 m^3 in three months:	0.50	0.13
Aleppo:	0.30	0.08
Homs:	0.25	0.06
Vendors (buying):	0.40	0.10
Vendors (selling):	10.00	2.55

[SL 3.925 = US$ 1 at this time period. The official rate as of 1988 was SL 11.20 = US$ 1.]

The last item, purchasing water from vendors, hits hardest the urban poor who live outside the city limits and who can least afford to pay.

The water Syria has been using to date has been relatively low cost. Damascus, for example, has traditionally been served by the Figeh Spring which flows downhill to the networks of the capital. Until recently, when pollution has rendered it undrinkable, Homs and Hama took their water from the Orontes at little cost. Aleppo, until the middle of the present century, drank directly from the Quweik River.

Now, with pollution of surface waters, Syrian cities have come to rely often on groundwater or long-distance pumping. For this production, costs are estimated to range from $\$0.31/m^3$ to $\$3.41/m^3$ [4383]. The costs are at the higher end of the range when production from a borehole is less than 5 liters per second, or when it is pumped from a depth greater than 75 meters. Thus, the fees listed in Table 3.8 do not begin to match actual production costs, not to mention capital development.

Agricultural water is almost wholly subsidized. The *Syria Times* [1280] reported in 1984 that it is normal practice to subsidize peasant families while implementing agricultural development projects. This was elaborated two years later by Meliczek [4569] who stipulated that to date no fees had been collected for irrigation water in Euphrates project areas. In the same year it was reported by the official paper, *al-Baath* [4364], that farmers in the Ghab obtain most of their irrigation water "illegally" from government irrigation canals. Since the Ghab project region has passed far beyond the development stage (it was operational in 1969), the non-enforcement of -- or non-compliance with -- fee collection in that district seems to reflect a general policy pattern.

This is a far different picture from the situation in Syrian agriculture in the 1950s. At that time, pumps to supply surface water for irrigation were privately owned and operated. The World Bank (cited by Manners [3317]) reported then that pump owners could exact from 45% to 60% of a crop simply for supplying the water. Groundwater wells, which account for more than 40% of the irrigated area, are still often privately developed.

Water for light industry is supplied in some areas by the municipal water systems at municipal rates; these tend to be minor users. Heavier industrial consumers usually own and maintain their own wells. While in theory wells and pumps are licensed, monitoring is perfunctory and information on withdrawal and recharge is sketchy.

3.3.3 Investment in Water Development

Since the advent of Baath Party rule in Syria in 1963, nearly all major water development has been done by the government. Before that time, it had been the "cotton sheikhs" of the Jezireh who had installed the pumps, supplied the seed, provided the know-how and transport to market, and transformed their previously independent tribal kinsmen into sharecroppers[4362]. The Baath Party, whose original power base was drawn from the periphery, set agrarian reform as a major priority. This involved land reform, empowering the rural peasant at the expense of the urban merchant, and raising the level of services and quality of life in the countryside. In short, the Baath needed the peasants and so had to provide them with the water they needed for better health and hygiene and to enhance their livelihood.

Although Syria has suffered delay after delay in some of its important water projects (sometimes because of technical difficulties, as in the Euphrates region, but more often because of financial problems), the amount of effort and money that Syria has invested in water development is impressive. World Resources 1987[4653] reports that Syria had by the early 1980s expended $100 per capita in the rural regions and $250 per capita in the cities for drinking water development alone. This would yield a total investment of $1.576 billion.

A more complete -- though still partial -- listing which includes irrigation projects is given in Table 3.9. That table has several lacunae, the most important being the main dams associated with the Ghab project. These were completed before the present regime and were financed by Syrian resources. (Projects planned but not yet contracted have costs in square brackets.) Table 3.9 has been collated from more than twenty sources, often contradictory. Where more than one cost figure is given, we have listed the highest. Further, the dollar and Syrian pound figures may not agree as they have been cited at varying times and using differing exchange rates. The purpose of the table is simply to give a crude order of magnitude for what has been undertaken.

The dollar values (converted at the official SL 3.925 rate that obtained until 1988) are summarized in Table 3.10 and a comparison is made to a similar compendium prepared by UNESCWA in 1986[4674].

Table 3.9
MAJOR WATER DEVELOPMENT PROJECTS IN SYRIA
(partial list)

Date	Location	Project	Purpose	$ mn	SL mn	Funder
Euphrates						
1975	Euphrates	Tabqa Dam	I,E	408	3,800	Sy,USSR
1987	Euphrates	Tabqa exten.	E		60	Sy
1986	Euphrates	Baath Dam	E	197	770	Sy,USSR
199?	Euphrates	Tishreen Dam	I,E	[383]	[2,000]	Sy
1985	Euphrates	Balikh Canal 1	I	64	270	Sy,WB
1988	Euphrates	Balikh Canal 2	I	89	570	Sy
1987	Euphrates	L.Assad Pump St.	I,M		450	Sy
1988	Euphrates	Balikh Pump St.	I,M	24	150	Sy
2000?	Euphrates	Khabur Project	I,M,E	[1,622]		Sy
1988	Euphrates	Khabur Dam	I,M,E	"	1,300	"
1990?	Euphrates	W. Hassakah Dam	I,M,E	"	1,500	"
1990?	Euphrates	E. Hassakah Dam	I,M	"	2,200	"
2000?	Euphrates	Khabur irrigation	I	"	[?]	"
??	Euphrates	Deir ez-Zor net	M	[5]		EC
1986?	Euphrates	Mangmt & purific	M	12.7	48	EC
??	Euphrates	Suweidiya net	M	[3.7]		EC
1972	Euphrates	Bab Hadid dam	M,I		2	Sy
1974	Euphrates	Jawadieh dam	M,I		0.5	Sy
1980	Euphrates	Mashuq dam	M,I		4	Sy
1985	Euphrates	Jarrehi dam	I	72		Sy
1986	Euphrates	Middle Euph Proj	I	170.5		Sy,Japan
1988?	Euphrates	Maskena canals	I	553.5		Sy,Japan
??	Euphrates	Lower Euph Proj	I	[118.4]		Sy,WB
Aleppo						
1978	Aleppo	L.Assad Pipe	M	116	461	Sy
??	Aleppo	Wastewater	M	[70]		WB
"	"	"	M	[112]		Sy
198?	Afrine	April 17 dam	I,E	?	?	Sy

M=Municipal & industrial; I=Irrigation; E=Hydroelectric power.

Sy=Syria; WB=World Bank; AFESD=Arab Fund for Economic and Social Development; SFD=Saudi Fund for Development; EC=European Community; USSR=Soviet Union; USAID=U.S. Agency for International Development.

Date	Location	Project	Purpose	$ mn	SL mn	Funder
Orontes						
--	Orontes	Kattineh Dam	M,I,E	?	?	Sy
--	Orontes	Rastan Dam	I,E	?	?	Sy
--	Orontes	Mehardeh Dam	M,I,E	?	?	Sy
1985	Orontes	Kashieh Dam	I	?	?	Sy
199?	Orontes	Homs wastewater	M	10.5		WB
199?	Orontes	Hama wastewater	M	7.5		AFESD
??	Orontes	Ghab irrigation	I	[53.3]		AFESD
Damascus						
1978	Damascus	City networks	M	260	1,027	Sy
1985	Damascus	Figeh spring	M	15		Sy,USAID
??	Damascus	Wastewater	M	[30]		SFD
199?	Damascus	Control system	M	10.7		AFESD
Coastal Plain						
1985?	Coast	Tishreen 16	I,M,E		?	Sy
??	Coast	Thawra Dam	I,E	[166.6]	[400]	Sy
??	Coast	Thawra canals	I	"	[306]	Sy
198?	Coast	Salah ed-Din dam	I		42	Sy
198?	Coast	Beit er-Rihan dam	I		27.5	Sy
198?	Coast	Huweiz dam	I		16	Sy
198?	Coast	Khalifeh dam	I		15	Sy
??	Coast	Sinn Project	I	?	?	Sy
1985?	Coast	Soreet spring	I	?	?	Sy
1985?	Coast	Salfan Dam	I	?	?	Sy
??	Coast	Akkar Plain	I	?	?	Sy
1984?	Coast	Muzaina Dam	I	?	?	Sy
Steppe						
1978	Suweida	Jabal Arab Dam	M		10	Sy
1978	Suweida	Sahut Bilat Dam	M		3.5	Sy
1980	Suweida	Jubran Dam	M		5	Sy
1980	Suweida	Mushnaf Dam	M		5	Sy
1984	Suweida	Teir Dam	M		1	Sy
1984	Suweida	Rum Dam	M		7	Sy
1984	Suweida	Khazema Dam	M		1	Sy
??	Suweida	Zif Dam	M,I	?	?	Sy

M=Municipal & industrial; I=Irrigation; E=Hydroelectric power.

Sy=Syria; WB=World Bank; AFESD=Arab Fund for Economic and Social Development; SFD=Saudi Fund for Development; EC=European Community; USSR=Soviet Union; USAID=U.S. Agency for International Development.

Date	Location	Project	Purpose	$ mn	SL mn	Funder
Yarmuk						
1982	Deraa	Sh. Meskin Dam	M,I	6	14	Sy
1982	Deraa	Sh. Meskin canals	I	"	12	Sy
1982	Deraa	Tafas Dam	M,I		4.5	Sy
1982	Deraa	Tafas canals	I		5	Sy
1984	Deraa	E.Deraa Dam	M,I		5	Sy
1984	Deraa	Ayun Ahd Dam	M,I		6	Sy
1985	Deraa	Deraa Dam	M,I		22	Sy
198?	Deraa	Adwan Dam	M		10	Sy
198?	Deraa	Tseel Dam	M	4.6	7	Sy
1988?	Deraa	Abdin Dam	I		22	Sy
1986	Quneitra	Ghadir Bustan Dam	M		12	Sy

References: 0406,0744,I267,1298,2195,2232,2252,2348,2434,3101,4131, 4162,4165,4175,4214,4285,4484,4485,4486,4541,4674.

M=Municipal & industrial; I=Irrigation; E=Hydroelectric power.

Sy=Syria; WB=World Bank; AFESD=Arab Fund for Economic and Social Development; SFD=Saudi Fund for Development; EC=European Community; USSR=Soviet Union; USAID=U.S. Agency for International Development.

Table 3.10
FUNDERS FOR MAJOR WATER PROJECTS IN SYRIA
(in US$ million)

	UNESCWA[4674]		Other Sources	
Syrian government	3,529.7		2,858.7	
External, of which:	215.7		899	
World Bank		111.7		173
AFESD		30		70
Japan		65		
USAID		9		
SFD				30
EC				21
USSR				605
	3,745.4		3,757.7	

References: 0406,0744,1267,1298,2195,2232,2252,2348,2434,3101,4131, 4162,4165,4175,4214,4285,4484,4485,4486,4541,4674.

Both of the above, UNESCWA and the list detailed from a variety of mainly journalistic reports, are incomplete. What they do show, however, is an investment in excess of $3.7 billion dollars. This is close to the current $4 billion total of Syria's external debt and gives some measure of the importance that has been allotted to water development. The consideration is also incomplete in that each municipality and province has also undertaken water projects. In 1985, reports from five out of the country's fourteen provinces totaled an allocation of more than 2 billion Syrian pounds for local water projects. This is a deceptive figure, however, since many projects are carried over from year to year. In one recent year, Latakia province reported that only a quarter of the previous year's allocation for water projects had actually been used[2346].

Such private financing of water development as still occurs is mainly in the agricultural sector. The most important provider of credit to the agricultural sector is the Agricultural Cooperative Bank, founded in 1884 and the oldest lending institution in Syria[4392]. It operates some 59 branches throughout the country, with representation in every province and many of the districts and subdistricts. In 1986, it provided some SL 1,700 to its clients in four categories of loans: short-term cash (less than one year term); short-term in-kind (agricultural inputs at term less than one year); medium term (one to five years, usually for machinery or livestock); and long-term (five to ten years for land

improvement, irrigation, orchard development, selected building construction). The growth of agricultural credit is summarized in Table 3.11.

Table 3.11
Growth of Agricultural Credit by Sector
(in million SL)

Year	Public	Cooperative	Private	Total
1970	4.5	40.5	117.0	162.0
1975	5.7	83.1	170.2	259.0
1978	10.8	149.1	177.8	337.7
1979	14	175	238	427
1980	17	188	242	446
1981	31	260	294	585
1982	28	309	355	703
1983	31	407	438	876

Sources: Hopkin[4392], El-Akhrass[4437].

Other sources of agricultural credit include:

- o Commercial Bank and Industrial Bank (directly or through agribusinesses, mainly to finance export of crops);
- o General Machinery Company (about 75% of all private tractor purchases financed by GMC);
- o merchants (either a forward contract for sale of crop, or an advance on operating expenses with crop to be purchased at harvest time);
- o food processing plants (advance money for raw products they need);
- o Tobacco Monopoly (interest-free loans in-kind and cash for inputs and development);
- o outside grants and loans for development projects;
- o self-financing (retained earnings and off-farm income).

Credit for infrastructure development is only an insignificant segment of the loans granted by the Agricultural Cooperative Bank (less than 2% per year[4392]) and other sources of agricultural credit. Most of the loans are for the purpose of providing seasonal inputs for production. It seems safe to assume, therefore, that nearly all important water development in Syria is done by the government -- either central or local.

The most recent variation on infrastructural development in Syria is the expansion of the category of mixed public-private sector investment to include agriculture and industry. This mixed category had previously included only the tourism industry. The Prime Minister announced the terms of the new investment category in 1986[4210]. The first mixed agricultural company was founded later that year; businessman Saeb Nahas was elected chairman of Ghadaq (Arab Syrian Company for Development of Agricultural Products) in 1987[4486]. In an economy long characterized by large state enterprises, with private enterprise relegated to very small artisanships and commerce, this opening could be a tentative first step toward the development of a private domestic capital market.

3.3.4 Electrification

Investment in water infrastructure in Syria is complicated by the fact that electrification is also a high priority for the Syrian government. The sparkling nightlights of the Euphrates Valley in the seventies, in stark contrast to nighttime darkness of the sixties, bear visible testimony to the efforts that have been expended. Electricity along with water is an important ingredient in improving the standard of living in the countryside. The Syrian regime has set 1990 as its target date when all 5,400 villages with population more than 100 will have electric power[4363].

To this end, Syria has sited many of its water projects at locations where dams can serve also the purpose of producing hydroelectric power. In Table 3.8 above, ten of the major projects comprising 75% of the dollar amounts invested are for multi-purpose installations that provide electricity as well as storing water. Six of the dams of the Euphrates basin include a hydroelectric generating component which will serve local users and provide power to the national grid. The main Euphrates Dam at Tabqa at one time produced up to 87% of Syria's electricity. That proportion was reduced to slightly over three-fifths by the early eighties because of rapidly increasing usage and added generating capacity elsewhere, even though production at the dam stood at an all-time high of 2.6 million kwh[2786]. Later in the decade production was reduced, as five out of the dam's eight turbines were shut down due to the low water level in the river[0744]. The subsequent power shortages and daily blackouts in Syria's major cities were an occasion of lively debate in Syria's People's Assembly; two cabinet ministers resigned in an atmosphere of harsh criticism[yyyy].

In addition to developing its hydroelectric potential, Syria has been investing in thermal generating capacity throughout the country -- some oil fired[4486], some gas fired[4364], and some to burn the coke residue from the Homs refineries[4484]. A related development is the bidding for a gas gathering and distribution network in

the Homs-Palmyra area[4485], as well as the utilization of associated gas in the Thayyem oil fields[4541]. Projects under construction or on the drawing board would nearly double Syria's electric power capacity by 1992 -- adding 1,948 MW to its 1986 installed capacity of 2,334 MW[4363] -- in the unlikely circumstance that all projects were completed on time. Looking to the more distant future, the Syrian government is reported to be studying the feasibilities of nuclear and solar power with technical help from the Soviet Union.

The interrelated priorities -- water and electricity -- make it very difficult in Syria to separate purely water sector investment from purely electric sector investments. Both are important, both serve the overriding political goal of improving the quality of life in the countryside, and both occupy the same line in the national investment budget. Both are also essential ingredients in the economic development of the country at large.

3.3.5 Water Research and Technology

Water-related research in Syria is conducted mainly by the government, with important supplements from the Arab League's ACSAD (Arab Center for the Study of Arid Zones and Dry Lands) in Damascus and from the World Bank-affiliated ICARDA (International Center for Agricultural Research in Dry Areas) in Aleppo. Modest amounts of research are done by the faculties of Damascus and Aleppo universities.

Since agriculture is the most important consumer of water, agricultural research is intrinsically connected with water studies. The Scientific Agricultural Research Directorate of the Ministry of Agriculture and Agrarian Reform conducts most of the work that is done in Syria. In 1983, SARD received almost half (SL 8.4 million) of the SL 17.4 million allocated to agricultural research. Its responsibilities include research on food crop varieties, vegetables and fruits, plant protection, food processing, and animal protection. It supplies information on new developments to farmers and, through the ministry's extension service, provides answers to problems that arise during the producing season. Agricultural land and water use are the responsibility of the ministry's Soil Directorate, which in 1983 received an allocation of SL 4.6 million[4437].

Other contributors to agricultural research include the Cotton Bureau and the Directorate of Steppe, Rangeland and Sheep (both under the Ministry of Agriculture and Agrarian Reform). Non-MAAR directorates that contribute include the General Administration for the Development of the Euphrates Basin (GADEB), the General Organization for Sugar, and the General Organization

for Tobacco[4437]. The Ministry of Defense has been active in some projects, especially in the area of drilling[4207] and meteorological services[zzzz].

The area of contribution of these agencies has been varied. SARD and ICARDA have been jointly involved in developing and testing new plant strains suited to arid zones, and in educating farmers to use the new seeds, with financial help from the World Bank, IFAD, FAO, and the Government of Canada[4363][4437]. GADEB and ACSAD have provided research on the gypsiferous soils of the Euphrates region[4328] and on the applicability of sprinkler irrigation techniques[4129] in Syria. ACSAD, with assistance from the Soviet Union, has undertaken surveys for deep fossile groundwater in the Syrian steppes[2255][4573]. This is a continuation of the groundwater and geological studies that ACSAD itself has carried on for some years[4274]. The Ministry of Agriculture and the Ministry of Defense have independently drilled for water, sometimes highly mineralized, that can be used to grow fodder shrubs to pasture flocks of sheep in the semi-desert regions[4207]. This is in addition to the ongoing work of the agricultural extension services.

In research as in other areas of economic development, progress in Syria is constrained by the shortage of qualified manpower[2254]. While Syria's scientists are well trained and have conducted an impressive quantity of excellent scientific research, there are not enough of them to perform all the tasks that need doing. This shortage is felt keenly at the intermediate levels, where more graduate agronomists ("agricultural engineers" in Syrian parlance) are needed to staff the extension services and provide direct training and advice to the farmers[4437]. One journalist complained recently that the expertise existed (in the Ghab region), but that the number of experts was inadequate and, further, they lacked even motorcycles as transport to take their knowledge to the farmers who needed it[4364].

3.3.6 Marginal Cost of Water

Since, as a matter of consistent policy, Syria does not intend to amortize the cost of water infrastructure development through users fees or any other direct assessment, the question of marginal cost of water is highly theoretical. The costs and benefits of water development are, of course, very real items in the national economy of the country, but they are not standard categories in Syrian government reports.

