House Committee on Foreign Affairs
Subcommittee on Europe and the Middle East

Testimony, June 26, 1990
Thomas Naff
University of Pennsylvania

Introduction

There is virtually no human artifact or commodity that is produced in the absence of water. Agriculture is impossible without it, and so are most manufacturing processes. Water resources in particular delineate the ability of any country to be productive and to feed its citizens. In so arid a region as the Middle East, water is the ultimate survival issue. In the Middle East, water cuts across and is a prime factor in all major socio-economic issues.

With trust so low among the area's nations and conflicts rife, problems of water sharing are intensifying existing rivalries. As usage demands increase, water scarcity and sharing will soon become the two most important issues in the Middle East. American and Middle Eastern policymakers will ignore or under value the issue of water only at grave peril to their national interests. The Jordan River basin is an excellent case study of the exigency of water problems in the Middle East.

Water and Conflict

Fresh water has always been a source of conflict. The word *rival* is derived from the Latin *rivalis*, meaning "one living on the opposite bank of a stream from another, or one using the same stream as another."

Why is water so susceptible to conflict? Generally, because it is essential to life, but specifically because water flows. Its unregulated flows are likely to be erratic, and in arid country, the consequences for any user unable to capture water the moment it is needed are likely to be dire. Also the unpredictable character of stream flow can create a tense environment of uncertainty that is disruptive of social relations. In the Middle East, water exhibits all of these elements of conflict.

Water Security and Foreign Affairs

As a contemporary issue of security and international relations, water displays certain distinguishing characteristics:

- Water is always a terrain security issue, especially when scarce, since all concerned parties feel compelled to control the ground on or under which water flows.

- The relationship between water dependency and security is perceived as absolute, i.e., as zero-sum, especially where two or more mutually antagonistic actors compete for the same water source.
- As a zero-sum security issue, water carries a constant potential for conflict.
- Because of its complexity, water tends to be dealt with piecemeal both domestically and internationally, thus tending to be fragmented as a strategic and foreign affairs issue.
- International law as a means of settling and regulating fresh water issues remains rudimentary and relatively ineffectual unless prior treaty agreements are in place.
- The strategic reality of water is that under severe shortage – which is the prognosis for the Jordan basin – water becomes a highly symbolic, contagious, aggregated, intense, salient, complicated, zero-sum-power-and-prestige-packed crisis issue, highly prone to conflict and extremely difficult to resolve.

Water and Conflict Resolution

One of the paradoxical qualities of hydro-political problems is that, despite their complexities and stubbornness, they exhibit a tendency in certain circumstances to encourage negotiations where other problems would degenerate into conflict. There is an underlying superordinate interest common to all riparians – water is essential to life – that sometimes can be made to override discords and produce agreements on water issues. In the short term, such accords are possible despite ongoing recalcitrant issues, and, if successfully negotiated, they can have a salutary impact on other problems.

The Jordan River Basin

Three countries are involved in the Jordan River basin. Jordan and Israel are the primary riparians; Syria is also an interested party since a branch of the Yarmuk, a tributary to the Jordan, has its headwaters in Syria.

The threat of a water crisis in the Jordan River basin has been growing more serious for some time. If it is not eased, it is highly probable that destabilizing domestic strife will erupt soon, most likely in Jordan first, with major regional and international repercussions.

Very serious problems of water scarcity and quality in the Jordan basin are the basis for this crisis. The basin's principal riparians, Jordan and Israel, have been consuming about 115% of their total usable water stocks. The prognosis is for continuing water shortages and over-exploitation of water supplies in both the short and long term, that is, through 2015, unless immediate drastic and politically difficult basin-wide remedial actions are taken.

The effects of ongoing water deficits, already severe in the Jordan basin, are cumulative and can quickly become irreversible. Neither known natural sources nor water technologies, now or in the foreseeable future, have the capacity to generate new usable water in needed quantities at an affordable cost. Failing a solution of scarcity, both Israel and Jordan will have to curtail their social and economic development. The result will be heightened competition among riparians and among domestic sectors within each country for decreasing amounts of water with concomitant destabilizing consequences, not the least being a significant rise in the probability of an outbreak of warfare between Jordan and Israel, which would almost certainly involve other Arab states.