To get some idea of what water production and development actually costs Syria in comparison to the fees that are collected, let us consider the following data for 1986:

Estimated population:	10.484×10^6
Municipal/Industrial consumption including systemic loss:	915×10^6 m^3/yr
Total consumption:	$8,278 \times 10^6$ m^3/yr
Water investment to date:	$\$3,757.7 \times 10^6$
Lost opportunity cost on capital invested at 5%/yr:	$\$187.9 \times 10^6$/yr
Average cost of production:	$\$0.25/m^3$
Average fee on M&I:	$\$0.13/m^3$

From these data we can derive the following:

1) Total cost of production is $2,069.5 million per year, or $197.40 per capita per year.

2) Total investment, if amortized over twenty years, would require an installment of $187.89 million for this year or $17.92 per capita per year.

3) Lost opportunity cost on the capital at 5% would be $187.9 million for this year, or $17.92 per capita per year.

4) Total cost for each Syrian citizen for water production and investment would be $233.24 per capita per year.

5) Fees paid for domestic and industrial use only would be $118.95 million or $11.35 per capita per year.

Therefore, the Syrian economy is subsidizing the water use of each citizen to the tune of $221.89 per year.

It should be understood, of course, that the major portion of this subsidy does not go to individual citizens but rather to agriculture, which provides employment to a third of Syria's workers and, in good years, supplies most of its food needs and cash crops for export. Few countries in the modern world actually charge their farmers the full cost of building water facilities, maintaining and operating them, and producing and supplying water for irrigation. Such a policy would price the farmers' produce out of the market, both regionally (since all Syria's neighbors subsidize water development) and globally. Such a calculation is useful, however, in evaluating the productive potential of the various economic activities available to the country. Social and security considerations, as well as tradition, will impel most countries to engage in agriculture, but the weight to be given to it should be determined after examination of the actual costs.

Chapter 4

THE ADMINISTRATION AND DEVELOPMENT OF WATER IN SYRIA

The administration of water in Syria is best characterized as fragmented. Historically, different aspects of water regulation and development have been the responsibility of many different ministries and agencies. This situation has changed over time, with agencies created, separated out, converted into ministries, and then re-merged into other configurations. In identifying the locus of authority for a water project in Syria, it is always necessary to ask what dates are involved; the answer changes from decade to decade and even from year to year. Like its neighbors, Syria has found some difficulty in devising a rational form of administration for its most vital natural resource.

The trend in the 1980s has been toward consolidation. The Ministries of the Euphrates Dam and of Public Works and Water Resources were first placed under one minister and then, in 1982, formally merged into the new Ministry of Irrigation. This ministry has, among other things, total responsibility for water resources development and the hydrological survey. The ministry also incorporated into its Directorate of Land Reclamation the once-ubiquitous Major Projects Administration. In the same time period, the Ministry of Housing and Public Utilities has in 1984 been made responsible for all drinking water and sewerage systems nationwide. Separate water administrations were established for each of the country's fourteen provinces under the aegis of the Ministry of Housing and Public Utilities, and all pre-existing organizations dealing with domestic water and sewerage were gathered under its roof.

While these are steps toward simplification and rationalization, the system is still rife with duplicated effort. Land reclamation, for example, is both a directorate under the Ministry of Irrigation and a general organization under the Ministry of Agriculture. The Euphrates Dam and development of the Euphrates Basin are responsibilities shared between those two ministries, and a Supreme Authority for the Euphrates Project, chaired by the Prime Minister, stands ready to step in at need. These complexities reflect the cross-cutting realities of water as an issue that touches many aspects of the body politic and is essential to life itself. But such complexities also make life more difficult for the average citizen, upon whose voluntary compliance with regulation is based the whole concept of the rule of law in a civilized society.

Nor is departmental duplication the only source of complexity. One of the political consequences of twenty-six years of Baath rule in Syria has been the enfranchisement -- and at least partial

empowerment -- of a much larger segment of its citizenry than heretofore, especially in the countryside. The result has been a proliferation of mass organizations and local councils at province, district, and city level, as well as the penetration of Party structures into nearly every village. All of these represent voices to be heard and opinions to be solicited in decisionmaking. Projects and priorities often originate at the local level, proceed to the center for final decision and authorization, and then back to the local office for implementation. This multiplicity of levels, councils and commissions does, at least in theory, insure that the needs of local citizens will be heard, but it adds several layers to the bureaucratic process.

Moreover, both the Party and affiliated mass organizations maintain their own wide-ranging bureaucracies. Their representatives sit as official members on local committees. These are not only constituencies to be placated; they are also political actors, links in alternative chains of two-way communications between the center and the periphery who have their own central offices to lobby for policy decisions in the capital. These structures can enhance the influence of a local community seeking solutions to its problems -- if they cooperate together. The converse is also true.

Finally, much of the expertise for planning and implementing water projects resides in a conglomeration of mixed-sector companies. These companies are authorized under public law and regulated by a government council on which they are represented. But they act in essence as private companies according to the rules of private enterprise, thereby avoiding much red tape. Their salaries and work rules enable them to attract the best talent. The efficiency and quality of the work done by these companies is attested by the fact that they have, in competition with foreign firms, successfully undertaken some two-thirds of Syria's water projects.

4.1 General Structure of Government Water Administration

A "short list" of the governmental bodies involved in water development and management in Syria during the past two decades reveals a bewildering array of departments, directorates, administrations, and general administrations. A score of entities are scattered among nine ministries and four supreme councils or authorities, and this is only the beginning. It does not, for example, count the local -- city or province level -- administrations that were independently incorporated, nor the public-private companies that were vested with responsibility for implementing projects.

Throughout the 1980s, a major reorganization has been taking place. The number of ministries with primary responsibility for water has been reduced to two: the new Ministry of Irrigation, and a much expanded set of directorates under the Ministry of Housing and Public Utilities. Major functions have been switched to these two ministries, although certain functions requiring technical skills are still farmed out -- e.g., water testing to the laboratories of the Ministry of Health, and meteorological forecasting to the Ministry of Defense. Some residual overlap remains in the area of land reclamation, which continues to be a partial responsibility of the Ministry of Agriculture.

The structure of water planning and management as currently envisioned in Syria is shown in Fig. 4.1. The policymaking councils and authorities are shown on the left, the implementing ministries on the right. It is, of course, an interactive process, with the Planning Council and Planning Authority occupying a central and dominant position in Syria's centrally planned society. The nature and functions of these entities will be discussed below, along with the contributions of the legislative and judicial branches of government and of popular and political structures outside the official circle. Since the Executive Branch is obviously the most involved in planning and implementing technical work such as water development projects, it is appropriate to examine the executive departments first.

A word is in order, however, about nomenclature. The alphabet soup of Syrian agencies is made more difficult by inconsistent translation -- by Syrians and foreigners alike. The use of French as an intermediate linguistic stage between Arabic and English further complicates the picture. Moreover, Syrian government documents may themselves sometimes err -- even in Arabic -- by using an old name for an organization several years after the name has been changed. The outcome is a confusing melange of names in which the same organization may masquerade under several variant translations. The safest procedure in identifying institutions is to refer back to the original Arabic form of the title. In terms of executive departments involved in water works, there are four key types of organizations reflecting differing levels of independence and responsibility. Their nomenclature is as follows:

Wizarah = Ministry. [This is quite clear; it is consistently translated and never confused.]

Mu'assasah Amah = General Establishment; also, general organization, administration, foundation, institute, institution .... [Any and all of these have been used in translation.]

Mu'assasah = Establishment; also, organization, etc. [This organization has less authority or autonomy than a General Establishment.]

Mudiriyah = Directorate. [Sometimes mistakenly called a department, which is a different word in Arabic. This is a major division within a Ministry; it is never autonomous.]

The *Mu'assasah Amah* and *Mu'assasah* are the most often confused through inconsistent translation. Their actual status is also indefinite within Syrian bureaucracy. While either may be attached to a ministry, they can also stand alone as independent or quasi-independent agencies incorporated as "public establishments" with their own administrative councils and boards of directors under Decree 18 of 1974.

For reasons that are not clear, except perhaps historical accident, the ministries of Irrigation and Housing and Public Utilities contain both directorates (*Mudiriyat*) and establishments (*Mu'assasat* and *Mu'assasat Amah*) among their water-related portfolios.

4.1.1 The Ministry of Irrigation

Until 1982 there had been a Ministry of the Euphrates Dam and a Ministry of Public Works and Water Resources. According to Law 16 of 1982, a Ministry of Irrigation was formed encompassing the water-related responsibilities and divisions of both ministries. The new Minister of Irrigation was Abdul-Rahman al-Madani, an engineer who had been Minister of the Euphrates Dam since 1980. The most important divisions taken over from the old Public Works ministry included the Major Projects Administration (*Mu'assasat Amah*), the Directorate of Irrigation and Water Power, and the Directorate for Treatment of Polluted Water(xxx3). [Kuwaiti conference, 1986]

The main responsibilities of the Ministry of Irrigation are the following(xxx1): [irrigation dept pamphlet]

- o To prepare studies related to water resources, both surface water and groundwater.
- o To gather and maintain data on the measurement of water levels and other indicators (Hydrological Survey).
- o To develop plans for irrigation projects and land reclamation.
- o To develop plans to protect water resources from pollution.
- o To regulate ways and means of making the best use of water resources.
- o To supervise the construction of irrigation systems and dams.
- o To recommend needed projects and introduce legislation to facilitate the execution of water projects.
- o To oversee the electrical complexes on the Euphrates River.

- o To oversee pumping stations.
- o To suggest economic, agricultural, and social plans for irrigation projects.
- o To assist in the training of technical cadres.

The authority of the Ministry of Irrigation was expanded in 1984 through the cession to the minister of the power of eminent domain. Law 3 of 1984 empowers the Minister of Irrigation to confiscate land for dams and irrigation projects. The minister is to coordinate this activity with the Minister of Agriculture and with the head of the General Union of Peasants. An oversight and administrative appeal committee is provided for the process, comprising the Prime Minister, the Deputy Prime Minister for Economic Affairs, and the Deputy Prime Minister for Services. [source?]

The structure of the Ministry of Irrigation, as it has developed over the past half decade, is shown in Fig. 4.2. The seven major divisions are as follows(xxxi):

1. The General Establishment for the Euphrates Dam.
2. The Directorate of Irrigation and Hydropower.
3. The General Directorate for Treatment of Polluted Waters.
4. The Directorate for Water Basins.
5. The Directorate for Dams.
6. The Directorate of Planning.
7. The Directorate of Land Reclamation.

In addition, a mixed-sector company has been established to work closely with the Ministry of Irrigation in producing the necessary knowledge base for water analysis and development. According to Law 16 of 1983, the General Company for Water Studies was created for the purpose of conducting surveys, studies, and plans relating to irrigation projects, land reclamation, groundwater, dams, and accompanying facilities for agricultural and social development. Although it is organized as a public-private sector company (*shirkah*) and is part of the Supreme Council for Construction Companies, this firm reports directly to the Ministry of Irrigation and is one of that ministry's prime instruments for executing its study mandate.

One of the major accomplishments of the Ministry of Irrigation has been the reorganization of Syria's water sector according to physical hydrological basins rather than administrative districts. Law 17 of 1986 defines the basins as Damascus, Aleppo, Coastal Plain, Euphrates, Orontes, Yarmuk, and Steppe. These natural divisions facilitate the analysis of water resources. These are the same divisions that were independently adopted for the present study as the most logical framework for analysis; this author can attest (see Chapter 2) that the process is infinitely more difficult when basin statistics must be disaggregated from reports collated according to administrative districts.

A separate department for each of the basins has been established within the Directorate for Water Basins of the Ministry of Irrigation. [sources?] Journalistic transcripts of scientific studies by basin are already beginning to appear in the Syrian press. An excellent 1987 report in *al-Thawrah*, the official organ of the General Union of Peasants, cites detailed basin statistics on the Orontes and Coastal Plain, forecasts imminent scarcities in the Orontes basin but long-term surplus for the Coastal Plain, and recommends planning for water transfer from the Coast to the Orontes basin after the year 2000(xxx2). [al-Thawrah, 9/11/87] This is precisely the kind of forward thinking that is needed. Such planning is facilitated when analysis follows the natural geographic divisions of the land.

One difficulty can be foreseen. The other ministries (most particularly the Ministry of Housing and Public Utilities) and the Central Bureau of Statistics retain their practice of collecting statistics by province. In order to maintain a longitudinal profile of Syrian development, it is of course necessary that this practice continue. Moreover, many categories of statistical reporting make the most sense when examined according to administrative divisions. However, to facilitate the analysis of water data, it would be useful if the relevant ministries would report *both* according to province *and* according to water basin for all water-related phenomena (including demographics, agricultural statistics, and industrial growth, as well as basic meteorological and hydrological indicators). Forthcoming *Statistical Abstracts of Syria* should include a special section with the most important data relevant to water aggregated according to hydrological basin.

4.1.2 The Ministry of Housing and Public Utilities

Although much of water administration and research has now been consolidated into the Ministry of Irrigation, one significant portion of water use and study remains outside its domain: namely, domestic water and sanitation, by which should be understood any water use supplied by a municipal system including certain light industry. These are the responsibility of the Ministry of Housing and Public Utilities, but here too some consolidation has taken place. This ministry now has prime responsibility for the design and construction of the countrywide water supply and sewerage facilities, including Damascus, Aleppo, Homs, Hamah, and other cities which have had their own administrations(4712).

Law Number 14 of 1984 stipulated the establishment of fourteen public establishments for drinking water and sanitation covering all the governorates and made them part of the Ministry of Housing and Public Utilities. This is the only authorized agency to plan, execute, and coordinate projects for the provision of drinking

water and sanitation and was, according to the law, to replace or take over responsilities from any authorities dealing with this field throughout the country.

The responsibilities of the fourteen public establishments were defined as follows: [source?]

- o To prepare, coordinate, and execute plans in the governorate relating to drinking water and sanitation within the overall government policy, while taking into consideration the economic and financial indicators, and then to recommend these plans to the authorized ministry.

- o To study, plan, and execute drinking water and sanitation projects in each governorate.

- o To administer, maintain, and supervise drinking water and sanitation installations in each governorate.

The work of these fourteen provincial offices is coordinated by the General Organization for Water Supply, one of the three water-related directorates of the Ministry of Housing and Public Utilities. They operate under the supervision of the MHPU, but work closely with the local authorities, especially the local Water Establishments(2139), on the operation and maintainance of facilities.[ESCWA] At the beginning of the decade, there were such public establishments for water (*mu'assasah*) in eight cities, two of them (Damascus and Aleppo) independent, the remainder depending on the Ministry of Housing and Public Utilities for planning and studies(3101). The formerly independent city organizations have been brought under the authority of the ministry, and the number of cities with their own water departments has expanded to twelve.

A recent crisis in Hama resulting from a flash flood on the upper Orontes demonstrates this coordination at the local level. An unseasonal cloudburst on June 16, 1987, overran the filtration reservoirs upstream on the river, and the city's water was cut off for three days because of impurity. The Hama Water Authority (subsidiary to MHPU) took charge, along with the Governor and City Council. They commandeered tanker trucks from other government departments and local industries, set up deliveries of drinking water to the populace, maintained a rigorous schedule of water testing, and cleaned up the mess, all within three days and without calling for outside help. Interestingly, the coordination was effective but not perfect. The local representative of the Orontes Basin Office of the Ministry of Irrigation complained that he had wanted to help, had offered to help, and was capable of helping, but was not included. [al-Thawrah, 07/12/87]

Three implications can be drawn from this incident, two positive and one negative. The Hama Water Authority operated efficiently to restore safe water service expeditiously and local government coordinated effectively to mobilize the community. But,

on the negative side, the Hama Water Authority (MHPU) did not coordinate with the office of the Ministry of Irrigation, which should have had a stake in the affair. This oversight might merely represent a local personality conflict, but it may reflect a more general state of non-cooperation between the two ministries. The latter would be extremely detrimental.

The Ministry of Housing and Public Utilities now has three major water-related divisions (see Fig. 4.3). These are the Directorate for Drinking Water and Sanitation, the General Establishments for Water Supply with branches in all fourteen provinces, and the General Establishment for Drinking Water which encompasses the twelve cities that have their own local water administrations(xxxl). [??source??] The technical services departments of local governments have also been transferred to the ministry(2445).

[Accomplishment: insert re new uniform pricing structures]

The Minister of Housing and Public Utilities is Muhammad Nur Intabi. He has been Minister since late 1987, when he replaced Adnan Quli, who moved on to become Minister of Tourism.

4.1.3 The Ministry of Agriculture

The programs of the Ministry of Agricultural and Agrarian Reform (MAAR) are Syria's most significant consumer of water, yet the role of that ministry in water planning and project execution has been steadily truncated throughout the years. Today, MAAR's General Organization for Land Development (*Mu'assasah Amah*) is the one directorate of that ministry that continues to be influential in water development decisions. This organization (also translated as the General Administration for Land Reclamation) is the successor to the General Administration for the Development of the Euphrates Basin (GADEB), which oversaw many of the pioneering schemes in the middle Euphrates and its tributaries. Its preferred method of implementation was the State Farm (i.e., collective farm). This mode has proven unpopular with farmers, who prefer the greater individual choice allowed by the growing service cooperative sector, which may in part explain the declining influence of MAAR in water decisionmaking.

Because of its responsibilities for central agricultural planning and marketing, as well as technical extension services, the Ministry of Agriculture maintains offices and its own field staff in each governorate and in some districts and sub-districts. This field organization reproduces at the governorate level the departments and sectors of the central ministry. While the Directors of Agriculture are appointed by the Minister of Agriculture, as are all college graduates working at this and at subordinate levels,

the tie in to the local government is through the Governor, the Baath Party representative for agriculture in the governorate, the chief of the Peasants' Union in the governorate, and the Governorate Agricultural Council. The Peasants' Union has since 1974 had primary oversight over agricultural cooperatives.

For technical backstopping and activities related primarily to the Ministry, the Directors of Agriculture report directly to the Ministry of Agriculture or his delegated representative. But these Directors are also under the direction of the Governors. The Governors have paramount authority as Presidential appointees and are the most influential officers in the governorates. They also serve as the chairmen of the governorate agricultural councils(4631). However, the local Director of Agriculture is himself represented on other local committees and councils such as planning, supply and marketing, and water authority advisory boards.

Subordinate offices of the Ministry of Agriculture at the district and sub-district levels are directly connected to the villages and farms. For example, it is at district and sub-district levels that licenses for agricultural production are issued to farmers. These licenses implement the program targets of the agricultural plan and entitle the farmer to obtain loans and in-kind inputs from the Agricultural Cooperative Bank. Councils similar to, but less structured than, the governorate Agricultural Councils are prescribed for the district, sub-district, and village levels to permit communications on agricultural matters to flow through official channels from the bottom to the top and vice versa(4631).

Governorate Agricultural Councils were created by law to serve the needs of planning and follow-up relating to the Central Government's Supreme Agricultural Council at the local level. Each is chaired by the incumbent Governor and its membership includes the Chief of the governorate Peasant Union, the governorate's Director of Agriculture, the Branch Director of the Agricultural Cooperative Bank, a representative of the governorate's Executive Office,, and the Baath Party's governorate representative responsible for peasant affairs. These GACs develop local plans, make recommendations, and forward recommendations to the central level. They also monitor and coordinate implementation of projects in these respective areas, and monitor each year's agricultural plan.

The Minister of Agriculture since 1987 has been Muhammad Ghabbash, a Party loyalist with prior cabinet experience (Minister of Supply and Internal Trade, 1980-1985; Minister of the Interior, 1985-1987). He replaced Mahmud al-Kurdi, who resigned in summer 1987 under parliamentary censure. Ghabbash is a member of the Baath Party Central Committee and the Baath Party Peasant Bureau. By 1985 he had emerged as a powerful member of the younger generation of Baathists. This, plus his experience in supply and trade,

tags him as a clean-up man to rectify the alleged mistakes of his predecessor in this all-important economic and water-consuming sector in Syria.

4.1.4 Other Ministries

Although water management has now largely been centralized into two key ministries, there are still a few residual functions elsewhere. Moreover, there are some related ministries whose responsibilities impinge closely on the water sector.

Perhaps the most important of these is the Ministry of Electricity. Syria is making extensive use of its potential for hydroelectric power. Its energy producing dams, which are the primary responsibility of the Ministry of Irrigation, provide an essential intersection of interests between Irrigation and Electricity. With countrywide electrification a high priority for both the government and the Party, officials at the Ministry of Electricity have a major stake in obtaining the maximum electrical production from every dam project. Electrical outages have been prevalent -- and controversial -- up to the mid 1980s. The Minister of Electricity since 1983 has been Kamil al-Baba.

The Ministry of Health provides for water quality testing through its nationwide network of laboratories under the Department of Preventive Medicine. The Ministry of Health maintains offices in each of the governorates. Dr. Iyad Shatti is the minister since 1987, replacing Ghasub al-Rifai who had been health minister from 1980 to 1987.

The assignment of the Meteorological Survey to the Ministry of Defense is historical. The level of technological competence required for the work is high and the military training systems have often provided the point of entry for new technologies into Syrian society. Its continued assignment to that department is probably related to the security considerations involved in the use of remote sensing data, as well as to inertia.

More peripherally involved are the ministries of Supply and Internal Trade, Economics and External Trade, Labor and Social Affairs, and Foreign Affairs. Of particular importance are the Central Pricing Committee and Supply Control Agency of the Ministry of Supply (these institutions control provision of some agricultural inputs as well as the pricing and distribution of agricultural products); the Rural Development Program and Centers of the Ministry of Labor and Social Affairs; and the export of agricultural products through the Ministry of External Trade. These departments figure as manipulators of the conditions surrounding water consumption rather than as direct contributors to water decisionmaking.

4.2 Local Government

It is apparent from the reports of projects undertaken, as well as from the structure of the government, that a significant amount of water policymaking originates at the local level. Both governmental and non-governmental institutions are involved in this process.

Each governorate has its own elected People's Assembly. The number of members on the council -- ranging from 30 to 100 -- is determined by the Minister of Local Government in proportion to the province's population, and confirmed by presidential decree(xxx5). [Tishrin, 19&22 Jan 87] The Governer of the province, a presidential appointee, presides over the People's Assembly of the Governorate.

The governorate Assemblies are meant to be policy determining and deliberative bodies. Members serve on a part-time basis during their four year elective terms. At least sixty percent of the membership of the Assemblies must represent the peasants, laborers, craftsmen, and people from the lower income levels. The assemblies formulate local plans and endorse, after deliberation, plans from a higher level; they adopt local rules and regulations for the administration of utilities and government projects; they assume organization authority not specifically reserved to the Central Government; and they generally monitor government programs, the expenditure of funds and generation of revenues(4631).

The local Assemblies hold hearings and sponsor committees and subcommittees on subjects of interest to the local communities, to which individual citizens can bring their problems. News reports frequently cite by name speakers at such meetings with no designation other than "worker" or "farmer" -- i.e., individuals having no official, organizational, or Party connection, who would customarily be identified by title or by the epithet "comrade". These speakers freely elaborate the difficulties they have encountered with various government services or economic systems and criticize the performance of agencies of the government, sometimes even lodging complaints against specific officials. Apparently these Assemblies do provide the average Syrian with a means to petition for redress of grievance.

4.2.1 The Executive Administration

The executive administration of the governorate is composed of the Governor, the Executive Office, and representatives of relevant ministries and ministerial committees.

The Governor is appointed by the President to serve at the pleasure of the President. He is Chairman of the Governorate Popular Assembly (or Council) and Chief of the Executive Office. Although the governor is often regarded as a figurehead -- it is common practice to appoint governors to areas far from their own homes -- on occasion a governor has become the locus of real power. One governor of Raqqa was a Party member with close links to the President. He used his role as governor to create relations with all the important groups in the region. He became a locus of regional power. He strengthened the position of the Party, but also made himself a by-pass to the local Party committee. Though an outsider, he made alliances with local leaders and through them was able to reach a great number of regional inhabitants and vice versa(4704). (He is now Minister of Information.)

Each governorate has its own Executive Office, headed by the Governor, charged with the day-to-day supervision of governmental activities within the province. Executive Office members, numbering from seven to eleven, are elected by the governorate People's Assemblies (Councils) from among its members for up to two-thirds of the total. The remaining one-third are appointed by the Minister of Local Administration. The tenure for Executive Office membership is two years. The Executive Office distributes the administrative responsibilities among its members, which are ratified by a decree from the President.

Duties of the governorate Executive Office include the supervision of the offices of the central government's representatives, e.g., the Directorates of Agriculture, Public Utilities, Health, etc.; preparation of annual economic and social development plans; contracting local works projects, etc. Since 1984, a Water Establishment has been attached to the Executive Office of each of the fourteen governorates, answering to the Ministry of Housing and Public Utilities. However, project suggestions originating at this level require endorsement by the central Planning Authority(xxx7).

The Executive Office of the governorate provides guidance to the lower level executive offices in the districts (*mintaqah*) and sub-districts (*nahiyah*). These are not corporate or legal entities, but are administrative subdivisions of the governorate. The districts and sub-districts provide services such as doctors and teachers on an area basis where they would not otherwise be available. They each have a District Administrative Committee and a Chief of District. The Chief administers district activities such as security, welfare, health, and law enforcement(4631).

4.2.2 Towns and Villages

Every town which qualifies as a municipality under the Local Administration Act of 1971 -- the list of qualifying municipalities is defined by the Minister and promulgated by presidential decree -- has its own elected People's Assembly and executive office. Of the 68 qualifying municipalities in 1987[xxx5], twelve towns had their own municipal water establishments responsible to the Ministry of Housing and Public Utilities. (This include Damascus City, which is both a governorate and a municipality.)

Every Syrian village and town section has an appointed Headman, *Mukhtar*, who is authorized to stamp and sign papers verifying a person's identity. The headman has no executive power, but is more like a respected witness or notary public. Every few villages form a unit with a police station, *makhfar*, which is responsible for maintaining order. The headmen represent their villages vis-a-vis the police station. In isolated regions the police stations deal with most aspects of the civil service. Above the police-station there is the director of the community. He has military rank, but is employed by the Ministry of the Interior. Although in the rural areas there is a formal hierarchy of executive power, clothed in military terms, real local power is at the governorate capital[4704].

4.2.3 Keys to Water Decisionmaking

For water administration and decisionmaking, the key levels for local government are the governorate and the municipality with their attached offices of the water directorates of the Ministry of Housing and Public Utilities. The creation of a water establishment for each province is an effort to speed decisionmaking for water matters in the outlying areas. Telkalakh, a town of 15,000, was still petitioning in 1988 to rectify drinking water problems first reported to the Homs governorate and the Deputy Prime Minister for Services in 1981. The town fathers were advised to enroll with the Homs Province General Water and Sanitation Organization, recently established to provide expeditious action on just such problems[xxx8].

It is not clear how the basin-wide directorates of the Ministry of Irrigation interact with the provincial structure. Since the basin administrations are not congruent with the administrative divisions and in most cases encompass more than one province or parts of several provinces, it seems likely that the Irrigation offices will less closely integrated with the local government structures than other departments. The exclusion of the Irrigation office from the circuit during the 1987 water crisis in Hama[xxx4] would seem to confirm this assumption.

4.3 Non-Governmental Structures

There are four distinct but overlapping sets of water decisionmakers in Syria. Two of these, the Popular Assemblies and the representatives of the Executive Branch, are governmental. The other two are, strictly speaking, outside the government although closely allied with it and enjoying a formal legal status under the constitution. These are the popular organizations and the Baath Party(4362). These groups are represented on most local decision-making bodies involving water, agriculture, pricing, supplies, credit, planning, and other matters.

4.3.1. The Popular Organizations

The popular organizations (*Munazzamat Shaabiyah*) were founded in the late 1960s to counterbalance widespread urban opposition to the Baath regime and broaden its popular base. However, the Jadid regime (1966-70) controlled these organizations so tightly that they were never able to develop into strong political structures to provide greater regime support and continuity(4423). Only under Assad's "corrective movement" have the mass organizations developed into an effective expression of grassroots concerns.

For water policy, the most important of the popular organizations is the General Federation of Peasant Unions (GFPU), which is one of the principal mechanisms devised by the Baath to break the old feudal system and enfranchise rural Syrians. The GFPU has four major functions. First, it is an instrument for carrying out the government's socialist rural policy. Second, it represents the peasants' interests in the system, being the main organ for channeling their demands and expectations. Third, it encourages peasant participation, self-management, and articulation of political demands in such areas as conflict control and/or resolution and village development. Fourth, it directs peasant politicization toward the Baath Party(4362). In short, it educates the peasant, both technically and politically; provides him access to infrastructures previously controlled by landlords and creditors; and represents the peasant to the government(4592).

The GFPU is headquartered in Damascus in a building that would do justice to a major ministry(0060). It sits atop a pyramidal structure, with a Peasant Union Office (*Maktab al-Ittihad al-Fallahiyah*) in each governorate, under the supervision and control of the Damascus office. In turn, each district (*nahiyah*) of the governorate has a Peasant League Office (*Maktab al-Rabitah al-Fallahiyah*) under the supervision and control of the governate

level office; and each village of the district has a Peasant League/Cooperative Office under the supervision and control of the district level office(4362).

The governing councils of these organizations are elected by official members at each level through a democratic secret ballot for a three-year term. Business meetings take place once every month except at the village level, where they are called once a week. Village-level elections are also more frequent, annual rather than tri-ennial. In addition a meeting can be called for at any of these levels when a pressing problem or circumstance occurs. Decisions are passed by half the votes plus one; in case of a tie, the president casts the deciding vote. The nationwide organization is supported by small membership fees collected from the members(4362).

The Peasants Union was strengthened in 1974 by merger with an older organization, the Peasant Cooperatives (*al-Jamiiyah al-Taawiniyah al-Fallahiyah*), which had functioned for a decade under the aegis of the Ministry of Agriculture and Agrarian Reform(4422). These are primarily service cooperatives -- there are only a few production cooperatives and those mainly in the animal husbandry sector. A Peasant Cooperative may be established in any agricultural village of more than 400 population. The Peasant Cooperatives assist the relatively new beneficiaries of agrarian reforms in agricultural production. To become a member, one must be from a peasant background, over eighteen years old, of good conduct and moral standing, and not possessed of more than twenty acres of land(4362). Members of the Executive Board of the Peasants' Federation supervise work in the cooperatives, each board member being assigned one cooperative to oversee(4208).

The cooperatives provide, among other services, access to agricultural credit through the Agricultural Cooperative Bank, but their goals are socio-political as well as economic. The Cooperatives and Peasant Union have founded Institutes for Peasant Education in each governorate, and sponsor the brightest students for special training in Syrian cities or in Europe(4362).

At both the national and local levels, the Peasant Union is probably the organization that is most consistently represented on policymaking committees and councils. Given the fact that the agricultural sector consumes some 90% of the water used in Syria, the relevance of having grassroots representation for farmers is quite obvious. Although the GFPU now constitutes a huge bureaucracy in its own right, observers have concluded that it does provide access points for a genuine "upward flow of opinion and election from below"(4592). Its inclusion in water decisionmaking gives rural Syrians the opportunity to have a real voice in decisions regarding their most important resource.

4.3.2 The Party Organizations

The Baath Party is not the only legal party in Syria, nor is it the only party represented in the current government. It has, however, in one form or another dominated all Syrian governments since 1963 and provided Syria with the greatest stability and continuity it has enjoyed since independence. In the present governments headed since 1971 by Hafez al-Assad, the Baath Party is very much the senior partner among the National Front coalition of progressive parties that officially rules the country.

The highest policymaking body in the Syrian Baath Party is the Regional Congress -- in Baath parlance, the nation-state is a region within the Arab Nation -- which meets periodically (the last two Congresses were in 1980 and 1985). This Congress, attended by delegates elected by all Party members, debates and decides major policy directions and elects the members of the Regional Command, a 21-man committee that runs the Party between Congresses with the occasional advice of a larger Central Committee, which is also elected by the Congress.

Subtending from this central structure is an elaborate system of provincial and local Party organizations: The Party Branch (*Farii al-Hizb*) at the governorate level, the Party Division (*Shui al-Hizb*) at the district level, and the Party Cell (*Firqaa al-Hizb*) at the village level(4362). Most estimates place the number of Baath Party members in Syria on the order of 100,000, with perhaps a rather larger number in supporting or novitiate status(4592). The leaders of these Party organizations are often represented on decisionmaking councils at all levels. In addition, they often influence or even control the affiliated popular organizations, such as the Peasants Union.

The Baath Party is organized into a number of topical bureaux, each headed by a member of the Regional Command. Of these, the most important for water policymaking is the Peasant Bureau (*Maktab al-Falahin min Hizb al-Baath al-Ishtiraki*). At the central level, the Bureau is one of several functional divisions of the Regional Command; directly connected to it are derivatory bureaus at the governorate and district levels.

The Bureau has responsibility for preparing the report of the Regional Command to the Regional Congress on rural affairs and for laying down a plan of work, in consultation with lower levels, state organs, and popular organizations, for the implementation of congress policies on rural areas. At the central level, the office is headed by a member of the Regional Command and includes in its membership the Minister of Agriculture and Agrarian Reform, the Minister of Labor and Social Affairs, the President of the Peasant Union, the President of the Cooperative Federation and the heads of the Agriculture and Cooperative Bank, cotton and wheat marketing offices, etc. Thus, formally, it incorporates, coordinates, and

controls the work of these various organs, reconciling conflicts between them (e.g., between the needs of the peasants and the technical requirements of ministries) and its congruence with party policy.

Its plan of work encompasses such matters as the expansion and supervision of the Peasant Union, recruitment of peasant membership to the Party, creation and supervision of the agricultural infrastructure, cooperatives, state farms, performance of relevant bureaucracies, and the general agricultural development plan. (At the provincial level, it performs analogously, assembling the directors of the various ministerial field offices, heads of local peasant and cooperative unions, etc., to follow up on the governorate agricultural plan, ensure the flow of supply and credit to peasants, enforce the agrarian relations law, and support rural development schemes, especially those directly involving Party and Peasant Bureau cadres.) The Peasant Bureau and its derivatives, therefore, perform as a center for the implementation of Party policy through the control of various bureaucratic organizations and the mobilization of peasant participation. At the same time, it seems to serve as a channel by which peasant opinion is made known to those taking decisions impinging on their interests(4701).

The Head of the Baath Peasants Bureau is a member of the Supreme Authority for the Euphrates Project(4794), and provincial bureau officials are often represented on governorate water committees.

4.4 The Role of Companies

The final ingredient for water decisionmaking in Syria is the aggregation of companies in the mixed public-private sector. Although these firms, like their foreign counterparts, act mainly as contractors to implement the water policies made by others, their status as a repository of scarce expertise gives them a significant impact -- before and after the fact -- on how policies will be formulated.

Of the seventeen companies (*Shirkah*) represented in 1986 on the Supreme Council of General Construction Companies, ten had been involved in water-related construction projects. Together, they undertook nearly half of the water and irrigation work that was done in Syria up to 1983. (The other half was split evenly between foreign contractors and government agencies that acted as contractors.)

Three-fourths of the water contracts fulfilled by Syrian companies were done by three companies: The General Company for Land Reclamation, the General Company for Irrigation Construction (Sarico), and the General Company for Water Projects (Gecop). The

last two were merged in 1988 to form the General Company for Irrigation and Drinking Water. The most active government agencies have been the General Establishment for the Euphrates Dam (*Mu'assasah Amah*), the Military Housing Organization (*Mu'assasah*), and the Organization to Construct Military Works (*Mu'assasah*).

A summary of the work undertaken by Syrian companies and agencies up to 1983 is shown in Table 4.1.

Table 4.1

DISTRIBUTION OF WATER AND IRRIGATION PROJECTS AMONG CONTRACTING COMPANIES AND AGENCIES -- TO 1983

	Number of Projects
Syrian Companies:	
General Company for Irrigation Construction (Sarico)	10
General Company for Water Projects (Gecop)	2
General Company for Land Reclamation	4
Syrian Road Company	2
Mount Kassioun Company	1
General Company for Road Construction	1
Ressafa Company for Construction and Building	1
Syrian Arab Company for Construction	1
General Electric Company	1
Construction Works Company	1
	32
Syrian Agencies:	
Military Housing Organization	8
General Establishment for the Euphrates Dam	4
Organization to Construct Military Works	4
General Administration for the Development of the Euphrates Basin (GADEB)	1
Major Projects Administration	1
	18
Foreign Contractors:	
Various companies	17

Source: (xxx1) or (xxx3)?

A General Company for Water Studies was founded in 1983, too late to be included in the data used for the compilation of Table 4.1. We will include this company among our descriptions of the companies most active in water-related construction and study. The four companies doing the most work are[xxx9]:

General Company for Irrigation Construction (Sarico). Founded in 1967 pursuant to Legislative Decree 45 of that year, the company has headquarters in Hama and branches throughout the country. By 1985 it had more than 4,800 employees and was executing an annual SL 575 million worth of work. Its activities are in the fields of irrigation works, water disposal, dam construction, and land reclamation. Its projects have included the Raeed Project, Salhabiya, irrigation networks at Homs/Hama and Deraa, the Bir al-Hashem Project, and dams at Balloran, Kabir Shemali, Rum, Jarrah, and more. It was merged in 1988 with Gecop.

General Company for Water Projects (Gecop). This company was founded by Legislative Decree 117 of 1974 to execute fresh water and sewerage projects and dig water wells. Its headquarters are in Homs with offices in many districts. The value of the company's works in 1985 was SL 300 million, performed by some 3,800 employees. The most important projects completed and under construction included water lines from Sinn to Tartus, from Wadi al-Ashari to Deraa, and from Ain Tannour to Homs, and water networks for Damascus, Qamishli, Raqqa, Deraa, and Thawra, in addition to well digging all over Syria. As of 1988, this company is part of the General Company for Irrigation and Drinking Water.

General Company for Land Reclamation. Since its establishment by Decree 34 of 1980 with offices in Thawra, the company has undertaken works for reclamation, hydraulic construction, pumping stations, hydroelectric stations, and canals. It is a major contractor for the Baath Dam to produce electric power and further regulate the flow of the Euphrates. In addition, it has built pumping stations at Lake Assad and in the middle Euphrates, canals from Lake Assad to Meskene and Aleppo and in the Balikh basin, and prepared 50,000 ha of land for reclamation. It had more than 10,000 employees in 1985, when the value of its work was SL 615 million.

General Company for Water Studies. Established by Decree 16 in 1983, its purpose is to study, survey, and design projects for land reclamation, irrigation, and dams. Its accomplishments since then have included a study of the steppe and Sinn basins, geological engineering studies for the Salhab and Afamia dams, study of the irrigation networks of the Ghab and Asharne, and the design of

five dams in the Coastal Plain basin. In 1985 the company had nearly 1,200 employees in various specialties, and did SL 105 million worth of work.

Between them, these companies encompass a considerable body of expertise. Their 20,000 employees, ranging from experienced construction workers to highly qualified design engineers in many fields, have again and again demonstrated their capabilities. Indeed, in one important project (the dam on the Kebir Shemali) Syrian experts were called in to rectify the design and construction errors of the foreign companies that had started the job. What was clear amidst the charges and recriminations was that the local experts knew best how to get the job done in the local circumstances, those circumstances including such factors as the physical geography of the site, the type of equipment that would work best with the installations already available, and the capabilities of the work force. [source]

Although these companies are mixed sector, in the sense that a substantial portion of their shares (25-51%) is owned by the Syrian government, they function as independent private companies. They bid for contracts, set their own work rules, take their own risks, and share the profit or loss, just as a company without significant government investment would do. In recent years, Syria has been encouraging the expansion of this mixed sector into new economic activities through the offer of tax and import-export incentives(4210).