Obviously, the stakes in a basin-wide solution to the problems of scarcity are very high for both Jordan and Israel. Between now and 2015 Jordan's population is projected to grow by 178% from the current 2.7 million to 7 million. That is a rate about 2.5 times higher than it should be in relation to the water and economic resources of the basin. If this growth rate continues without an increase in water supplies, stringent conservation, and dramatic changes in present habits of consumption, Jordan will be unable to support a population that large. Even if Jordan eventually constructs the planned Unity Dam (assuming that the current U.S.-mediated negotiations between Jordan and Israel over the dam's construction succeed), Jordan will still suffer an annual water shortage.

Although Israel's population growth is significantly lower than that of Jordan and the Occupied Territories, Israelis consume 5-6 times more water per capita than their neighbors: 280-300 liters per capita per day (l/c/d).

Among the most politically charged implication of the basin's water shortage is whether Israel will be able to absorb successfully the anticipated one million Russian-Jewish emigrés. At present, it is unlikely that there will be enough water on Israel's side of the basin to absorb a million people consuming water at the rate of 280 l/c/d. The waters of the Occupied Territories are already being over-exploited by about 100 mcm/yr. Allowing large numbers of emigrés to settle there would only intensify current problems.

Because of the current disparity in power among the Jordan basin's riparians – Jordan, Israel, and Syria – there appears to be no immediate prospect of water-based warfare. However, water issues are central to the strategic planning of all the basin's riparians; water has become significantly militarized and water problems contribute importantly to the basin's inter-riparian tensions. The potential for open conflict over the basin's diminishing water stocks is rising.

If current policies and patterns of consumption in Jordan and Israel persist, a mounting series of water crises will be touched off before the end of the decade (perhaps as early as 1995-1997), particularly if economic conditions deteriorate further or there is a drought, which is almost certain given the drought history of the basin. The severity of the crisis could break present restraints on conflict. If that occurs, water will combine with other underlying forces of instability and hostility among the basin's riparians, and water-driven warfare will almost certainly ensue, spilling out into the region beyond the basin. King Hussein has stated privately that although he could conceive of few reasons to go to war with Israel, he could be compelled to fight over water despite the almost sure prospect of defeat.

Unless Israel and Jordan are able very quickly to devise effective policies for the reduction of water consumption, they will be unable to meet the developmental needs of their societies. Whatever combination of actions might be taken, some degree of economic restructuring and a reduction in population growth must be a part of the process. Such alterations always result in social dislocation and hardship. Consequently, rather than warfare among riparians in the immediate future (which is certainly possible), what is more likely to ensue from water-related crises in this decade, is internal civil disorders, changes in regime, political radicalization, and instability. All of these developments would have a negative effect on U.S. interests.

Water and the Occupied Territories

The water in the Occupied Territories has become so integral to Israel that the delicate balance of Israel's water system has become dependent on the water system of the Territories. In needy times, which is more and more the situation, Israel satisfies up to 35-40% of its water needs from the West Bank and Gaza; in the past, an average of one-quarter of the nation's supply has normally come from the Territories. It is inconceivable that an Israeli government would ever give up any part of the Occupied Territories without an effective plan, replete with a full array of guarantees and inducements, that gives Israel secure and permanent access to sufficient quantities of the Territories' waters or guaranteed access to other comparable sources in the area (probably the Litani River in Lebanon). In fact, owing to serious shortages, it is reliably reported that Israel has been trucking water from the Litani River, which lies entirely within sovereign Lebanese territory, into Israel. Again, in this context, it is useful to recall the challenge that scarcity poses for Israel in its efforts to absorb a million emigres within five years without first mitigating her water problems.

It might eventually be possible to overcome Israel's security arguments for retention of the Territories, but the hydrological arguments will persist unless the water issue is settled. It is water, in the final analysis, that will

determine the future of the Occupied Territories – and by extension, the issue of conflict or peace.

Unless patterns of consumption change, sometime between 1995 and 2005 Israel, Jordan, and the Occupied Territories will begin to experience such acute and progressively worsening perennial water shortages and degradation of water quality that the effect can be likened to a situation in which the three areas were to run out of all renewable sources of fresh water. Clearly, the best solution to the hydropolitical problems of the Jordan basin (and for all the region's international river basins) would be creation of basin-wide authorities with enough independence, power, funding, and expertise to determine and regulate water usage among the riparians.

However, owing to insufficient financial resources, shortage of technical and managerial expertise, domestic and political constraints, paralysis of leadership, and deep-seated, even implacable, feelings of mistrust and hostility among the basin's actors, the leaders of Israel and Jordan will be unable to solve their water-related problems without outside assistance.