These companies work under their own Supreme Council. With the Planning Council and Planning Authority, they take prime responsibility for implementing the priorities of the Five Year Plan. Each company works in close liaison with the most relevant ministry, and then submits its plans and recommendations for approval to the Planning Authority and the Ministry of Finance. Thus, the priorities reflected in the projects undertaken by these companies are the priorities of the government and its ministers and planners, as well as of the companies themselves.

For 1988, the distribution of projects relating to drinking water, sanitation, sewerage, and well drilling for the company most involved in those activities is shown in Table 4.2. Both the number of projects and the financial resources committed to them are of interest, reflecting well the areas of identified need for such projects and the country's priorities for dealing with them. The distribution, according to Gecop's Director-General, Engineer Abdul-Munem Fatrawi, was as follows:

Table 4.2

DISTRIBUTION OF WATER PROJECTS
UNDERTAKEN BY GECOP IN 1988

Province	No. of Projects	Cost in million SL
Damascus	15	59.30
Homs	18	53.80
Hama	17	93.45
Idlib	5	7.40
Aleppo	8	10.70
Raqqa	4	10.60
Deir ez-Zor	16	40.00
Hasaka	9	20.40
Tartus	14	23.00
Lattakia	14	91.50
Deraa	16	67.40
Suweida	20	20.50
Miscellaneous	--	1.95

Source: *al-Thawra*(xx10), July 8, 1988.

As shown above, the areas of greatest need -- Damascus, Homs, and Hama -- are receiving significant attention. Tartus and Lattakia, on the well-watered coastal plain are also high priorities because their needs must be met in order to calculate how much of the Coastal Plain basin's surplus may be available for future water transfers. The provinces in the Euphrates basin are relatively low priority, presumably because they have already received so much attention and are the target of ongoing projects. Deir ez-Zor, however, is also in the Euphrates; it is interesting to speculate that the new oil communities in that district may be imposing increasing demands. The largest number of individual projects is in Suweida, on the edge of the desert, but the financial column indicates that they must be small in scope -- which makes sense in view of the water resources available there. On the other hand, Aleppo is receiving only a moderate amount of attention despite its urgent need.

4.5 Role of the Top Leadership

The government of Syria rests on a Constitution which was promulgated under the auspices of the Baath Party and last revised in 1973. The constitution emphasizes the service of the state to the people. The people are represented in a unicameral legislature, the People's Assembly, which elects the President subject to ratification by direct referendum. The candidate for President is nominated by the Regional Command of the Baath Party; the Party is charged by the constitution with providing the ideological framework for the government, and thus serves the broader function in society of regime validation.

Among the three branches of government -- the Executive Branch, the Legislature, and an independent Judiciary -- the President is the dominant partner. His authority derives from more than his constitutional role as head of the Executive Branch. The Presidency rests on three independent institutional pillars: the ministries, the military, and the Party. In Syria, the ministers (subject only to a legislative vote of no confidence) serve entirely at the pleasure of the President, who is also commander-in-chief of the military and head of the Party.

While the President is clearly dominant in the Syrian system, his power is not absolute. His role is defined in the constitution and circumscribed by a complex and interlocking political system. Moreover, he is surrounded by a coterie of friends of long-standing and proven personal loyalty(3800). These colleagues from school, army, family, and the early days of the Baath Party are not mere staff who can be disregarded at will(4261). Many now hold high position and are political actors in their own right, who can provide a genuine sounding board in the decisionmaking process. "The Group" (*al-Jamaah*), as this circle of advisors is called by Syrians, sits atop a pyramid of informal networks extending deep into Syrian society(4711). Many of these old friends are Alawi, because President Assad himself is Alawi, and many are from the military, because he himself had a military career. But these facts are historical in origin, and do not make the regime intrinsically either sectarian or military. This is said to be a point of some sensitivity to Assad(4075).

For water administration and development, the key actor is the Executive Branch with its ministries and supreme councils. Except where foreign affairs are involved, e.g., the 1987 agreements with Turkey, there is little evidence of direct presidential involvement. Water decisionmaking falls under the responsibility of the Deputy Prime Minister for Services, Mahmud Qaddur, with occasional involvement also of the Deputy Prime Minister for Economic Affairs, Selim Yassin. Qaddur, who has held this position since 1985, is a former Minister of Industry; Yassin, also

appointed in 1985, had been both Minister of Planning and Minister of Economy and External Trade. Both Qaddur and Yassin are frequently included in water discussions with foreign countries.

Within the Syrian government, the ministries tend to be more policy implementers than policy makers. Initiative for developing programs and projects may come from a ministry; it may also originate at the local level in one of the provincial and municipal councils. All major projects are referred to one of the appropriate supreme councils in Damascus, and ultimately to the central Supreme Planning Council and subsidiary Planning Authority for decision and the allocation of funds. Projects must fit within the priorities of the current Five Year Plan (the Sixth Five Year Plan runs from 1986-1990) and be approved by the Planning Authority and People's Assembly for inclusion in the Investment Budget for a given year.

For water decisions, the key councils are the Supreme Planning Council and the Supreme Authority for the Euphrates Project.

4.5.1 The Supreme Planning Council

The Supreme Planning Council is the highest planning authority in the country; it gives final approval to proposed project studies after they have passed through the State Planning Authority, which is its administrative unit. The State Planning Authority coordinates all sector programs of the different agencies, designs the Five-Year Plans, and exercises functional authority over individual small planning units. It is staffed by specialists in evaluation of projects and in formulating the short-and long-range economic and social plans of the country. In addition, it provides the planning units of each industry with detailed instructions and recommendations for the preparation of the quantitative and financial aspects of project studies(4700). All water projects involving significant expenditure must go through this process.

The planning organizations focus their attention on the expanding public sector, but most of the decisions and plans formulated by these organizations affect the private sector as well. The pure private sector is composed mainly of retail merchants and entrepreneurs involved with small industries. Any entrepreneur may seek statistical, technical, and other information from the Ministry of Industry when formulating plans for the establishment of a new industry(4700). The large mixed-sector companies that have implemented the major portion of Syria's water project are more closely integrated with the planning process.

Planning Units serve the function of preparing the actual detailed studies of proposed projects, as well as the follow-up on implementation of these projects. They are are attached to and under the direct authority of their respective administrative, economic, or cooperative organization, and may be either topical or geographical in scope.

The Minister of State for Planning is Sabah Baqjaji. He has held this position since 1985, when he replaced Kamal Sharaf, who became Minister of Higher Education.

4.5.2 The Supreme Authority for the Euphrates Project

The Euphrates is the principal source of water for Syria, and maximum development of this source and its basin has been a major concern of the government for over two decades. The Supreme Authority for the Euphrates Project was founded nearly two decades ago to give overall, high-level leadership to this massive development effort. Other organizations have come and gone, but this Authority has remained to guide the work through its difficulties.

The Supreme Authority for Euphrates Projects meets as needed. It is chaired by the Prime Minister, and its membership is made up of heads of relevant ministries, organizations, and institutions. Its meetings are attended by members of popular organizations and local institutions, by representatives of the Party's Regional Command, relevant ministers, the Deputy Prime Minister for Public Services and the Deputy Prime Minister for Economic Affairs, as well as general managers of companies and institutions operating their businesses in the Euphrates Basin(4794).

The Prime Minister, in his capacity as chairman of this Authority, was instrumental in conceiving and pushing through the recent re-organization of the water sector in Syria.

4.5.3 Other Policymaking Bodies

The mixed-sector construction companies play a significant role in providing expertise for planning and implementing water projects. They are subject to their own self-governing body, the Supreme Council for Construction Companies.

4.6 The Role of the Legislature and Judiciary

Although the People's Assembly is often portrayed as a mere debating society, it does have influence over topics that affect the people as directly as water. Not only does the Assembly pass necessary legislation, it also must pass on the annual budget and the Five Year Plan. Moreover, its oversight committees, such as the Public Utilities Committee, are active, and are not afraid to speak out when mismanagement or malfeasance result in public inconvenience for their constituents.

The recent resignation under legislative censure of four ministers is a case in point. Even ministers who escaped actual censure, such as Ministry of Electricity Kamil al-Baba, had to listen to intense criticism and dissatisfaction with the performance of their departments. In the light of the power outages of the past several years, the People's Assembly is now requiring regular reports from the Ministry of Electricity as to its progress in developing adequate new power sources.

The Judiciary provides a court of review and appeal for citizens and groups against decisions and programs that contravene their interests. The Supreme Court for Constitutionality reviews laws, while the Court for Economic Security can be asked to determine whether a program truly serves the economic objectives of the country.

4.7 Policymaking Overview

It should be apparent from this chapter that water decision-making in Syria is a complex and multiply ramified system. The ministries, whose administration and planning are crucial, are by no means the only actors. Local government plays a significant role, non-governmental organizations (Party and affiliated mass organizations) are important alternative structures in the process, and companies offer both badly needed advice and essential services.

In the absence of direct presidential involvement -- and this seems to be the case most of the time -- the major decisions seem to be made in the supreme councils and authorities, especially the planning bodies. Both the legislature and the courts provide opportunities for review of controversial decisions or unsuccessful efforts.

Perhaps most important, in the light of the outside perception of Syria as an authoritarian society, is the degree of involvement by local citizens in suggesting, petitioning for, and planning the waterworks that are needed in their localities. These individual

Syrians may go through the official representational structures starting with their local councils; they may appeal through their Baath Party organizations; or they may lobby through the appropriate mass-based or professional organizations. Networks of personal relationships are often used as well as official and organizational channels to help citizens solve their daily problems. Although there is a structural inequality in favor of Damascus in actual decisionmaking, there is also active two-way communication. The people living in a region do not merely react to forces beyond their influence(4704).

Chapter 5

CURRENT WATER POLICY IN SYRIA -- POLITICS, REGULATION, IMPLEMENTATION

Syria, before the advent of the Baath, was more an aggregation than a country. Under 400 years of Ottoman rule, and for many centuries before that under assorted other empires, the realm of government was directed to the cities. It was the traditional, almost feudal, notables of the cities -- the great families who comprised the landed aristocracy, intelligentsia, and commercial magnates -- who mediated the rule of law to the unorganized, often illiterate peasantry and controlled access to the corridors of power and the benefits accruing from power. Nor did the cities themselves act as one unit. Although some of the notable families had branches in more than one city (e.g. the Azzams of Hama and Damascus), the relations between the nine major cities of Syria were characterized by fierce rivalries. The French, during their brief tenure as Mandatory, built on a situation fragmented almost to the point of disintegration through a deliberate policy of "divide and rule".

Syria's first two decades of independent national existence were filled with instability. Coup followed coup as the traditional families -- working sometimes through political ideologies, sometimes through sectarian allegiances, sometimes through regionalisms, and always through personal ties -- sought in turn to establish hegemony over the fledgling state. It was despair with this chaos that led Syria into its ill-fated union with Egypt in 1958. And it was this chaos that formed the crucible for the Baath determination, when it finally seized power in 1963, to overturn the traditional leadership and forge a new mass power base and new political reality for Syria.

The core of the Baath strategy involved the mobilization of the disenfranchised peasants -- small landowners who worked their own land, tenants, sharecroppers, agricultural laborers. The Party sought, through its cellular, pyramidal structures and ultimately through its mass organizations, to give the people of the countryside their own avenues of access to government, thus breaking their dependence on the urban elites and depriving these old notables of their monopoly on the provision of needed services. This choice of base was not purely ideological, for the first recruits to the Baath Party had been among the rural youth who gained their educations through the government high school system. The founders of the Baath were teachers by profession, and their followers in 1947 and after were young men like Hafez al-Assad, poor boys from villages who came to town to high school, and then passed on to the military academy or normal school, those being the only available sources of higher education open to them without cost.

This rural base has served to define the policies of every Baath regime in Syria. Assad is more pragmatic and less ideological than his predecessors; indeed, his 1970 "Corrective Movement" was predicated on realistic development goals in place of doctrinal purity. But the rural nature of Baath party cadres is a salient reality. It is a definitive life experience and mindset for the party leaders. It is a supporting clientele whose needs must be met.

Hence, agricultural development and improvement in the quality of rural life are key policy goals for Syria's Baath government. Neither of these is possible without water.

5.1 Current Goals

The strongly rural orientation of Syria present rulers was reaffirmed at the most recent Baath Regional Congress in 1985. Faced with a sluggish economy (to use the mildest adjective consistent with truth) and foreign policy constraints that required continued high military spending, the delegates debated ways to revive economic growth. They recommended continued emphasis on strategies to increase agricultural productivity with a view both to food security and to providing low-cost inputs for light industry[4171].

It should be noted that debate in the Baath Regional Congress tends to be free-wheeling and very candid. It is one of the forums (the People's Assembly is another) in which Syria's leadership solicits the opinions of cadres and regional representatives regarding policy, providing a route whereby ordinary citizens can express their concerns and grievances. Although the leadership makes the decision in the end, it tends to listen carefully to the opinions offered. The *quid pro quo* is that all parties agree in advance to support the final decision, like it or not. Some observers[4239] have called this process "participatory consensus"; a doctrinaire Marxist (which the Baathis are *not*) would call it "democratic centralism". What is important is that the debates in the Congresses and Assembly, while not the actual decision points on policy, do provide a useful portent of what the policy will be and why.

In the present instance, the 1985 Regional Congress endorsed more investment in the Tabqa Dam project and in schemes to improve farm technologies and extend rural services -- hygiene, electricity, credit. The delegates saw this as economically rational and politically effective. The controversial mixed public-private joint ventures, which were approved after a full week of strenuous debate as a way to compensate for the decline in government investment, seem to function well in agriculture. Moreover, the delegates were cognizant of the demonstrated loyalty

of the peasant population. Pleased with the steady growth of state services for the countryside, the peasants gave the state the support it needed to prevail over the revolt of the Muslim Brotherhood in Hama in 1982[4171]. To satisfy this constituency, the Baath party sets rural concerns high on its list of priorities.

These priorities are reflected at the government level. Water and agriculture have by far the largest quotas in the 1988 investment budget, and agriculture was re-emphasized in the Sixth Five Year Plan (1986-90), with electric power generation as another high priority. Specific goals of the plan, as reported to UNDP in 1986 (UNDP/DP/CP/SYR4, 10-23-86), included the following:

1) Investment in agriculture and the food processing industries to ensure food security;
2) Consolidation of the industrial sector;
3) Development of oil and gas resources to meet internal energy demand;
4) Expansion of electrical generation capacities.

The first and fourth goals above are directly related to improving the quality of life and livelihood of rural Syrians. They are also both directly dependent on the proper development of water resources. These concerns are fully reflected in the projects Syria is undertaking at present (see Chapter 3). They are also reflected in the Syrian water priorities reported by UNESCWA in 1986:

-- Surface water development and conservation by constructing weirs and dams for domestic and agricultural purposes;
-- Domestic water supply projects to service 100% of urban and 67% of rural populace;
-- Groundwater studies and exploration;
-- Strengthening manpower.

These goals have been confirmed by the present cabinet. In his state of the nation speech to the People's Assembly shortly after taking office (speech given on 12-28-87), Prime Minister Mahmud al-Zubi highlighted agriculture, irrigation, electric power, drinking water, and the reduction of water waste. He pledged the speedy completion of planned land reclamation projects, but placed equal emphasis on increased productivity through modernization, intensification, and training. He pointed to the efficient use of water resources and the elimination of loss as essential to the realization of goals for agricultural development and hydroelectric power generation. The fact that Zubi is an agronomist with experience in Euphrates projects is in itself an indicator of probable government priorities. Zubi also stressed the role of joint sector investment, a policy for which Economy and Trade Minister Muhammad Imady has been an important public advocate[4372].

5.2 Regulatory Principles

As with many Middle Eastern states, the fundamental principles on which Syrian water practice is based derive from the legal precepts of Islam. The prescriptions of the Sharia law are few in number but general in application, and provide a flexible framework for the development of modern water systems. Among these principles are the following[3774]:

- o Water is the common property of all mankind. The fact that water passes over or under private property does not confer ownership rights on the landlord; he may only withdraw water for his own needs like anyone else, and may not deny access to others.

- o Water for survival must never be denied; first priority in water use is to satisfy the thirst of man and his domesticated animals.

- o Reasonable agricultural uses, i.e., sufficient for cultivation, are to be allocated on a first come, first served basis.

- o Prior uses in time (first user) and geography (upper riparian) take precedence over later or downstream uses.

- o Hoarding and speculation are discouraged. Each person should take from the common stock only what he needs; it is permissible to make a living by carrying water to others but one should not profiteer from God's gifts.

- o Artificial channels, above or below ground, belong to the builders. Others, including landowners, may withdraw from them only for domestic needs, and may not impair access for repair and maintenance.

- o Primary water supplies must be protected against contamination.

These commonsense prescriptions differ little from the notions and practices of other peoples. The inclusion of domesticated animals as domestic users is not universal. Also, some countries -- and some U.S. states -- treat groundwater as private property, the rights to which may or may not be attached to the sale or lease of the land above it. Purchasers of mountain retreats in California have sometimes learned these facts to their sorrow. In general, however, the Islamic principles could form the basis for much of international practice.

The Islamic principles do, moreover, predetermine certain underlying attitudes on the part of the populace. Since water is seen as the gift of God to all mankind, the extension of this prin-

ciple to say that water belongs to the state and not to any individual meets little resistance. On the other hand, the state's imposition of fees for delivering water meets with incredulity. Why should people pay anyone, even the state, for God's gifts? The result seems to be a low level of compliance with fee collection and, as a natural corrollary, widespread approval of illegal extractions from government canals[4364]. Even in cities, where the almost universal presence of "artificial channels" could be held to justify fees, the imposition of anything beyond what could be seen as maintenance charges meets with low compliance[3101].

The situation today, with water ownership in the hands of the people as represented by the state, differs dramatically from the situation that obtained during the period before and after independence. Patterns of communal ownership had been disrupted already in the waning years of the Ottoman Empire. The land registration features of *Tanzimat* offered signal opportunities to the urban merchant classes to convert their client relationships in the countryside into legal ownership, thereby reducing the peasantry to tenant farmers. The merchants, who had long held the peasants in debt bondage, were able -- through their literacy, proximity to officials, and sometimes outright graft -- to register themselves as owners of lands that had previously been classed as *miri*, that is, owned by the crown but with usufruct guaranteed in perpetuity, contingent on continued utilization, to the community that worked it. The peasants, always deeply in debt, lacked the power and often the knowledge to challenge this change in their status.

This change in the nature of land tenure, reversed in Syria only with the Agrarian Reform of the 1960s, was accompanied by a change in the pattern of water rights. The irrigation of cotton spawned a generation of "cotton sheikhs" in the 1950s. The tribal leaders of the Jezireh, who had registered themselves as titular owners of their tribal lands, realized after World War II the profits that could be made from the cultivation and export of cotton. They bought the pumps, the tractors, and the trucks, established the relationships with traders in Aleppo and other cities, and then settled their previously semi-nomadic fellow tribesmen as sharecroppers on irrigated plots to grow cotton. The profits in those early years were tremendous, and upwards of 60% of those profits went to the sheikhs in return for the equipment, seed, and intermediary services they provided[4362].