The Interconnectedness of Water Issues

It is an axiom of Middle Eastern affairs that all major situations or events in one sector of the region will ultimately have an impact on all other areas. No issue demonstrates this proposition better than water, which is integral to so many other issues. For example, the quintet of nations occupying the Jordan and Euphrates River basins – Jordan, Israel, Syria, Turkey, and Iraq – are linked by hydropolitical interests through Syria, which has riparian status in both basins, by strategic factors, by competing development schemes, by common hydroelectric needs, and by competition for scarce water resources. Turkey has proposed a so-called "peace pipeline" for the transport of water out of the Euphrates basin in Turkey to the Gulf region. But such a plan, though technically feasible, would be very costly and politically vulnerable because its route requires the acquiesence of Jordan, Israel, and Syria.

Perhaps the most telling illustration of the interconnectedness of water is the issue of the Unity Dam on the Yarmuk between Jordan and Israel. Without going into the background details of Unity, it is possible to demonstrate how this single issue, because of its hydraulic nature, has ramifications across basins, borders, and both socio-economic and strategic affairs. For Jordan, the construction of Unity Dam involves several questions critical to that nation's economic future and political stability: Whether Israel will obstruct the construction of Unity Dam on which Jordan is pegging much of its water security and future development; whether Syria will acquiesce to whatever Jordan and Israel agree on without pulling out of its accord with Jordan on Unity; future guaranteed allocations of Yarmuk water among its

riparians; the impact on Jordanian-U.S. relations of the American mediation efforts in the Jordanian-Israeli Unity Dam negotiations; whether Turkey will assume a pivotal role in the hydropolitics of the region. The future issues of importation of water from Turkey and Iraq are subsumed under these rubrics because both Syria and Israel will have to agree not to be obstructive, otherwise it is highly unlikely that Jordan would be assured a secure pipeline in the future. All of these issues are linked by the Unity Dam negotiations.

Construction of the Unity Dam constitutes Jordan's main hope for a politically stable and viable socio-economic future. Despite Unity's limitations, there is no other comparable option for Jordan. Therefore, Jordan must negotiate with Israel until a workable arrangement is reached. Military action, except in extremis, is not a viable choice. If the Israelis play their hand badly, they will lose much despite their riparian and military advantages. Creating a water-based political or economic crisis could destabilize Jordan, perhaps topple King Hussein's regime, and radicalize the government. Not only would that event add significantly to the forces of destabilization in the region, but Israel could be faced with another radical and militarily hostile neighbor.

Syria could gain much from a successful Unity negotiation; in addition to more electricity and water, Syria could win political credit in the Arab camp, more influence in Amman, possibly more U.S. economic cooperation, and a small improvement in its position vis a vis Turkey and the Euphrates. In hydropolitics, incremental advantages matter. Turkey looms important in the background of the Jordan-Israel-Syria talks because of her links with the negotiants and the mediator and because Turkey's good offices and influence – in part because of its upper riparian status on the Euphrates – are available to all of the principals (though the Syrians are not likely to make use of them).

The Unity negotiations offer the U.S. an extraordinary opportunity to advance its Middle East interests and pursuit of peace in the region. Although the inherent volatility of the water issue and the seemingly unmitigated enmity of some of the actors could overwhelm the American mediatory venture, if the U.S. plays its hand with great finesse, flexibility, equitability, and persistence, it could emerge from the Unity negotiations having achieved a major milestone in its Middle East policies and the possibility of parlaying a successful result into further exchanges over other issues.

U.S. Role in the Region's Hydropolitics

American Middle East interests are directly and substantially engaged by the hydropolitics of the Middle East. The U.S. is committed to a pivotal role in the peace-seeking process, and water issues in the Jordan basin are a

basic determinant of whether that process will succeed or fail. Jordan is a moderate Arab friend of the U.S. whose monarch has consistently sought peaceful, negotiated settlement of the Arab-Israeli problem. If Jordan's water problems overwhelm the current regime, it will almost certainly be replaced by a more radical, hostile, confrontational one. Not only would the U.S. have lost an important moderate friend, the chances of open warfare would be increased and the U.S. policy of protecting and maintaining Israel's security would become more difficult. These are the kinds of stakes the U.S. has in the region's water problems.