Under the situation that developed in the fifties, water belonged not to the people, as per Islamic law, but to the pump owner. The above description was drawn from the Euphrates basin, where the change was perhaps most dramatic. But it applied with variations all over Syria -- and southeastern Turkey as well. In the Ghab, for example, most of the land and its attendant water rights were in the hands of a few mercantile families from Hama and Irbid. Metral[4368] reports for the Ghab region that the project significantly changed these pre-existing patterns (as of the 1950s) of access to water. After the project, the state controlled all of

the water and most of the land but considered that it belonged to the public domain. Thus, the Baathist state seemed to be "returning to the tradition of Islamic Law under a slightly more refined formula".

5.3 Agricultural Policy under the Syrian Baath

Because irrigation accounts for almost 90% of Syria's water use, Syria's water policies and agricultural policies are inextricably entwined. The need for food security, a common Third World goal, only reinforces the rural base and orientation of Syria's leaders. The water and electricity projects that are so emphasized in Syria's current investment strategies are necessary ingredients for providing better services for the rural populace. Indeed, the stipulated priorities of Syria's agricultural policy are water projects, agrarian reform, and education and training of the peasant population[4255].

Despite massive investments of men and resources, and despite a thoroughgoing agrarian reform program, the performance of Syrian agriculture has been mixed. Acreages increased dramatically in the fifties and then declined into the sixties. Agricultural and food production indices showed steady gains during the 1970s, but unfortunately, even the bumper harvest of 1980 barely kept pace with population growth. During much of the recent period Syria has been a net importer of grains[3317].

In part, Syria's shortfall on agricultural goals is a direct result of its rapid population growth. Syria, *like all its neighbors without exception*, will eventually have to learn the ecological limits of its resource base which will not sustain unlimited demographic expansion.

In part, Syria's shortfalls are the result of a natural physical process whereby farmers learn by experience which of their lands are suitable for cultivation and irrigation. The initial fertility of some of Syria's rangelands, first ploughed in the 1950s, rapidly diminished. Like the farmers of the American plains, Syria's agriculturalists are now returning to grass and fodder some of the Jezireh lands that had threatened -- what with salination, erosion, and accretion of gypsum -- to become a dust bowl. Intensification of cultivation on the more suitable lands is now the priority for Syria, rather than further horizontal expansion of ploughed acreages.

And in part, Syria's shortfalls may be the result of the very agrarian reform measures that were such a necessary ingredient of its social program. Although reform, that is, expropriation and most redistribution, was essentially complete by 1970, it has taken many years to replace the supply and marketing mechanisms that were

disrupted by the reforms. Lack of training, lack of manpower for harvests, lack of needed inputs such as fertilizers, lack of credit, and lack of access to markets are common complaints among Syria's farmers. All of these services had, under the old system, been supplied by the farmers' merchant patrons in return for their subservience, clientage, and a major share of the crops. It requires time and intensive training programs to provide for these needs through mechanisms such as extension services and cooperatives that the Syrian leaders will deem socially progressive.

5.4 Land Reform

Ulrich Planck[4326] has traced the history of the implementation of land reform in Syria. Although there were efforts as early as 1950 to regulate the private use of state land, especially on the part of large landowners, and to benefit landless and small-holding peasants, effective land reform came only during and after the transitory union with Egypt. The Agrarian Reform Law #161 of 1958 essentially applied to Syria, with little adaptation, the provisions of Egypt's land reform measures. The break up of the United Arab Republic in 1961 saw the immediate repeal of Law 161. A new law was passed in 1962, but was annulled a month later when Law 161 was reinstated. Finally in 1963, all previous legislation was repealed and a new Decree #88 was promulgated with provisions adapted to Syrian conditions.

The political purpose of land reform in Syria was a thoroughgoing social change, to sap the power of feudal landlords by empowering and mobilizing a new class of small landowning peasants who would till their own land. The major changes in the laws involved the amount of land that would constitute the maximum land holding, and the size of the plots to be allotted to the new small holders. The 1958 law simply applied the upper limits that Egypt had used: 80 ha of irrigated or orchard land, 300 ha of rainfed land. The short-lived 1962 law raised these limits drastically while imposing a graduated system of limits depending on the region of the country and quality of the land. The final version of the 1963 Law established lower ranges, also graduated by region and quality:

15-55 ha of irrigated land
35-40 ha of orchard land
80-300 ha of rainfed land

Land holdings beyond these maxima were expropriated. By 1969, some 1.4 million hectares had been expropriated from more than 4,000 big landlords. Excluding marginal soils, a million hectares were deemed suitable for distribution. Of this, 43% was distributed to 52,500 peasant families and the remainder was reserved for state farms or large tenant farms. In addition,

49,700 peasant families received some 432,000 hectares from the state domain. Except in the development areas of the Euphrates basin, where projects are still ongoing and peasants are still waiting to be resettled, the process of land reform was considered complete by 1969[4326)(2425)(4569)].

Criteria for receipt of distributed land -- in plots of approximately 2.5 ha of irrigated land plus varying amounts of dry land -- were explicitly framed to prevent absentee landlordism: recipients were farmers, most were previously landless, married, aged 35-45, and residing on and working the land themselves. [Criteria in the Euphrates were only slightly different: landless, 35-50 years, literate, married with children, experienced in growing cotton[4569)].] Although the state retains eminent domain over land and water, the terms of exploitation (*infita'*) for the beneficiaries more nearly resemble that of ownership than tenancy. The farmer is required to join a cooperative to which he pays a nominal annual fee (a tax of SL 10 per hectare), but he does not share his crop. His right of usufruct is permanent, but it is personal to the farmer and his family and it is indivisible (he may cede his land to one of his children, but he may not subdivide it or sell or rent to an outsider)[4255)].

Although the agricultural supply and marketing system was not wholly reorganized, in large part due to lack of qualified personnel, the impact of land reform was still significant. Planck[4326)] reports that surveys show land reform villages tend to have larger irrigation areas, more diverse crops, more intense cultivation, and a higher level of animal husbandry along with cultivation. But these economic benefits are less significant than the social changes. As a result of the land reform, Planck says the urban feudal landlords have lost much of their power over the peasants, both land ownership and agricultural income is more evenly distributed, and fragmentation and tenant farming have diminished. He concludes that the peasants display a remarkable change in mentality.

Prior to land reform, two thirds of Syria's peasants had been landless[0094)], and almost half of Syria's farm ownership had been in estates of more than 100 hectares (250 acres). After land reform, the extent of the large estates had been reduced from half to a fifth, and the amount of land in moderately sized holdings had increased dramatically. Table 5.1 demonstrates the change:

Table 5.1

Syria: Land Holdings, 1952 and 1970
(in percent of area)

Size of holding	1952	1970
< 2 ha	1%	3%
2-10 ha	12%	20%
10-50 ha	28%	47%
50-100 ha	10%	12%
> 100 ha	49%	18%

Source: Manners[3317].

The growth of substitute service structures has been far slower than the redistribution of land. Nonetheless, the cooperatives represent the real growth sector in Syrian agriculture. Private ownership, still dominant, is dropping steadily, and the situation with state collective farming can only be described as dismal. But membership in cooperatives more than doubled between 1975 and 1982 (see Table 5.2).

Table 5.2

Cultivated Area by Type of Farm
(000 ha)

	1975	1980	1982
Private	3,041	2,866	2,650
Cooperative	593	1,001	1,314
State	66	26	23
	3,700	3,893	3,987

Source: Manners[3317], p. 274; al-Ashram[2059].

Obviously, the Syrian peasant displays no fixed resistance to membership in a cooperative although the state farms, which reduce the peasant to employee status, are not popular. Slowness in organizing cooperatives is due to the lack of adequately trained personnel. Training of additional cadres of agricultural engineers is one of the stated objectives of Syrian agricultural policy.

5.5 Regulation of Water Use to the Present Decade

Until the mid-1980s, the regulation of water in Syria was a crazy-quilt of competing agencies and authorities. The administration of water resources was the responsibility of several agencies, among which were the following:

The Directorate of Irrigation and Water Resources. This directorate belonged to the Ministry of Public Works and Water Resources and was mainly concerned with the preparation of studies and the supervision of the execution of certain dams and medium-sized irrigation canals. In addition, it was entrusted with the study of surface and ground water resources.

The Public Institute for Ground Projects. This institute reported directly to the Minister of Public Works and Water Resources. It was entrusted with the study and execution of major water projects and irrigation canals.

The Ministry of the Euphrates Dam and the Institute of the Euphrates. The ministry and institute prepared studies and supervised the execution of projects related to the Euphrates and the reclamation of land in the Euphrates basin.

The Directorate of Drinking Water and Sanitation. This directorate was part of the Ministry of Housing and Public Utilities. The work of the directorate was supplemented by the following agencies in providing drinking water and sanitation on a national level:

- Public Institutes for Water in the administrative governorates and in certain city municipalities.
- Local Councils for drinking water and sanitation, which reported to the Ministry of Housing and Utilities.
- Directorates for Technical Services, which were part of the councils of certain municipalities.
- Administrative Units in municipalities of the fourth degree and other cities and towns which dealt with drinking water and sanitation.

With decisions regarding investment, allocation, operation, management, and enforcements being made at so many levels, that this competitive atmosphere seldom erupted into outright water conflict was more a reflection of the fact that Syria had at that time faced only regional water shortages than the result of rational management or decisionmaking. Nonetheless, the complication of the regulatory process inhibited the application of development and conservation strategies because of the sheer difficulty inherent in compliance.

Many decisions -- investment in major projects, agricultural production quotas, credit for infrastructure development -- were taken in the capital and passed on through government, party, or popular organization structures to the provinces. The translation of these decisions into local objectives was in the hands of local officials of different agencies. And local-level officials also had the authority to initiate certain small-scale developments, either themselves or, more likely, in concert with an array of other provincial agencies. In two instances, Syria tried to cut through this maze by establishing independent authorities with multi-faceted responsibilities to manage major projects, either at the ministerial (the Euphrates project was for a time headed by a cabinet minister) or sub-ministerial (Ghab) level. This valiant effort at simplification, in the end, added another to the list of agencies with which a Syrian had to deal.

Within such complexity, we can only identify major categories of water regulation within the Syrian system and look at examples of each. The selected categories, each governed by its own rules and practices, are agricultural water use, domestic water use, and groundwater development.

5.5.1 Agricultural Water Regulation

Historically in the twentieth century, public waters and public domains in Syria have been governed under several laws: by Law Number 144, dated June 10, 1925; by Law Number 320, dated May 26, 1926; by Legislative Decree, dated November 28, 1942; and by Law Number 148, dated June 22, 1949.

These general laws of public domain were applied specifically to irrigation water on September 27, 1958, in Law Number 165. This law restricted the right to pump public water -- both surface and groundwater -- for agricultural irrigation purposes to licenced users. Law 165 of 1958 contains several important provisions. **Article 3** states that the Ministry of Public Works and Water Resources (now defunct) determines, in accordance with the water in each basin, the maximum amount of water that can be licensed for use, the area that can be irrigated, the restrictions that must be imposed on the method of extracting water, the conditions fo protecting this water, and the limits for its use. **Article 5** states that the authorities can refuse to grant a license if it would conflict with the rights of others or with the public good. **Article 8** states that a license should be withdrawn if that would serve the public good or if it can be shown by the courts that the license causes severe damage to the rights of others.

Based on Article 3 mentioned above, the Ministry of Public Works and Water Resources issued a number of resolutions for regulating the exploitation of water in sectors, basins, and rivers whose waters are susceptible to depletion because of increasing demand and usage. Some of these resolutions are:

- o Discontinuing licensing in the Damascus Plain, Qutayfah Basin, Majar al-Qalamun Basin, Salamiyah Basin, the eastern half of Aleppo Basin, and Damsarkhu Basin (1960).
- o Withdrawing licenses granted in al-Qalamun Basin (1963).
- o Defining protection zones for Ira Springs and Barada Spring (1963).
- o Regulating the exploitation of artesian groundwater in Ras al-Ayn Basin, north of Jazireh (1963).

The administration faced some difficulties in implementing this law, derived principally from the inadequacy of information. The regulation of exploitation was to be premised on the available water potential, but many of the hydrologic basins had not been properly studied. Further, the "principle of common right", which the administration sought to impose in place of the "principle of previously acquired right", also required an assessment of the quality and quantity of annual water inflow according to basins and land areas so as to allocate it in ways that would provide equal benefit for all users. Application of these provisions of the law was therefore delayed awaiting the collation of the necessary data.

On December 7, 1972, Law Number 46 was issued. This law regulated the affairs of the government irrigation networks from the administrative, financial, juridical, and statistical aspects, with a special emphasis on the determination of annual fees. The law was motivated by the goal of unifying annual fees all over the country on the basis of the actual irrigable areas that are included in the public networks; it also cancelled the principle of cost recovery.

These laws were applied unevenly because of the inadequate statistical base, and various efforts were made to devise systems suited to the ecological circumstances and pre-existing practices of different regions. In some instances, special laws were promulgated and special administrations created. Perhaps the best studied region for agricultural water regulation was also the first to be developed: The Ghab.

According to Law 225 of 1969, which set up the autonomous Ghab authority, all lands in the water-distribution network are equal, regardless of public or private ownership. Water rights adhere to the land itself, not to ownership. Quotas for water distribution are fixed by the government administration and vary from area to area: 0.5 l/s/ha in the Ghab, 0.35 l/s/ha in Asharneh. Within each distribution area (*maqsam*), the schedule for water delivery is worked out by the peasants through the cooperatives to which they belong. A quasi-symbolic water tax of SL 70

/ha/year was decreed in 1972 for all state networks, but it is no longer being collected[4368]. Both private owners and recipients of distributed land receive water for free, but they are alike subject to the rule of the distribution network and schedule[4368]. The Ghab Project prohibits private pumping from the private stations that had previously been set up by large landowners[4255].

Distribution of state and expropriated land was executed in accordance with the Agrarian Reform Law, with elegibility determined by a Land Distribution Commission composed of representives of the Ministry of Agriculture and Agrarian Reform, the Peasants Union, the local Baath party branch, and the governorate. Law 22 of 1969 authorized distribution of land in the Ghab Project area, with minimum 2.5 ha plots going to 11,000 families[4368]. By this law, the land remains state property, with transfer to third parties strictly under state control, but the individual peasant has control over usufruct. The peasant must pay dues to his cooperative for 25 years, and must participate in achieving the production goals assigned to the cooperative. Water-sharing is worked out at the cooperative level by an elected council. The 1969 law also released peasants from prior debts to Agricultural Cooperative Bank.

For better coordination of the previously fragmented region, an autonomous Office for the Exploitation of the Ghab and Asharneh was established in 1969 and attached to the Ministry of Agriculture. This office set production goals, supervised financial and technical support for the peasants, and sought to insure that the division of land into small plots did not impede development. The peasants were organized into 52 service cooperatives which reported to twelve agricultural sections. The head of each section, usually a resident agricultural engineer, coordinated the supply of credit, seeds, fertilizers, organized deliveries of crops to state factories or to market, and disseminated technical information. He also controlled the stamps and vouchers needed for official transactions, and mediated on behalf of the peasants with the Agricultural Cooperative Bank[4368].

Practices in other regions are less well documented. There seems to be agreement among the regions on the subject of water fees -- that is, the absence of water fees. In regions where agriculture was well established before the current regime, pre-existing practices of allocation are probably of more importance than in the Ghab, where 80% of the land is reclaimed or redistributed. For regions without an independent authority like the Ghab Project, local government and various local ministry officials must coordinate the allocations and scheduling. The role of the Baath branch office or Peasants Bureau head is proportional to the regional strength of the party. All of these are pieces that made up the crazy-quilt.

5.5.2 City Water

Eight of Syria's major cities had independent (Damascus, Aleppo) or semi-independent (Hama, Homs, Latakia, Suweida, Raqqa, Idlib) water authorities. The independent water authorities had total responsibility for the water supply to their municipalities, the semi-independent authorities were subject to technical guidance from the Ministry of Housing and Public Utilities for design and construction of major projects. In smaller urban areas, distribution systems were managed by a unit within the local administrative structure[3101].

The independent and semi-independent water authorities were governed in accordance with Decree #18 of 1974 on public authorities. This decree sets forth requirements for management, lending, financial accountability, and ministerial responsibility, and defines the powers of the General Director and his administrative council. It also specifies that each authority will be established by its own separate By-Law which will spell out its detailed functions. The By-Law for Damascus (Decree #252 of 1975) defines that authority's functions, capital, sources of funds, and staff regulations in great detail; it sets up a major projects office within the authority and designates its staff positions down to the level of doorman.

Among the local authority's duties was the establishment of tariff structures to finance its operations. These are fairly complex, involving items from the purchase of water rights by large establishments (SL 2,000 per m^3/day) to installation fees, usage rates, and meter maintenance, down to an SL5 fee for name change on the account[3101]. Enforcement of those fees is another matter, with about half of municipal consumption either free or unaccounted for.

Investment in major projects, including the much-needed upgrading of leaky distribution systems and much-needed sewage treatment facilities, comes from three sources: the investment budget of the central government, the investment budget of the local administration, or external loans. As public establishments, the water authorities are authorized to enter into local and foreign loan agreements to finance their projects[3101].

5.5.3 Groundwater Regulation

Water drilling has been regulated in accordance with Resolution 208 of 1958. By this law, procedures for acquiring permits are very complicated, which inhibits efforts at compliance. One farmer reported in 1980 that he had spent 15 days and more than

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SL 200 trying to get the necessary permits, and he was "still at the beginning of the road". In order for a citizen to apply for a permit, he must present the following documents[1560]:

1. Proof of land ownership.
2. Certificate of identity.
3. Police report on the required engine.
4. License for the engine, including its number, kind, and power.
5. Discharge from the Ministry of Finance.
6. Approval of the Peasants' Union.
7. Approval of half the landowners, which often requires probate of the estate. [Note that, due to inheritance laws, much private property is actually under multiple ownership.]
8. Approval of social security.

Assembling this documentation is so cumbersome and time-consuming that unauthorized drilling, with a fine usually varying from SL 25 to 50, is far easier. Further, there are few personnel to monitor what is taking place and enforcement is usually delegated to the police, who have more important duties[1560].

5.6 Current State of Water Legislation and Administration

By the 1980s, the Syrian Arab Republic was reaping the benefits and liabilities of its scientific advances and crazy-quilt administrative system for water. Impressive advances in development were being impaired by the inadequate and overly complicated administrative structures. An overall review of water legislation was instituted with the goal of unifying it into a practical framework. The result was a move to consolidate all agricultural water regulation and development into a newly formed Ministry of Irrigation, and to consolidate development of drinking water and sewerage into a directorate under the Ministry of Housing and Public Utilities.

Recent legislation has provided the following laws:

(1) **Law Number 3 of 1984.** Deals with land ownership and the confiscation of land by the government for the construction of water projects.

(2) **Law Number 14 of 1984.** Deals with the establishment, as part of the Ministry of Housing and Public Utilities, of a public institute in each of the fourteen administrative governorates, charged with the planning and execution of projects providing

drinking water and sanitation. The Ministry of Housing and Public Utilities is to be the only authorized agency to plan, execute, and coordinate projects for the provision of drinking water and sanitation and is to replace or take over responsililities of any previous authority dealing with this field throughout the country. The responsibilities of the fourteen public institutes were defined as follows:

- o To prepare, coordinate, and execute plans in the governorate relating to drinking water and sanitation within the overall gavernment policy, while taking into consideration the economic and financial indicators, and then to recommend these plans to the authorized ministry.

- o To study, plan, and execute drinking water and sanitation projects in each governorate.

- o To administer, maintain, and supervise drinking water and sanitation projects in each governorate.

This law has been put into effect, but it is facing problems for the following reasons:

- o The lack of detailed studies for some water basins.

- o The lack of specialized staff to be put in charge of projects. The absence of qualified technicians to prepare studies and to supervise the execution and maintenance of major projects is hindering the implementation of government policies in this field.