If the hydrological problems of the region are to be mitigated in time to avoid conflict, the U.S. must play an immediate, sustained, central, and genuinely even-handed role, acting mainly as a facilitator/mediator, providing necessary inducements and guarantees for agreements, as well as mobilizing and working with other outside parties to assist in the effort. Also, the U.S. must be prepared to provide – preferably in conjunction with other powers – sufficient, strictly dedicated financial resources to make possible the economic restructuring essential to solving the region's water problems without unbearable political and socio-economic hardships.

American influence with the principal users of the Jordan basin's waters is sufficiently strong that the U.S. could play a positive role. In addition to using its political and economic leverage, the U.S. can mobilize international diplomatic efforts to encourage a basin-wide agreement with inducements of economic aid and political support. Such actions, together with judiciously proferred water technology and expertise, could advance American interests in the basins and region simultaneously.

There are various short-term actions that Congress can take toward easing the water crisis in key parts of the Middle East, such as the Jordan River Basin. These actions are achievable and would have a salutary effect without having to await settlement of larger, recalcitrant political issues:

1) Provide technical expertise and appropriate water technology, especially in respect to return flow, extraction, and purification, as soon as possible.

2) Provide training, on site and in the U.S., on advanced techniques of conservation, irrigation, crop planning, and efficient water management.

3) Assist in the creation of local water research and training centers (such as the one at Jordan University) to encompass such programs as the use of effluents in agriculture, the development of marketable saline-tolerant crops, low-water-consumping crops, etc.

4) Encourage the investment of private capital in the infrastructure of Middle Eastern water establishments.

5) Support and encourage World Bank and United Nations agencies in their efforts to assist Middle Eastern nations with their water problems.

6) Consult with the European Community and Japan on devising joint efforts aimed at easing the most critical water problems in the region.

7) Use whatever influence the U.S. can to encourage the creation of basin-wide authorities for the management and allocation of water resources and discourage any of the region's riparians from using water as a political weapon.

8) In various ways, give official public acknowledgement of Congress's recognition of the urgency of water issues in the Middle East – for example, by having a report on the issue prepared and given wide dissemination and extensive media coverage.

9) In the various economic aid packages Congress makes available to Middle Eastern nations with water problems, earmark rigorously those funds that are to be spent exclusively on water-related projects.

10) All of these steps can be implemented through existing channels. However, as a means of highlighting its concern in the issue of water, Congress could devise special, high-visibility programs for some of these proposed actions. The best long-term means for dealing with these issues effectively would be to create a special interagency group, encompassing both the executive and legislative branches, to coordinate American policy formulation in the realm of international fresh water issues. This group should serve functions of coordination, data collection, policy and project assessment, education, and review. It could also be an international data clearinghouse and a reservoir of international expertise. Its purview should include the technological, political, socio-economic, strategic, and legal dimensions of international water use issues.

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June 27, 1990

Shibley Telhami
Subcommittee on Europe
and the Middle East
2187 Rayburn Building
U.S. House of Representatives
Washington, DC 20515

Dear Shibley,

Pursuant to our phone conversation of this morning, I am sending a proposed set of short-term actions the U.S. government can take toward easing the water crises in key regions of the Middle East, such as the Jordan River basin. These actions, in my opinion, are achievable without having to await settlement of the large, seemingly intractable, political issues.

The proposed actions are attached as (1) text for insertion into my statement of June 26 and (2) an addendum for distribution to members of the Subcommittee. You will see that the two differ only in the last sentence, which in the insertion text provides a lead-in for the last paragraph and in the addendum for Subcommittee members refers to my prepared text distributed on June 26.

I'm pleased that you are going to make copies of the addendum available to the Subcommittee members. If I can be of any further assistance, please let me know.

Sincerely,

[redacted]

Thomas Naff

House Committee on Foreign Affairs
Subcommittee on Europe and the Middle East

Addendum to Testimony, June 26, 1990

Thomas Naff
University of Pennsylvania

There are various short-term actions that Congress can take toward easing the water crisis in key parts of the Middle East, such as the Jordan River Basin. These actions are achievable and would have a salutary effect without having to await settlement of larger, recalcitrant political issues:

1) Provide technical expertise and appropriate water technology, especially in respect to return flow, extraction, and purification, as soon as possible.

2) Provide training, on site and in the U.S., on advanced techniques of conservation, irrigation, crop planning, and efficient water management.

3) Assist in the creation of local water research and training centers (such as the one at Jordan University) to encompass such programs as the use of effluents in agriculture, the development of marketable saline-tolerant crops, low-water-consumping crops, etc.