- o The slow pace of mechanization has maximized project costs.

- o The need to import materials and parts creates financial problems, which offset expected enhancement of economic growth.

- o The absence of drinking water and sanitation statistics for many towns and villages in the countryside delays planning and slows down the execution of projects. Thus, a significant sector of the population continues to depend on traditional sources for drinking water and is deprived of sanitation services.

(3) Law Number 16 of 1985. Deals with the establishment of the Ministry of Irrigation. The main responsibilities of the Ministry of Irrigation are the following:

- o To prepare studies related to water resources.
- o To keep track of measurements of water levels and other indicators.

- o To develop plans to protect water resources from pollution.
- o To regulate ways and means of making the best use of water resources.
- o To recommend needed projects and introduce legislation to facilitate the execution of water projects.

Despite the difficulties of establishing a new department, the Ministry of Irrigation has in its short life gathered a cadre of qualified staff into a centralized agency concerned only with water resources. A national agency for hydraulic affairs and major water projects now reports directly to the Minister of Irrigation concerning the study and the execution of different water projects. This has led to the centralization of the data collected, more efficent operations, and less dependency on foreign experts. The Ministry has also recommended additional legislation to facilitate cooperation between the Ministry of Irrigation and other government agencies, and to enhance the continued recruitment of staff qualified to plan and execute projects relating to water resources development. Among the most important of the Ministry's recommendations was the establishment of directorates of irrigation according to natural water basins and not according to administrative governorates.

(4) Law Number 17 of 1986. Deals with the establishment of directorates according to natural basins. Syria is divided into seven major basins, each with its own directorate. These directorates have already started to work. Only the Directorate of the Euphrates Basin needs more organization because of the magnitude and variety of the responsibilities assigned to it.

Upon the recommendation of the Ministry of Irrigation and by a decree of the Prime Minister, the Government has established a specialized committee to oversee the following:

- o A review of previous legislation which would lead to recommendations of new laws necessary for the facilitation of the responsibilities of the Ministry of Irrigation.
- o The introduction of legislation to enhance the modernization and development of agencies working with water resources.
- o The identification and explanation of concepts pertaining to modern water resources legislation (such as, for example, "hydrological unit" and "hydraulic basin") and the clarification of their relation to surface and groundwater resources.

- The recommendation of legislation to protect sources of surface and ground water from overuse and from pollution, so that groundwater is "safe, secure, and not depleted". This applies mainly as it applies to artesian wells, damage to which would be a major threat to large centers of population.

- The working out of a long-range water policy that will provide the nation with water for both irrigation and drinking, especially in consideration of the tremendous demographic changes and shifting economic needs of the present time.

- The introduction of legislation which considers water resources as part of the national wealth and penalizes heavily any violation that jeopardizes the safety and security of water resources.

- The review of policies related to the costs of water, mainly drinking water, and to the right to use certain springs for irrigation purposes.

These reforms and the ongoing studies are a measure of the seriousness with which the government of the Syrian Arab Republic now regards its water problems. It is too soon to tell how effective the new structures will be, whether they will indeed consolidate the regulation of water into a rational and workable system or whether the new systems will be yet another layer of bureaucracy.

Chapter Six

CONFLICTS WITH NEIGHBORING STATES OVER WATER

Syria's water conflicts with its neighbors have, with few exceptions, been until now deeply imbedded in its overall bilateral and multilateral controversies. Except for the dramatic fall in the level of the Euphrates during the filling of the Keban Dam, Syria's treatment of international water issues has not focused on water in and of itself, but rather on water as an instrument of other concerns of state. That this is so is perhaps a measure of the fact that Syria is only now coming to terms with looming scarcities, a situation that has been a reality for several of its neighbors for many years. As the water level in the Euphrates drops and Syria's countrywide surplus dwindles toward an absolute deficit, we must anticipate that international water sharing will become an increasingly salient issue in its own right for Syrian policymakers.

Syria today is at odds with almost all its neighbors. In some instances the conflicts are political, having to do with party ideologies and rival claims to regional hegemony. In some instances, the conflicts are historical, rooted in the post World War I antics of British and French mandatories who carved up the area to suit their own interests with little regard for local geographic and demographic realities. In one instance, implacable hostility derives from outrage at the implantation of a "colonial settler state" after the date when the Third World believed colonial adventures were to be terminated rather than initiated. These territorial and turf disputes are all the more virulent in view of the fragile and defensive newness of national identities in the region. And most of Syria's land disputes have water rights as an essential ingredient.

In the following pages, the identity, history and intensity of these water-related disputes will be examined, country by country, together with the prospects for new or intensified conflict over the region's increasingly limited water resources. In the end, we will seek to relate water controversies to the larger issues of bilateral, regional and international cooperation.

6.1 Identity, History and Intensity of Conflicts

Syria shares water systems with all of its neighbors. Turkey, its large neighbor to the north, controls the headwaters of both the Euphrates and the Tigris, while Syria is upstream of Turkey on the Orontes for the sensitive Hatay-Alexandretta region. Iraq, Syria's rival in the stakes for Baath ideological legitimacy, is

low man on both the Euphrates and the Tigris, although Syria's present utilization of its short frontage on the latter river is minimal. Jordan is downstream from Syria both on the Yarmuk and on major aquifers in the steppes. Lebanon controls the headwaters of the Orontes, but Syria controls that part of Lebanon if anyone does. Israel is downstream on the Yarmuk, but by occupying the Golan Heights and patrolling in southern Lebanon it controls all the major sources of the upper Jordan system including those that rise in Syrian territory.

In a region of increasing water scarcity, all the above relationships are fraught with conflict. Even were Syria the best of friends with these neighbors, the issues of water use, scarcity, and degradation would require careful negotiation to achieve an equitable arrangement to serve the interests of all parties. As it stands, the relations between Syria and its various neighbors range from variable to consistently bad, and efforts at negotiation have been always difficult, often impossible.

6.2 Controversies with Turkey

Syria-Turkish relations are tenuous with resentments going back to Ottoman days. Syria was the scene of several ill-fated rebellions against Ottoman rule during the nineteenth century and, as ethnic nationalisms grew to mirror the Turanism of the Young Turks, Damascus became a hotbed of Arab separatist sentiments. The starvation endured in the region during World War I, especially severe in Syria, was seen there as punitive and has not been forgiven although it may eventually be forgotten.

The Turkish-Syrian frontier, drawn in Europe by Europeans without consent of the parties, left in Turkey the fertile regions of Diyarbakir, Mardin, Gaziantepe and Harran, a plateau that is geographically an extension of the Syrian Jezireh. It was also ethnically Arab, and had been claimed as such by Sheikh Hussein ben Ali, the Sharif of Mecca who was the Arab interlocutor in the famed Hussein-McMahon Correspondence in which the Britain pledged -- mendaciously as it turned out -- to support Arab independence in return for Arab help to the British war effort. This plains region, which still resonates in Syrian sentiment though no longer in Syrian government policy, is the site of Turkey's massive Southeast Anatolia Project (GAP). To Syrians it appears that Turkey is using the development of alienated Syrian land to harm Syria.

"Turkey is stealing our water and trying to sell it back to us," is how one Syrian official expressed these sentiments(c.i.). Looking at the Great River Euphrates, which from earliest antiquity has been a cornucopia of flowing abundance to its adjacent peoples, such attitudes seem natural. Five thousand years of urban settlement and irrigated agriculture give rise to a rational belief that

the water is there in perpetuity, a sure source of life and sustenance to those who live along the river's banks. The specter of scarcity would be barely credible, except that it has already been presaged by low water in time of drought that turned off the turbines at the Euphrates Dam.

As with many of the boundaries imposed by European fiat, the Turkish-Syrian frontier was drawn with little regard to hydrologic realities[4556]. Through much of its length, the border followed the old Berlin-to-Baghdad railway. Quite literally, a passenger exiting the train to the north would be in Turkey; his seat partner who stepped off the opposite side of the carriage would be in Syria. The hydrologic complication was that the railway had originally been surveyed to minimize the number of culverts required. The rails followed the base of the foothills at the most level topographical line, just before the welling springs cut ravines for perennial flows. Thus, the major springs and permanent streams are in one country, the watersheds feeding those springs in the other.

Despite historical resentments and topographical irrationalities, the sharing of Euphrates waters between Syria and Turkey is perhaps the most negotiable of the country's water problems. The nascent aspirations for Syrian or Arab nationhood, which had been frustrated by the latter-day Ottoman Empire at the end of the nineteenth century and beginning of the twentieth, were fettered even more severely by the French Mandate. The growing struggle for Syrian independence during the period 1920-1946 was directed against the French and anger against the Turks was siphoned off in the realization that the Turks had also been victims of European domination. Moreover, modern Turkey is not seen as a rival to Syria for hegemony in the Arab world. Turkey is simply a neighboring state, one too powerful to be challenged by force, but with a common historical experience to ease discourse. With Turkey, unlike its other neighbors, Syria can interact in the languages of international diplomacy, national interests, and trade -- far less complicated than the idioms of Arab nationalism and Arab-Israeli confrontation that govern relations with its other neighbors.

For Syria it is well that this should be so, for the Euphrates is by far the most serious of the international water problems it is facing. It is the Euphrates which currently gives Syria a cushion of countrywide surplus, although some regions suffer severe water deficits today, and even that Euphrates surplus is in jeopardy. If Turkey's GAP schemes are successful -- and the record of such projects elsewhere warrants skepticism at least with regard to completion dates -- then the amount of Euphrates water available to Syria will be drastically reduced. Some mutually agreed regime to regulate the apportionment of Euphrates water is essential to Syrian security.

6.2.1 Turkey/Syria: The Euphrates

Development in the Euphrates basin has, to date, been undertaken on a strictly unilateral basis by the three riparians. There has been little coordination and no integrated planning. Until 1974 no adverse ecological impact was evident.

The first problems arose in 1974 and 1975 when, with Turkey's Keban Dam and Syria's Tabqa Dam filling at the same time, the amount of water flowing downstream to Iraq fell to a fifth its normal rate. Tripartite meetings were convened in May, 1974, but quickly deadlocked over conflicting claims for quotas (Syria demanded 350 m^3/second; Turkey offered only half that amount)[0595]. The resulting crisis was mediated by Saudi Arabia with the Soviet Union as a silent partner. The resolution involved a one-time "good will" release of water by Syria to ease Iraq's shortage and a verbal Turkish acquiescence -- soon dormant, but long irrelevant because for years thereafter Turkey's withdrawals were trivial -- to the Syrian quota demand. The crisis apparently had more to do with the state of political tension between Syria and Iraq than it did with water. The resolution was purely *ad hoc* and produced no permanent mechanisms for resolving future problems. Turkey seems to have been only marginally included either in the political posturing or the physical solution to that year's water scarcity[3235].

There is precedent, however, for water discussions on the Euphrates basin. Already in 1926, under the French Mandate, there was an agreement with Turkey regarding the supply of required water for Aleppo and its environs from the Qweik and Euphrates rivers. This agreement is rarely cited and seems no longer to be in effect, both because of the demise of the French Mandatory government which concluded it and because needs have long since outstripped the demands foreseen at that time. But the salient principle embodied in the agreement, that of equitable apportionment of water, could provide a workable starting point for future negotiation[4279]. A 1946 agreement between Turkey and Iraq, which is still extant, includes the obligation for mutual consultation regarding development projects so as to adapt them "as far as possible" to the interests of both states[3235]. These too are useful principles. A later effort between Syria and Turkey in 1952, regarding two of the bi-national tributaries of the Euphrates, failed of ratification because Turkey's National Assembly wanted a comprehensive agreement for all the common rivers[4556]. The sensitivity of the Hatay-Alexandretta question for Syria precluded discussion of the Orontes and thus blocked further agreements at that time.

Since the crisis years of the mid-1970s, consultation regarding the Euphrates seems to have been desultory, mostly at technical levels and outside the spotlight of public notice. Until recently, there seems to have been an effort by the parties to keep water

issues separate from political conflicts. Tripartite technical contacts were reported in 1976 and 1983, with bilateral contacts between Turkey and each of its two co-riparians taking place in between. In 1980, a bilateral agreement by which Turkey guaranteed 500 m^3/second to Syria was reportedly signed, and the formation of a Tripartite Euphrates River Commission was announced[3267]. In 1984, both Turkey and Iraq accused Syria of having refused to discuss water apportionment for more than a decade[1247].

Discourse on some level has also been maintained through intermediaries. Saudi Arabia was active in resolving the 1975 crisis in the interests of regional stability. The Soviet Union, with its prestige on the line through technical and financial involvement in development projects in both Syria and Iraq, seems to have been influential in 1975 and may even have a secret but formally agreed-upon role as arbitrator between its two friends. Bilateral and multilateral funding agencies serve as an instrument of communication and coordination. The World Bank withheld funding requested for Ataturk Dam because of the lack of agreement on fair apportionment of waters for the downstream riparians, and requests to Islamic and Gulf agencies were tabled for the same reason. Whether this latter refusal was due to Syrian objections, as Turkey professed to believe, or whether it was part of the routine collaboration among agencies regarding funding criteria is not clear. It might be noted, however, that, when the Ataturk request was being considered in the Gulf, the director of AFESD was a Syrian economist, Dr. Muhammad Imady, who has now returned to Damascus as Minister of Economy and Foreign Trade.

The impact of this intervention has been twofold. First, the communications network has kept countries apprised of their neighbors plans and enabled them unilaterally to modify their separate development plans so as to achieve some form of *de facto* coordination. Second, the lack of outside help has pushed Turkey in particular to expand its own in-country development potential so that its companies are now significant exporters of engineering expertise (e.g., a Turkish company is building Iraq's Bekme Dam and other Turkish companies are exploring for Syrian oil).

Most recently, with the Ataturk Dam rapidly becoming a reality, water conversations between Syria and Turkey have once again achieved a political and semi-public significance. Water was on the agenda when Syrian Prime Minister Abdul-Rauf Kassem visited Ankara in 1986. Water constituted one of a pair of linked protocols signed in Damascus during Turkish Premier Turgut Ozal's return visit in July 1987. These twin agreements specified that: (1) Syria and Turkey would cooperate to prevent strikes by insurgents across their mutual frontier and would share counter-insurgency intelligence through Interpol; (2) Turkey would guarantee to supply Syria with 500 m^3/second from Ataturk Dam (15,768 Mcm/year), an arrangement which the two parties believed to form a valid basis for future tripartite agreement. Ozal (*Cumhuriyet*, 7/18/87) said that President Assad had intervened personally to expedite the

agreement and that Syria would cooperate in the feasibility study for Turkey's proposed Peace Pipeline. These protocols are to be in effect for two years, annually renewable thereafter if neither party objects.

A November 1988 meeting in Ankara of the Tripartite Euphrates River Commission was the first to be held at ministerial level for several years. Syria's Irrigation Minister, Abdul-Rahman Madani, and Iraq's Minister of Agriculture and Irrigation, Karim Hassan Ridha, reported no concrete discussion of the major substantive issue they have with Turkey: the low volume of the river. They appointed a committee to collate the flow records and report back within three months (*al-Khayyat*, undated clipping from late 11/88). However, the reconvening of the commission at elevated level under Turkish auspices was taken as a token of Turkish recognition of the seriousness of the problems that will follow the completion of GAP. The Turkish-Syrian economic protocol concluded in August 1988 by Turkey's Minister of State Mehmet Yazar and Syria's Deputy Prime Minister for Economy Selim Yasin, which includes provision for a jointly constructed dam on the Euphrates at the border, is another indicator of Turkey's interest in dealing with these problems. (EIU 88:4).

6.2.2 Turkey/Syria: The Orontes

Negotiation between Turkey and Syria on the Euphrates has often been complicated by a Turkish desire to conclude a package deal including the Orontes. Turkey's contention is that they should consider at the same time all those rivers that flow from Turkey into Syria (Euphrates and tributaries, Qweik) and the rivers that flow from Syria into Turkey (Orontes, Afrine). This argument contains a certain surface logic, but, in Syrian eyes, it appears as a backdoor device to wring recognition from Syria of France's officious donation of the Alexandretta region to Turkey.

French plans to develop the Orontes in the early 1930s divided the river into three areas: (1) the stretch between Homs and Hama, (2) the Ghab, and (3) the Amuq Plain[3235]. On the eve of World War II this latter area, along with the classically Syrian cities of Alexandretta and Antioch, was ceded to Turkey by the French mandatory authorities in an attempt to improve Franco-Turkish relations. The Turks renamed the area Hatay Province. Over time a certain amount of population transfer has taken place, and the citizens of Antioch are fluent in both Turkish and Arabic.

The Syrians were understandably outraged, and the transfer became a rallying cry for nationalists and anti-colonialists throughout the Arab world. For the loss of Alexandretta and Antioch not only deprived the city of Aleppo of its traditional access to the sea, the loss of the well-watered Amuq Plain also

deprived Syria of one of its richest agricultural areas. Since independence the Syrian Government has refused to recognize the loss and maintained a campaign -- stronger in the 1950s than it is now -- for the return of the lost areas. Even today, Syrian maps show Hatay Province as part of the Syrian Arab Republic. Relations with Turkey, Syria's erstwhile overlord during the Ottoman period, remain cool, dropping to frigid when this subject is raised. Syrians and Turks are at their most cordial with Alexandretta-Hatay is not mentioned.

The differences between the sentimental Syrian memories of Diyarbakir and the politically irredentist feelings toward Antioch are striking. There are several reasons for this. First, the Jezireh region was remote and until very recently sparsely populated, as is the northern Jezireh (Turkey's Harran plateau) to this day. The number of Syrians who have active ties with Harran is relatively small. Second, the Alexandretta-Hatay region was a thriving member of the Syrian economy and social fabric at the time of its alienation, prosperous and educationally advanced. Its loss was felt as a disruption of Syrian life. Third, the two decades that intervened between the truncation of Syria's northern plains and the lopping off of its principal seaports are important both temporally and ideologically. Syria's leadership is relatively young and few of the current leaders can recall the time when a Syrian could travel without passport to Diyarbakir, but they do remember Antioch and Alexandretta. More, at the time of the earlier loss, Syrian identity was fluid and ill-defined. By 1939, after two decades of struggle against the French Mandate, Syrian nationalism was fully conscious if not fully organized. The loss of Alexandretta was felt as an affront to Syria's *amour propre*, the loss of Harran was merely part of the process defining it.

The hydrological issues on the Orontes, the only Syrian river that flows north, are also significantly different than those for the Euphrates. The sizes of the two basins and the volumes of their flows are simply not comparable. The Euphrates comprises more than 80% of the water available to Syria. Its continued quality and adequate quantity are essential to Syrian well-being. The Orontes at its best is only a drop in Turkey's annual water bucket. Even within the Hatay Province, the main stream of the Orontes is only one of several important water sources, and of these others the Karasu lies wholly within Turkey's borders.

The Syrian Ghab project has altered the course of the main stem of the Orontes and has surely degraded the quality and diminished the quantity of the water flowing into Hatay. But these changes are now twenty years old, and Turkey has had ample time to adapt its systems to accommodate the new circumstances. Whatever minor modifications might be useful to improve the systems or mitigate their downstream impact, the passage of time has removed the immediacy and urgency of the Orontes and the Ghab as issues requiring negotiation.

The one issue that does remain for mutual accommodation is the Afrine. Syria has plans to build a medium-sized dam on that river and to install some 20,000 ha of new irrigation. This will surely affect the quality and quantity of water flowing into Hatay. The configuration of the Afrine basin is singular, however, in that Turkey controls both the headwaters and the lower reaches of the river. If Syria, in the middle position, made changes in the river which adversely affected its downstream neighbor, that same downstream neighbor could retaliate against Syria through its control of the Afrine headwaters.

In the circumstances, it seems safe to say that Turkey has matters to discuss, but no great need for formal negotiations regarding the water resources of the Afrine. Syria can and probably will proceed unilaterally, but at its own risk. If Syria's projects prove too damaging to downstream Turkey, then Turkey has the upstream riparian position to forestall them as well as the military superiority to buy immunity from other sanctions. Syria can proceed with its plans in moderation, so long as it shows due consideration for the needs of what it will continue to regard as the "Arab peoples of the Alexandretta district". Low-level technical conversations (as among engineers, without prejudice as to sovereignty) could be helpful to determine the needs of the peoples of the basin and adapt plans to meet them. Beyond that, an agreed accommodation could be useful to both, but is necessary to neither.

6.2.3 Turkish/Syrian Accommodation

The major water issue in contention between Syria and Turkey remains the Euphrates. This river, a world-class watershed, is the scene of impressive development plans for both countries.

For Syria, the Euphrates has been the flagship for state development. Despite technical problems, which at least in part have been the result of poor work by foreign consultants, the Euphrates region is seen as an exemplar of what Syria can do. The massive Tabqa Dam (now only the largest of a series) is itself a source of national pride, the electricity it produces has changed the face of all Syria, and the technical problems that have delayed land reclamation are seen as setbacks rather than failures. The Euphrates is yet expected to provide livelihood for its residents and food for the nation, as well as a prestigious showcase of regional rural development to demonstrate the validity of the Baath model.

Turkey's interest in the Euphrates came later than Syria's, but is none the less intense. Early work such as the Keban Dam was hydroelectric only and therefore, in terms of water, a nonconsumptive use. Only in the 1980s did Turkey turn to an integrated development of its southeastern provinces, a region that from the

viewpoint of Ankara and Istanbul is extremely remote. The Ataturk Dam will be the fifth largest in the world; its tunnels, canals and pipes will transport water many hundreds of kilometers to the east to be used and re-used many times over before its much diminished and polluted residue rejoins the Euphrates by way of its eastern tributaries in Syria. This project has assumed great ideological importance for Turkey, both as a demonstration of its technical and economic expertise and as a long-overdue investment in the peoples (many of them Kurdish and other minorities, although Turkey prefers to ignore that fact) of its neglected southeastern region.

If Turkey's plans are successful, the amount of water available for Syria in the main stream of the Euphrates will be significantly reduced, with serious consequences both for its present hydroelectric production and its future irrigation potential. Indeed, the polluted residues from Turkish irrigation will rejoin the Euphrates downstream from Syria's three hydroelectric dams, leaving them high and dry. Coordinated planning is needed to mitigate these consequences. If Turkey and Syria are both successful in developing their stretches of the river to full potential, the residue for downstream Iraq will be a briny trickle good for little more than flushing the river bed. Thus, now as never before it seems imperative that the three riparians should plan together for integrated basin development. The preoccupations, antagonisms, and political rivalries that have blocked prior efforts at discussion are a luxury that none of the parties can now afford.

It should be remembered that for much of the period covering the developments in the Euphrates basin -- that is, the 1950s to present -- the three riparians have been focused on other issues. Syria and Iraq were both extremely unstable during the early stages of development. The Baath Party, and especially the 1970 "corrective movement" of Hafez el-Assad, provided Syria with its first stable government since independence. Turkey also has gone through several periods of civil strife, ending in each case with a military takeover. Syria's foreign policy has been directed toward the Arab world, with questions of Pan-Arab leadership, conflict with Israel, civil war in Lebanon, and the recovery of occupied Syrian land taking priority. Turkey has looked more often toward Europe of which, as a member of NATO, it considers itself a part. These divergent interests have left Syria and Turkey with relations that are very correct but sometimes distant, although they are active trading partners.

Syrian policy toward Euphrates arrangements has vacillated, sometimes favoring a tripartite authority for the whole basin and, when relations with Iraq turned sour, sometimes demanding a bilateral accord with Turkey alone. For its part, Turkey prefers a trilateral arrangement that includes Iraq, now its primary trading partner. Commissions from the Iraq-Iskenderun oil pipeline are an important source of foreign exchange for Turkey, and its trade with Syria is also increasing in importance. Turkey is determined to

push forward with GAP, but it is reluctant to jeopardize lucrative trade by imposing hardships on its downstream riparians[3235]. This offers Syria some scope for negotiation in a situation in which Turkey is clearly the dominant power both geographically and militarily.

At present, Turkey seems to be signalling interest in accommodation for its own internal reasons. Although Turkey is striving to accelerate work on the Ataturk Dam toward completion in 1991, there were work stoppages at the site during summer 1988 due to lack of funding[c.i.]. Severe austerity measures were announced in the National Assembly in Ankara by Turkey's Finance Minister Ahmet Temocin on October 29, 1988. Moreover, work on the dam has now reached the stage where imported inputs become increasingly necessary. This will require foreign exchange or credit. Turkey has done extremely well using Turkish companies, Turkish manpower, and Turkish resources for the heavy construction phase of the work; completion requires turbines, electrical materiel, tunneling devices, and other sophisticated equipment that must be acquired abroad. Turkey's need to achieve a basin-wide agreement that will untie the pursestrings for major international credit does place some leverage, at least temporarily, in the hands of its Syrian and Iraqi co-riparians.

This opportunity for negotiation by Syria on less than totally disadvantageous terms is temporary at best. Turkey is far larger and stronger than Syria, and Turkey has the advantage of the upper riparian position. Once Turkey has acquired the funding and installed its facilities on the upper Euphrates, there is little likelihood that it could be dissuaded from extracting as much water as it can profitably use. Now is the time to work out an arrangement that, while allowing Turkey to develop its southeast, will provide some safeguards for the needs of downstream riparians.

For Syria, the strongest position against Turkey would be a unified negotiating front with downstream Iraq. Not only would a common front increase the moral suasion of the downstream position, it would also give Syria an iron-clad excuse for excluding the sensitive Orontes issue from discussion. In view of the long history of antagonism between Damascus and Baghdad, this seems unlikely to happen.

6.3 Syria and Iraq

The political chasm between Syria and Iraq only increases Turkey's natural dominance, and this chasm is both wide and deep. Some historians might trace this to the imperial divisions of remote antiquity or, at least, to the rivalries beteen Ummayad and Abbassid empires in the Islamic period. While historical memories do certainly resonate in the perceptions of modern Syrians and

Iraqis, it is sufficient to understand that each country considers itself the natural leader of the modern Arab world. They are not the only contenders for that role, but it assumes a greater importance for them than for others in the light of the Pan-Arab world view of the ruling Baath party(ies).

For the last two decades, rival wings of the Baath Party have governed in Damascus and Baghdad. The claims -- often well-founded -- that one of these fraternal regimes was trying to overthrow the other have been too numerous to count. The oil pipeline transporting Iraqi oil across Syria has been the object of repeated thrust and counterthrust in both directions, now mercifully ended by the completion of an Iraqi line across Turkey and the conversion of the Syrian line to carry Syria's own newly discovered oil from Deir ez-Zor. Most recently, the bloody Gulf War found Pan-Arabist Syria supporting non-Arab Iran against Arab Iraq on the grounds -- notably unsuccessful in application -- that it could use its influence in Tehran to protect the Arab Gulf states. The hospitality Damascus has offered to Kurdish groups, with alleged connections to one or other of the myriad Syrian security organizations, has far more to do with Iraqi-Syrian relations than with any Syrian desire to annoy Turkey.

There are three hydrologic issues of mutual concern to Syria and Iraq: the Euphrates, the Tigris, and shared groundwater. Of these the Euphrates is clearly the most important for Syria.

The Tigris is of utmost importance to Iraq and far less important to Syria and Turkey. Syria's frontage on the Tigris is short and conveyance of water from this remote corner of the country would be very costly. Syrian reliance on Tigris water for anything other than local consumption would be far from ideal. For Turkey, too, the Tigris is remote and a much lower priority than the Euphrates. While works on the Euphrates are well under way, Turkey's feasibility plans for the Tigris are not yet complete. For Iraq, of course, the Tigris is by far its most important source of water, a massive annual volume passing through Iraq's population centers, with extensive engineering works already in place and more planned or under construction. In terms of both equitable apportionment and prior use, Iraq has very strong claims on the Tigris. Syria's claims on Tigris water -- and even its ability to use it -- are small. The participation of Turkish construction companies in the construction of Iraqi dams in the Tigris basin points to an accommodating stance from Ankara which should, if the Baghdad government is wise, be formalized while the mood lasts.

As for groundwater, the matter has been inadequately studied. Discussion involving anything more concrete than general principles is probably premature, although the subject should be on the agenda for the near future. Meanwhile, ongoing research should be pushed so as to assess the capacity of the aquifers and trace their inter-

connections in Syria, Iraq, Saudi Arabia, Jordan, and perhaps as far as Kuwait. Safe yields must be defined before fair portions can be allocated, preferably on a regionwide basis.

It is the Euphrates, and specifically Turkish development of the Euphrates, that poses a severe and immediate threat to Syrian and Iraqi well-being. The crisis of 1974-1975 was ephemeral and will be remembered as very small compared to what will be the case after the filling of Ataturk Dam and diversion through the Urfa tunnel (see Fig. 1.2). Not only are Syrian and Iraqi development projects at grave risk, but it is probable that, without an agreement, Iraq will be deprived of nearly all its historic use of the Euphrates. The three parties need to work out a regime for the river that will cover:

- o apportionments for each country, including sub-basins;
- o scheduling of releases from the major dams to meet the most urgent needs of downstream users;
- o control of water quality, with adequate cleanup provided by each polluting party;
- o a tripartite regulatory regime to monitor and enforce the agreement;
- o special schedules to cover exceptional circumstances during the coming on line of new facilities.

What are the chances for an effective three-way agreement for the management of the Euphrates basin? Turkey has good, or at least civil, relations with each of its neighbors. Iraq has supplanted Germany as Turkey's prime trading partner; Syria is now cooperating with Turkey on the control of insurgents. The strength of these ties, as compared to the animus imbuing the Iraq-Syria leg of the triad, merely confirms the dominance of Turkey as the lynchpin of the relationship. If Syria and Iraq want to protect their claims to Euphrates water, they will have to improve their own relationship. Otherwise, the tripartite regime will consist essentially of two bilateral agreements with Turkey in which Turkey is in each case the more powerful partner. This will in all likelihood constitute a Turkish *diktat*. To prevent this, Syria and Iraq must cooperate in presenting a lower riparian position -- now while Turkey feels the need to come to an agreement and while it has a government that apparently (*vide* Ozal's Peace Pipeline proposal) values the image its neighbors have of it.

Syria and Iraq have been at odds for so long that it is difficult to see them making common cause. Even now, with the Gulf War scarcely (*inshallah*) over, the two countries are supporting rival surrogates (indeed, rival regimes) in Lebanon. At some time soon, they will have to choose between a cooperation on water -- at least at the technical level -- that will give their impressive development efforts a chance of success, or contining the savage competition for leadership of the Arab world that has characterized their

recent relationship. If they choose the latter course, one must regretfully predict that neither will succeed, economically or politically.

6.4 Syria and Jordan

The relations between Syria and Jordan could almost be described as a *menage a trois*. Each negotiates with an apparition looking over its shoulder, and it is the same ghost that haunts them both: The Palestinians.

Both Syria and Jordan have important Palestinian populations. This population segment is larger in absolute number and in population share for Jordan, but is politically and culturally significant for Syria as well. Moreover, each country has an ideological stake. For Jordan, this has involved the sovereignty it claimed until July 1988 over the West Bank; for Syria, it is the dominant place of the Palestine Question in the Baath's Pan-Arab pantheon. As the pendulum of Syrian-Jordanian relations has swayed -- from Syrian invasion of Jordan in 1970 to Jordanian harboring of Syrian Islamic dissidents in 1980 with patches of economic, educational, and even political cooperation in between -- one senses a Palestinian rationale at the fulcrum of the swing. More than with any other two Arab states, Syrian-Jordanian relations can be seen as a reflection of the fortunes of the Palestinian movements. In any negotiation between Syria and Jordan, the observer must watch for the hand of this spectral third party.

There is another ghost, a real one, that has haunted Syrian-Jordanian relations. Jordan's founder, King Abdullah, had aspirations for the leadership of "Greater Syria" that inspired both fear and opposition in Damascus. Not only did this objective threaten to usurp the role that Syria erogated to itself, but Abdullah, by virtue of his sharifian ancestry, carried in himself an Islamic legitimacy that could not be matched by a secular regime. This ghost is fading now. King Hussein, after a tenure on the Jordanian throne approaching four decades, seems very conscious of the obligations imposed by his Hashemite heritage, but he shows no sign of espousing his grandfather's larger ambitions. Hussein's quittance in favor of the Palestine Liberation Organization of all claim to the West Bank may well have laid Abdullah's ghost for good, but it brings the Palestinian specter into clearer view.

Hydrologically, there are two issues of mutual concern to Syria and Jordan: the Yarmuk River and shared groundwater.

Of the two issues, groundwater is both simpler and more complicated to handle. Technically, it is far more difficult. The aquifers have not been adequately evaluated to determine their safe yields with precision, and the parties are at present withdrawing

from those aquifers at rates which they know to be excessive and for which Jordan is already paying a price at Azraq. These overdrafts, and their ecological consequences, only make more difficult a process of scientific analysis that already involves highly sophisticated technology. On the other hand, the political issues seem manageable. The region in question is sparsely populated on both sides of an uncontended frontier, so there will be little in the way of a local lobby to constrain the choices of policymakers.

Jordan, because its water budget is so much smaller than Syria's, needs this water more, and is already conveying large quantities of pumped groundwater to population centers to meet immediate requirements. Further, Syria is on the up gradient of these aquifers and can, lacking a binding agreement, simply take its share first. These facts would seem to give Syria the upper hand in negotiation. Degrading the aquifer, however, would eventually harm both parties, and this provides a fairly strong incentive to cooperation.

And there are other incentives to cooperation. First, the third party in these aquifer systems is Saudi Arabia which, being downstream, would be the first hurt. Syria badly needs Saudi economic aid to stay marginally solvent. Second, Syrian-Jordanian relations are at present in their most friendly mode. The pro-Syrian Zaid Rifai is Prime Minister in Jordan, Hussein has drawn back from entanglements with the PLO's Yasser Arafat, and trade between the two countries is fluorishing. Third, both Syria and Jordan now seem deeply committed to the Unity Dam, a project of great immediate importance. Work has apparently begun, with both Syrian and Jordanian companies on the job. Stopping now would be hydrologically disastrous for Jordan, and economically and politically embarassing for both. Lack of appropriate cooperation on groundwater, souring relations to the point of placing the Unity Dam in jeopardy, would be absurd.

The Unity Dam, under various names, has been planned for almost 40 years at a site on the Yarmuk river straddling the Syrian-Jordanian border. First proposed in 1952 by an American engineer, who saw the site from the air, the plans for the dam have been revised many times, but always failed to be implemented for political reasons. The dam, then called Maqarin, was included as one of the elements of the Greater Yarmuk Project that was mapped out by Syria and Jordan in 1957[3235]. Of this plan, only Jordan's East Ghor Canal and its irrigation networks were constructed. The Maqarin dam was blocked on several occasions by Israel by means of objections to the American government, whose agencies would have been providing funding and technical advice. Work did begin on a smaller Yarmuk dam downstream at Mukheiba that was to have been funded by the Arab League as part of its 1964 Jordan River diversion scheme, but this project was bombed by Israel while under

construction. Syria was preoccupied during this period by its own internal instability and did little to implement projects in its part of the basin.

Indeed, Syria had little incentive to push forward such work at that time. Even before depopulation by advancing Israeli armies in 1967, southwestern Syria was one of the least populated regions of the country. The land is rocky, the hills are steep, and the amount of water available in the basin is really very small compared to what is found elsewhere in Syria. The fact that small dams have been built and some irrigation installed in the late 1970s and early 1980s is probably due less to the objective economic potential of the district than it is to the historical strength of the Baath Party in Deraa. As in any political system, projects are often granted as a reward for proven loyalty.

Throughout the 1970s, Syria's interest in developing the Yarmuk basin was minimal for two reasons. First, it was concentrating its efforts and resources in other regions that promised a quicker and more fruitful return. Even now, the irrigation potential of the district is deemed so moderate that Syria is far more interested in hydroelectric power to feed its national grid (and further its goals for rural electrification) than it is in the water itself. Second, its relations with Jordan were too unfriendly to warrant Syria investing any resources or taking any risks to benefit Jordan. For several years during this period, Assad and Hussein did not even exchange holiday greetings. Only in 1984 did relations begin to mend, starting with parliamentary delegations and continuing through trade agreements despite Jordan's deplorable (from Syria's viewpoint) displays of independence in such matters as restoring relations with Egypt and concluding agreements with Arafat. By that time, Syria was feeling isolated in the Arab camp and was willing to soften its demands for fraternal relations, mellowing its complaints at these initiatives to a mild grumble.

The outline of the agreement for Unity Dam that was concluded in September 1987 reflects these realities. The dam, with a total storage capacity of 220 million cubic meters, will be built jointly by the two countries. Most of the water will go to Jordan; most of the electricity will go to Syria; and Jordan will organize most of the financing as well as handle the still ticklish problem of potential Israeli pre-emption. Syria will continue with the construction of seven small dams for local consumption, total combined storage less than 20 Mcm, on the upper tributaries of the Yarmuk. This arrangement gives both countries what they most need.

Jordan is desperate for water, and the Yarmuk floodwaters are the last source of relatively cheap water that Jordan can develop. The distance between the Unity Dam site and Jordan's population centers is moderate compared to other options (e.g., the Qa-Disi aquifer), and the configuration of proposed conveyance networks will allow the water to be used more than once, thus multiplying its effect. For Syria, the southwestern region comprising the

Yarmuk basin is remote and underpopulated, and likely to stay that way. Barring a settlement with Israel that returned the Golan Heights to Syrian control, there are probably few Syrians who would choose to take up residence in the shadow of Israel's guns. The remaining people, who wish to live there because their ancestors did before them, are adequately served for water by the modest facilities Syria is building itself.

Syria, on the other hand, has an unquenchable thirst for electricity. Electrification, with all that it means in terms of modern amenities, has produced a revolutionary change in the life styles of rural Syrians. The prime items in the shops of one Syrian market town in the 1960s were kerosene lamps and camp stoves; shop windows in the same town fifteen years later featured hair dryers and other small electrical appliances. Expansion of electric power facilities has been a high budgetary and development priority for every recent Syrian administration. Moreover, electric power is easily transferrable over considerable distances, so the remoteness of the Unity Dam from Syrian population centers is unimportant. Recent power shortages, occasioned in part by low water at the Euphrates Dam, were sufficiently damaging politically that several cabinet ministers in Damascus lost their jobs. The outages were also a topic of acrimonious debate at the most recent Baath Regional Congress. Syria has a strong interest in developing additional, more reliable sources of electric power.

As for the financing, Jordan's credit rating is better than Syria's. Amman has already hosted one conference of potential funders and expects to present its case to another such gathering in February 1989. The Jordanian government has also argued that USAID funds once approved for this dam should be regarded as "in the pipeline" by the U.S. government. There is as yet no evidence that this argument has won the day in Washington.

The probable hitch, in Washington and with multilateral funding agencies, is the as yet unclear response of Tel Aviv. Israel has only a brief frontage on the lower Yarmuk and, in terms of extant understandings, could claim no more than the 25 Mcm/year that was agreed to in the Johnston negotiations of the 1950s. This early effort at shuttle diplomacy by America's special ambassador Eric Johnston was never completed and never ratified, but the fact that all parties have subsequently pointed to the Johnston allocations as normative in justifying their own unilateral developments gives these quasi-agreements some standing in customary international law[4279]. The problem is that Israel has in recent years become accustomed to using far more than its 25 Mcm/year, and Israel is a regional military giant with great powers of interdiction and demonstrated willingness to use those powers. No funder would contemplate with pleasure the liability or the waste of having its project blown out of the water, so accommodation is necessary.