4) Encourage the investment of private capital in the infrastructure of Middle Eastern water establishments.

5) Support and encourage World Bank and United Nations agencies in their efforts to assist Middle Eastern nations with their water problems.

6) Consult with the European Community and Japan on devising joint efforts aimed at easing the most critical water problems in the region.

7) Use whatever influence the U.S. can to encourage the creation of basin-wide authorities for the management and allocation of water resources and discourage any of the region's riparians from using water as a political weapon.

8) In various ways, give official public acknowledgement of Congress's recognition of the urgency of water issues in the Middle East – for example, by having a report on the issue prepared and given wide dissemination and extensive media coverage.

9) In the various economic aid packages Congress makes available to Middle Eastern nations with water problems, earmark rigorously those funds that are to be spent exclusively on water-related projects.

10) All of these steps can be implemented through existing channels. However, as a means of highlighting its concern in the issue of water, Congress could devise special, high-visibility programs for some of these proposed actions. The best long-term means for dealing with these issues effectively would be to create an interagency group such as the one described in the final paragraph of my testimony of June 26, 1990.

One Hundred First Congress

Congress of the United States

Committee on Foreign Affairs

House of Representatives

Washington, DC 20515

June 29, 1990

Professor John Waterbury
Woodrow Wilson School
Princeton University
Princeton, New Jersey 08540

Dear Professor Waterbury:

Attached is a transcript containing your remarks from the June 26th hearing before the Subcommittee on Europe and the Middle East on Middle East Water Issues in the 1990s.

Your cooperation in making any necessary corrections and returning the transcript to me by Friday, July 13, 1990 would be appreciated. If I do not receive it by the deadline, I will assume that you have no corrections and will send the transcript to GPO as it now appears.

If you have any questions contact me at 202-225-3345.

Sincerely,

Kristine Willie
Staff Assistant
Subcommittee on Europe
and the Middle East
B359 Rayburn House Office Building
Washington, D.C. 20515

RPTS STEIN

DCMN SWANNER

HEARING ON MIDDLE EAST WATER ISSUES IN THE 1990s

Tuesday, June 26, 1990

House of Representatives,
Subcommittee on Europe and the Middle East,
Committee on Foreign Affairs,
Washington, D.C.

The subcommittee met, pursuant to call, at 9:00 a.m. in Room 2200, Rayburn House Office Building, Hon. Lee H. Hamilton [chairman of the subcommittee] presiding.

Present: Representatives Hamilton, Gilman, Smith, and Lukens.

Mr. HAMILTON. The meeting of the subcommittee will come to order. The Subcommittee on Europe and the Middle East meets today in open session to discuss Middle East water issues in the 1990s. This is the third hearing in a series of hearings on issues in the Middle East in the 1990s.

The subcommittee would like to examine a number of issues, including assessment and projections of the water shortages in the Middle East; potential international disputes relating to water sharing problems and riparian rights; how the water issue will affect the political and economic situation in the region in the coming years; and analysis of the problems related to the Nile, Jordan, and Euphrates-Tigris Rivers.

Our witnesses today are Professor John Waterbury, Woodrow Wilson School, Princeton University; Professor John Kolars, Department of Geography, University of Michigan; and Professor Thomas Naff, University of Pennsylvania.

Gentlemen, we welcome you before the subcommittee. Your prepared statements will be entered into the record in full. I would like to ask that you limit your opening remarks to five or ten minutes, so that we may turn quickly to questions from Members.

Professor Waterbury, you may proceed.

I think you are aware we have a special session of the Congress at 11:00 this morning, so we will have to adjourn

shortly before that, probably, in order to permit Members time to get to that. So I would like to ask you to make your opening statements relatively brief, if you would.

Professor Waterbury.

STATEMENT OF PROFESSOR JOHN WATERBURY, WOODROW WILSON SCHOOL, PRINCETON UNIVERSITY

Mr. WATERBURY. Mr. Chairman, there are nine sovereign nations that lay claim to some portion of the Nile Basin. In any efforts to bring about basin-wide coordination in the use of the river's waters, all nine would rightfully have some say, and conceivably veto power, as well.

However, only two countries in the system are dependent upon its waters for their livelihood and survival. Egypt, the downstream state, is utterly dependent upon the Nile for life itself and the food and hydropower that sustains its economy. Egypt does not add a single drop to the Nile; it can only take.

The Sudan, which, unlike Egypt, has substantial rainfed agriculture, is less dependent upon the river, but its betst soils all lie within the catchments of the Blue and White Niles, and they are ideally suited for irrigated cultivation.

The seven remaining countries either have abundant rainfall or other sources of river and lake water. They are relevant only in that they can, potentially, affect the size and quality of the discharge that ultimately reaches Sudan and Egypt.

Also given their location upstream or at the headwaters the sources of the Blue and White Niles, they would have to be coaxed into any plans to use their territories for storage projects that would benefit mainly Egypt and the Sudan.

Of these seven countries, three are of crucial importance both for what they could do to alter the discharge of the river, although that is the most remote of all possibilities, and for what they could do to facilitate water storage on their territories.

They are Ethiopia, which controls Lake Tana and the headwaters of the Blue Nile and the Atbara, together providing about 60 percent of the total discharge of the Nile; and Uganda and Zaire, which share Lake Albert, now known as Lake Mobutu. This lake could one day be a major storage site for controlling the discharge of the White Nile.

At present, there is only one treaty binding any of the riparian states in the use of the Nile. It is the 1959 agreement signed by Egypt and the Sudan prior to construction of the Aswan High Dam.

These are the bare facts of the geopolitics of Basin. Let me turn to the dynamics of the situation. First, there is today no major problem facing any countries of the Basin so far as water supply is concerned. But that should not be

taken as good news.

The only reason why there is not a major problem is because most of the states in the Basin have been in chronic political disarray and hence incapable of financing and implementing the agricultural projects that would have laid new claims on Nile water.

Uganda has scarcely had a state since the collapse of Idi Amin, and Ethiopia and the Sudan have been in the throws of civil war for decades. Only Egypt has maintained a stable policy, and only Egypt is using the water available to it to the maximum.

Were it not for the political and economic collapse of some of the key actors, the supply situation could be truly grim. While it is always hazardous to make projections of climate and rainfall, it nonetheless appears to be the case that there is a secular decline in the amount of water annually discharged in the Nile system.

There is considerable variance around the mean, but the mean discharge trend is down. We don't know how long that may last, but in the coming decades, it would seem to make good sense to plan on less water.

For Egypt that has meant elaborating two strategies. One that favored by most Egyptian leaders until recently, has been to pursue coordination with upstream neighbors in the While Nile Basin in order to store water, regulate

discharge, and reduce surface evaporation in the Sudd Swamps of the Southern Sudan.

This strategy led to the partial construction of the Jonglei Canal. A project that had to be abandoned after the Civil War flared up once again in the Southern Sudan after 1983. It is still Egypt's hope that one day, using Lake Mobutu for storage, there will be two canals through the Sudd Swamps, adding a net benefit of about 10 percent of the river's annual discharge.

Faced with the unending turmoil in the Sudan and Uganda and some indifference in Zaire, Egyptian leaders have begun to emphasize the second strategy. That is to increase the efficiency with which water is used in Egypt itself.

In some ways, this is a far more difficult challenge. It requires retraining the Egyptian peasant in the ways in which he or she uses irrigation water. It means lining thousands of miles of canals in order to reduce seepage. It means introducing costly drip irrigation systems and pursuing efforts to use drainage water for irrigation.

The effort would only make sense were Egypt to shift most of its agricultural base to the production of high value crops destined largely for export. There is really no alternative today to the pursuit of this strategy, but it is not one that can be implemented rapidly.

Let me close with a few observations concerning Ethiopia.

Mythology abounds as to Ethiopia's capacity to shut off the Blue Nile. The absence of storage sites that would not be subject to rapid siltation, the prohibitive cost of any possible projects, and the fact that Ethiopian agricultural development has been concentrated in the eastern watershed of the Highlands and in the south of the country would seem to make very remote any kind of project that could substantially reduce the flow of the Blue Nile and Atbara before they enter the Sudan.

Mr. Chairman, until the key countries of the basin enjoy stable government, there can be little progress toward negotiated understandings on basin-wide coordination in the management of the Nile. But were such governments to emerge, ready to take up the task of developing their countries, then the pressure on water available in the Nile could become acute.

Unlike the situation in the Jordan and Euphrates, however, that development is not close at hand.

Thank you.

[The statement of John Waterbury follows:]

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Mr. HAMILTON. Thank you.

Dr. Kolars.