Reports in summer 1988 indicated that the United States was mediating an arrangement whereby Israel would withdraw its opposition to Unity Dam in exchange for a much larger share (perhaps 75 - 100 Mcm) of Yarmuk water[c.i.]. There is precedent for such mediation, since the United States has had to intervene several times in the past twenty years to obtain Israeli permission for routine Jordanian maintenance at the intake to its East Ghor Canal. Indeed, the two issues may be linked in the current round of conversations. Syria seems to be watching the situation very quietly, allowing Jordan the flexibility to come to an arrangement that will make the dam possible for both countries.

Assuming that these arrangements are worked out successfully, the Unity Dam project bodes well for a more stable relationship between Syria and Jordan. Each party will be getting what it needs most and will have every reason to want to keep it that way. This means a pragmatic decision by both parties to divorce the work on the Yarmuk from any political concerns that might divide them. There remain two questions: What will the Israeli juggernaut do? And, how will the unresolved Palestinian issue, the Banquo at the feast, interfere with the bilateral relationship?

6.5 The Dispute with Israel

Syria, seen by the Israelis as one of their most "hard-line" and implacable foes, has been a bitter opponent of the Jewish State since its establishment in 1948. Throughout the 1950s and the early 1960s, the number of cease-fire violations between the two countries steadily increased[3235]. Much of this tension was the result of unilateral plans by one side or the other to develop and utilize the waters of the Jordan. Israel's 1951 draining of the Huleh swamps infringed on the demilitarized zone with Syria, and Israel's National Water Carrier (completed in 1964) enabled it to transfer large amounts of water from the Jordan basin to the coastal plain. There were numerous episodes of shooting, directly and indirectly related to these activities, that were reported by UN Truce Observers or refered to the Security Council. The Arab League plan to divert the Jordan headwaters into the Yarmuk commenced work in 1965, and Israel responded with a series of military strikes. The wave of Iraeli air attacks deep inside Syria in April 1967 was a major escalating factor leading up to the June War[3235].

With the loss of the Golan Heights in the June War, Syria lost control of the headwaters of the Upper Jordan and the diversion plan became inoperable. She also lost her shore of Lake Tiberias and the town of Quneitra, the regional capital of the Golan and an important market center of southern Syria. Returned to the Syrians in 1974 as a result of Kissinger's disengagement agreements after the October War, the town had been largely destroyed by the Israelis during their last few days of occupation. With Israeli

artillery staring down at it from the western highlands, Quneitra has not been resettled or rebuilt. Instead, it is kept by the Syrian Government as a kind of memorial to the rest of the Golan Heights, which continues to be occupied by Israel. As such, Quneitra symbolizes one of the primary determinants of Syrian foreign policy: the desire to regain the Golan before agreeing to any other form of Arab-Israeli settlement.

Syria's concern with Golan is strategic as well as symbolic. The occupation of the Golan Heights by Israel significantly changed riparian relationships in the Upper Jordan system -- to Israel's advantage and Syria's disadvantage. Before 1967, the sources of the Jordan were divided among Lebanon (the Hasbani), Israel (the Dan), and Syria (the Banias), while Lake Tiberias was shared in part between Israel and Syria. Along with Golan, Israel captured the Banias in 1967 and now, with its "security zone" in southern Lebanon, has taken control of the Hasbani as well. Thus, Israel now has absolute control of all the waters of the Upper Jordan. Syria has neither Jordan water nor access to Lake Tiberias. Moreover, Syria's foothold on the Yarmuk has been shortened by several miles. The site of the Unity (Maqarin) Dam still lies between Jordan and Syria only, but the site of the Mukheiba Dam now abuts Israeli-occupied territory on the Syrian side. These changes significantly reduce Syrian leverage in any water discussion involving the Jordan system.

In the intervening years, Israel has become totally habituated to having untrammeled control of the Upper Jordan, using as much of the water as it chooses in any way it sees fit. In the same period Syria has been learning to do without the 42 Mcm of Banias and Jordan water that had been allocated to it. Syria has in part made up this shortfall by increasing its demands on the Yarmuk, and its local needs were decreased sharply by the virtual depopulation of Quneitra province. The population that scattered before Israel's attack is now drawing its water from other basins in Syria. Even were it available, the conveyance of Banias and Jordan water from the wrong side of Mount Hermon to the regions where Syria is experiencing deficits would be extremely costly. From the viewpoint of Syrian interest, it would appear that this 42 Mcm of water is too much trouble and too small an amount to be worth quarreling over.

If Upper Jordan water is not a salient issue for Syria, the Golan Heights as territory is important both symbolically and strategically. Syrians feel extremely vulnerable with Israeli artillery perched within lobbing distance of their capital. After all, Israel has bombed Damascus on more than one occasion, so Syrian fears are not entirely irrational. Syrians are also deeply shamed by the 1967 defeat which cost them the Golan, a loss they could not attribute to the nefarious acts of a colonial power. Syria regained much self-confidence through its more respectable showing in 1973, but the recovery of the Golan Heights is still a major policy goal[4805].

The 1981 Israeli annexation of the Golan Heights left, from the Syrian perspective, nothing for Syria and Israel to talk about. The Golan as Syrian national land is a core issue for Syria. The water of the Golan region is tangential at best, for Syria's major water concerns lie in other directions.

6.6 The Lebanese Quagmire

Syria's relations with Lebanon are so convoluted as almost to defy description. History, genealogy, geography, culture, commerce, and, above all, mutual security entwine Lebanese and Syrians into a closely-meshed web of strategic interdependence. It is a complex, love-hate relationship. It is also a reciprocal relationship, with all parties acknowledging the vitality of the ties that bind them ... though often for reciprocally opposite reasons.

Fortunately for us, in the midst of such complexity, the water issues are fairly straightforward: Syria must ensure that the flow of the upper Orontes is unimpaired.

By a 1972 agreement, Syria and Lebanon stipulated that Lebanon would have the right to withdraw up to 80 Mcm/year from the Orontes. At that time, the region of the Bekaa north of Baalbek was sparsely populated, and the 80 Mcm, comprising slightly more than one-tenth of the Orontes' flow originating in Lebanon, seemed like an ample allotment. It may still be adequate. The problem is that, in the present disturbed situation, no one knows.

In 1972 there were, in retrospect, clear signs of disruption in the Lebanese body politic. Israeli bombing raids in the south had already begun displacing large numbers of villagers, and the ubiquitous Palestinian guerilla groups were disseminating firearms far beyond the traditional militias. By mid-decade the fabric of the Lebanese confessional system had disintegrated into full-scale civil war, and waves of forced migration were sweeping whole communities from south to north, from west to east, and back again. As a remote, uncontended, and fairly peaceful locale, the northern Bekaa was one of the favored destinations for migrants.

Eyewitness accounts in the 1980s(c.i.) indicate that this region is now much more densely populated than it had been a decade earlier. Descriptions show a fluorishing farm economy, with owners, tenants and even squatters installing their own pumps for personal and agricultural use -- with no meters, no measurements, no schedules, no regulation of any kind. Government monitoring of water withdrawals, along with aggregation of statistics, had virtually ceased with the civil war, so there is no means of verifying how much water is currently being used.

Since Syria badly needs an assured flow in the Orontes, for its Homs and Hama metropolitan centers as well as the Ghab development region, such a situation seems ripe for collision. There are two factors that militate against confrontation at this time. First, although Lebanese statistic-taking is suspended, Syrian measurements continue; the lack of complaint from Damascus may indicate that water extractions in the northern Bekaa have not yet exceeded the prescribed limit and that the right amount of water is indeed flowing across the border. Second, this is an area that falls within the Syrian sphere of influence in Lebanon; if anyone is in a position to impose any form of order in the area, it is Syria itself. One would expect Syria to use that influence, however circumscribed, to protect its own interests.

Syrian concern over the Litani is more a reflection of Syria's distrust of Israel than of any direct water interest. In the aftermath of the 1982 invasion Damascus expressed a concern, shared by many Lebanese, about the possibility of Israel diverting the waters of the Litani River(4642). Although it seems that Israel did not undertake diversion works, the worry was founded in oft-proclaimed Israeli intentions dating back to the Cotton Plan, in which Israel proposed to join the Litani and Hasbani rivers and appropriate the former to its own use. This would have materially harmed the farmers of South Lebanon, but Syria's interest was only second-hand. The only benefit Syria has derived from Lebanon's Litani was some transfer of excess electrical power in the days before Lebanon began experiencing electrical shortages of its own.

Thus, water will not solve Syria's problems in Lebanon, but at least it will not make those problems worse.

6.7 Regional Overview

Water is definitely a problem for Syria with deficits in some basins even now and overall scarcity on the horizon. But water as an international issue for Syria does not have equal force in all directions. The Euphrates is critical as a water issue, and Syria must soon come to arrangements with its co-riparians in that basin or face serious consequences. The Orontes is sensitive but not critical, and the riparians will probably muddle along as long as neither of them becomes too greedy. The Jordan-Yarmuk basin is a water problem for Jordan and Israel, who are desperately searching for even moderate quantities of additional water, but for Syria the issue involves politics and security rather than water itself.

The critical Euphrates issue seems ripe for discussion. Turkey is involved with ongoing contacts at various levels with both Syria and Iraq, and both the Soviet Union and various Arab states are reportedly trying to bring about a modicum of coopera-

tion between Damascus and Baghdad[fbis]. With so many mediators proferring good offices to mitigate the painful political fissures in the basin -- with a view to addressing regional political issues such as Lebanon and the Gulf War -- it would seem opportune for the parties to attempt some progress on the Euphrates water issues so vital for them all.

Turkey, which is creating a major part of the foreseeable problems in the Euphrates basin, is indicating a strong inclination to come to resolution of these problems. Neither Syria nor Iraq should be deluded into thinking Turkey could be persuaded to curtail its GAP development schemes. However, an integrated basin-wide plan could do much to mitigate the problems, and a tripartite negotiation would be the strongest formula for achieving such agreement. If Turkey is creating the problems, it is also the party with the best capability for doing something about them. We, along with other analysts, are skeptical about the feasibility of the "Peace Pipeline" from the Seyhan and Cehan rivers, for there is not enough water in those streams. But Turkey has many rivers and can -- if willing -- satisfy its own needs and still have something to share with its thirsty neighbors. The Peace Pipeline proposal indicates such willingness. It should be explored as a creative idea rather than as a specific proposal.

The problems further south are both more immediate and less tractable. Israel and Jordan are both teetering at the edge of absolute water deficit. They are surviving with standard of living intact only by bequeathing disaster to future generations. And there is, in addition to the greater need, an important difference in world view. No matter how badly they may act toward each other at times, the Arab states of the Middle East do view themselves as inter-related parts of one integral whole. Always in rhetoric and sometimes in actual practice, there is a limit to self-interest beyond which the common good (*maslaha* in Islamic political thought) becomes the dominant concern. While not Arab, Turkey is indigenously Middle Eastern, and shares this minimal constraint on behavior toward its fellow Muslims. Ozal, with his Peace Pipeline, is not just being nice; he is being true to the norms of his own traditions.

Israel, on the other hand, feels itself an alien in its environment. It does not partake of the Middle Eastern, Islamic cultural milieu in which it has planted itself. It sees its own security, therefore, not in the unity of its neighbors but in their divisions, and, like the British and French earlier in this century, seeks to "divide and rule". Perhaps as a result of this alienation, Israel displays little solicitude for the welfare of its neighbors. As exemplified in the Cotton Plan, when it proposed to commandeer water from Lebanon's Litani, Israel seeks to maximize its own good without counting the needs of others. This is an attitude that is essentially competitive, not cooperative, and does not lend itself well to regional solutions.

Yet, within the foreseeable future, there are no solutions to Middle East water scarcities that are not regional. The areas of worst shortfall have literally no place to turn. Israel and Jordan have claimed every drop over which they have sovereign control and are well advanced in the art of double and triple use. The Saudis and Gulf states have long been mining the fossil waters of the last hundred thousand years or more, with little sense of how long this irreplacable treasure will last. Syria is in something of an intermediate position. It has scarcities and, in some districts, knows the meaning of rationing, yet it does still have annually renewable supplies of water at its disposal adequate to meet most of its needs. In the near future, however, if upstream Euphrates drawdowns increase as predicted, Syria knows it will join the ranks of the water-poor. Iraq's position is similar to that of Syria. Turkey alone in the region is truly "water-rich". Its offer of sharing is on the table, but such projects can only be achieved cooperatively.

Not only are regionwide solutions the only feasible solutions to the water scarcities of the Middle East, the problems originating in water scarcity are also regional in scope. Recent outbreaks of polio and hepatitis in Israel, which prides itself on its up-to-date facilities, might only be the foretaste of future epidemics of water-borne disease throughout the area if people must drink unclean and inadequately purified water because there is no other water available. Chemicals and microbes are no respecters of frontiers, no matter how well defended those frontiers may be. Moreover, this is a region where indigenous populations still have folk memories of the cholera and black death. Few will doubt that a disease, beginning in a water-poor locale that drinks from a polluted source, could easily become a pandemic affecting all its better-endowed neighbors. This is only an example of what could be in store for the region.

The problems are regionwide; the solutions, if any, will be regionwide. Yet some of the parties seem incapable of thinking in a truly cooperative, regional way. This presents opportunity for constructive superpower intervention, if they are so inclined.

6.8 Superpower Roles

Both the United States and the Soviet Union have been deeply involved in Middle East water for many years -- technically, financially, and diplomatically.

The United States tried valiantly, through its Johnston mission in the 1950s, to negotiate a basin agreement for the Jordan River system. Jordan's East Ghor Canal was built with American aid and technical assistance. The U.S. has helped both Jordan and Syria with water schemes for their respective capitals, and it was

the U.S. Bureau of Reclamation that first elaborated the plans for Lebanon's Litani project. In Israel the United States has been involved in many projects, especially those with technological innovation, and it was U.S. diplomatic action that ended Israel's incursions into the demilitarized zones during Huleh drainage.

The Soviets have been deeply involved in dam building. After earning their stripes at Aswan, Soviet engineering companies have built several dams on the Euphrates in Syria and Iraq, and are now engaged in work on the Tishreen Dam at Yusuf Pasha in Syria. Soviet and Syrian scientists are collaborating on the much-needed surveys of groundwater in the Syrian steppes. Moreover, the Soviet Union has treaties of friendship with both Syria and Iraq, and seems to play an effective role in arbitrating water disputes between them.

Other players that might be effective include the countries of Europe, both EC and Comecon, Japan, Saudi Arabia, the GCC, the Islamic Conference countries, and international funding agencies. In view of the fact that Israel is one of the states with the greatest water need and the least reason for inclination toward Middle East regional cooperation, it is tempting also to include the organized community of World Jewry as a potential influence.

The modes of possible intervention include diplomacy in all its manifestations, finance in various forms, and technology transfer. All of the countries concerned, and certainly Syria, are financially troubled and amenable to persuasion by funders. All of the countries are in need of the best water technologies to meet present needs and mitigate future dangers. And all of the countries concerned have relations with one or both of the superpowers, to whose representations they must needs listen with respect even while maintaining a decent display of sovereign independence.

The Soviets have close ties with Iraq and Syria, which they have used before and are using now to mediate differences. They have respectful relations with Turkey, with which they share a border and which controls at the Dardanelles the Soviet lifeline to warm water. The USSR has representation in several other Arab capitals. Soviet relations with Israel, broken off in 1967, seem to be warming slowly toward formal restoration. The Soviets are thus in a position to offer communication services in several directions. In addition, the Soviets have earned considerable gratitude from a number of the parties for their financial and technical development assistance. Of course, with the Soviets as with other great powers, the repayment of Third World debt is one of its possible instruments of manipulation. Syrian debt to the Soviet Union, though not on the public record, is reportedly huge, and the rescheduling of that debt is often a barometer of Syrian-Soviet relations.

The United States has friendly relations with Turkey, Jordan, Saudi Arabia, and Egypt, and at least correct relations with Iraq. The U.S. tie with Israel, described by friend and foe alike as a "special relationship", involves unconditional contributions to the Israeli budget of some $4 billion per year, more than U.S. aid to any other country regardless of size. It is generally believed that Israel, forever prickly about its sovereignty, is amenable to advice only from America, and then only reluctantly. Thus the United States also is in a position to offer communication services in several directions and is uniquely qualified to mediate in matters including Israel. American public and private financial contributions to Middle Eastern development have been considerable, although the effectiveness of Third World debt as an instrument of American policy is perhaps blunted by extensive Arab holdings in American securities; the calling in of debt is a game that two can play. American technology is the preferred commodity throughout the region, giving a built-in advantage to American companies.

Both the United States and the Soviet Union have assets they can use, if they so desire, to encourage cooperation on regionwide water programs in the Middle East. While there is some overlap, the above brief sketch indicates that the two superpowers both have unique strengths. On certain topics and with certain interlocutors, one and one only of the superpowers will be the more effective mediator because that one has the better contacts and has earned more trust. This points up the need not only for cooperation and collaboration among the parties in the Middle East, but for cooperation among the superpowers as well.

For many years, indeed until the advent of Mikhail Gorbachev, any suggestion of Soviet-American cooperation to solve a Third World region's water problems could have been accurately characterized as a pipe dream. The relationship between the two superpowers was confrontational, with their competition being carried out all too often through the medium of Third World surrogates. For the past year or so it has seemed, on the basis of public utterances, that there is the beginning of a better understanding between Washington and Moscow. At least the two leaders are talking with each other, instead of lobbing epithets from afar. And a backing down from extreme positions in support of Third World clients seems to accompany this moderation in language.

It is in the light of this better understanding that we suggest something that, just a few years ago, would have been naive in the extreme: A joint U.S.-USSR effort, calling on the help of other influential actors as needed, to mediate among the parties to bring about a regionwide set of water-sharing agreements for the Middle East.

These efforts need not always be carried out in tandem. Indeed, the uniqueness of some of the relationships would make such an approach counterproductive. Rather, they should be carried out separately sometimes, together sometimes, but always cooperatively.

There is evidence, cited earlier, that some of this is taking place on a piecemeal basis, each superpower working among its own friends and presumably according to its own agenda. What we are suggesting is that there should be a common agenda and a common plan of action. Then, when the separate efforts come to fruition, they will fit into an overall network of arrangements to bring adequate and safe water to the whole region.

The issues to be settled are both technical and political. The technical issues *must* be resolved, willy-nilly. This will require transfer of technologies for conservation and reclamation of water. These are expensive, and none of the countries have the means to pay for what they need; they will require generous help on generous terms. Political issues will also have to be addressed, and some will be resolved on the way to the old swimming hole. Anyone who thinks he can resolve the region's water problems without addressing political issues needs his head examined; anyone who thinks he can solve all the political issues through dealing with water simply doesn't know the Middle East. We will try to identify some of the most salient issues in the following chapter, "Summary of Recommendations".

Finally, there is an irony involved in recommending that the United States and Soviet Union take a more active hand in resolving the water problems of the Middle East. The two superpowers have both been assiduously fouling their own nests, while the civilizations of the Middle East have survived for six thousand years in a fair degree of equilibrium with their environment. But, as the father told his erring son when confronted with the record of his own youthful peccadilloes: "You will confess that a liberal experience of vice has given me the basis for judgment". It is the techniques learned through environmental disasters in America, the USSR, and Europe that will have to be used to save the Middle East -- where nature is far more unfriendly -- from a worse fate.