STATEMENT OF PROFESSOR JOHN KOLARS, DEPARTMENT OF GEOGRAPHY, UNIVERSITY OF MICHIGAN

Mr. KOLARS. Thank you, Mr. Chairman.

I would like to begin by laying out a little of the general problem within the Middle East and proceeding then to the Euphrates.

The Arabic speaking peoples of the Middle East and North Africa seem to face a crisis of such dimensions that all others which have gone before will seem simply by comparison. Water-related events in the Middle East (including North Africa) including growing domestic shortages and the possible unilateral control of international streams by one or another country, are being noted with increasing frequency by the world press.

Domestic security, food for growing populations, settlements of territorial disputes such as that over the West Bank and the Golen Heights, as well as the continued well-being of governments which have invested huge sums in development schemes dependent upon ample supplies of groundwater, are all at stake.

By examining in some detail one of the sources of water

upon which Middle Eastern people depend, another example should suffice to emphasize the urgency of the situation. Over 50 percent of all the population in the Middle East and North Africa, excluding the Maghreb, depend either upon water from rivers which cross an international boundary before reaching them or upon desalinized water and water drawn from deep wells.

More startling, two-thirds of all Arabic-speaking people in the same region depend upon river water which flows to them from non-Arabic-speaking countries, while another 24 percent live in areas with no perennial surface streams whatever.

That is, the latter must rely upon either well water from rapidly depleting sources or upon seawater which is expensive to purify in sufficient quantities and expensive to pump to its places of use.

These water dependent populations are increasing rapidly in number. World Bank data show a total population of 217.4 million in 1983 in the area under discussion. It is conservatively estimated that by the year 2000, less than a decade away, an additional 119.6 million will be added to this figure, a population increase of 55 percent.

I would add parenthetically that within the Nile Valley of Egypt, there are one million new Egyptians every eight to nine months. That is births over deaths. Not only will

these people need water to drink but water for industry and all the uses that occur within cities.

They also need irrigation water to grow as much of their food as possible before turning to what they may view as potentially unreliable imports.

Americans will appreciate this better if they consider arid West, the states of North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, Texas, Montana, Wyoming, Colorado, New Mexico cover 1,115,000 square miles. The Arabian peninsula south of the Jordanian-Iraqi borders has an area slightly larger of 1,160,000 square miles within which not a single permanent surface stream is found.

If we add riverless Libia, the Arabian world would toll 1,839,000 square miles. To match this in American, we would have to add all of the remaining western states plus Minnesota to the list.

Furthermore, one must remember that within these so-called arid American states are the sources of the Missouri, Colorado, Snake, Rio Grande, Platt Canadian, Pecos and Arkansas Rivers, as well as numerous other streams and, of course, the source of the Mississippi in Minnesota. I don't want to leave that out.

Let me say that the Euphrates River is a case in point. Petroleum-poor Turkey, driven by its need for new sources of energy, has turned to the hydroelectric potential of its

many rivers, the greatest of which is the Euphrates.

During the time when Arab oil was very expensive. Turks were importing up to $4 billion worth of petroleum a year, mostly from Arab states and Iran, and even now it will cost two-and-a-half million dollars, approximately.

With this end in mind, Turkey has undertaken a gigantic development program on that river. The Southeast Anatolia Development Project (Turkish acronym GAP) is intended not only to provide hydropower but also to earn foreign exchange to be raised on over a million hectares of land (1 ha equals 2.47 acres) irrigated with water drawn from the river.

If all these projects planned for GAP are to be realized, the flow of the river into Syria will be reduced by over 50 percent.

Turkey is well on its way to accomplishing a major part of GAP. The Keban Dam farthest upstream is already in place and producing electricity. Next downstream, the Karakaya Dam, which came on line in 1989, is also meant for hydroelectric production.

Biggest of all, the Ataturk Dam is nearing completion downstream from the other two. The Ataturk will be the fourth or fifth largest dams of its kind in the world and will Be used not only to produce hydro-electricty but also the waters impounded on its reservoir could eventually irrigate more than 900,000 hectares.

Of this amount, 157,000 ha on the Harran Plain just north of the Syrian border are scheduled to receive water beginning in 1991. To complicate matters further, return flow from these fields may bring added pollution to Euphrates waters making them more difficult or impossible to reuse farther downstream.

Nor is this the entire story. Syria, the next downstream user, has similar needs for electricity and irrigation. It is attempting to meet these demands by means of the Tabqa (Ath-Thawra) Dam which it completed in 1974, as well as with several smaller dams on the main stream and along its major tributary in Syria, the Khabur River.

Perhaps 300,000 hectares of land will be irrigated in this way. Further depletion of river water plus further pollution is inevitable. The Euphrates third riparian partner is Iraq, farthest downstream and historically the first and largest user of the river's water. As many as a million hectares of irrigated land in this latter country may be jeopardized in the near future by shrinking supplies, as well as by increasing pollution from both upstream users.

Because as much as 98 percent of the Euphrates water has its source in Turkey and most texts allot 12 percent of the river's flow to Syrian tributaries, I can show that as much as 10 percent of that 12 percent originates from Syrian springs which have their catchments on the north in Turkey

where pumping of the groundwater could possibly diminish or staunch their flow.

Syria and Iraq find themselves in similar and unenviable situations when on January 13 of this year Turkey began filling it at a Turkey reservoir, the flow of the river into Syria and Iraq was reduced to a trickle for 30 days.

Turkey had previously guaranteed a continuous flow of 500 cubic meters per second across the border into Syria. Prior to January, this amount has been increased for a time to 750 cms, but the overall impact of the cutoff, according to the Syrians and the Iraqis was disastrous.

Electric power was curtailed in Syria, and both downstream countries had to ration river water for domestic and farm use. Moreover, this brief interruption of river flow accounted for only a tiny fraction (3 percent to 5 percent) of the reservoir's total capacity.

This is a point worriedly stressed by both the Iraqi and Syrian governments as to how the reservoir will be filled in the near future, so this seems to me to be a possible flashpoint in the while situation.

The Turks, on the other hand, have responded with an idea which I think has more merit than it is often given credit for; President Ozal's so-called peace pipeline, in which he proposes that the Turks would give surplus water, of which they have a large quantity, to their neighbors to the south

by means of twin pipelines, one which would go along the western side as far as Mecca and another which would go along the eastern side of the peninsular as far as Sharjah.

To date, the Arab nations which have been approached on this have shown very little interest, possibly because they feel it would be placing them in the hands of an ancient adversary.

On the other hand, the Turks certainly have been dependent upon the Arab oil nations for petroleum and for the loans, short-term loans to buy that petroleum. This, if one had time, one could go into the whole problem of delusion of the underground water resources upon which Saudi Arabia and other peninsula states must depend.

However, time is short, so I won't do that, and instead close by saying that there are ways out of this situation many similar to those suggested by Professor Waterbury, mostly the parsimonious use of water, and a realistic view of how these shortages can occur.

I call attention to our problems with the Oglalla aquifer on our great planes. In any event, the need for attention to this matter is extreme, and I don't think we have much time before a crisis emerges.

Thank you very much, Mr. Chairman.

[The statement of John Kolars follows:]

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Mr. HAMILTON. Thank you.

Dr. Naff.

RPTS STEIN

DCMN SWANNER

Mr. NAFF. Thank you, Mr. Chairman.

Mr. Chairman, it seems to me that the major implication of what my colleagues have been saying is in so arid a region of the Middle East, water is the ultimate survival issue, and in an area where trust is so low among the areas' nations and conflicts so rife, problems of water sharing are intensifying existing rivalries.

As usage demands increase, water scarcity and sharing will soon become the two most important issues in the Middle East. American and Middle Eastern policymakers will ignore or undervalue the issue of water only, at grave peril to their national interests.

The Jordan River Basin is an excellent case study of the exigency of water issues in the Middle East. The countries are involved in the Jordan River Basin. Jordan and Isreal are the primary riparians. Syria is also an interested party since a branch of the Yarmuk, a tributary to the Jordan, has its headwaters in Syria.

The threat of a water crisis in the Jordan River Basin has been growing more serious for some time. If it is not eased, it is highly probable that destabilizing domestic strife will erupt soon, most likely in Jordan first, with major regional and international repercussions.

Very serious problems of water scarcity and quality in the Jordan Basin are the basis for this crisis. The basin's principal riparians, Jordan and Isreal, have been consuming about 115 percent of their total usable water stocks.

The prognosis is for continuing water shortages and over-exploitation of water supplies in both the short and long term; that is, through 2015, unless immediate drastic and politically difficult basin-wide remedial actions are taken.

The effects of ongoing water deficits, already severe in the Jordan basin, are cumulative and can quickly become irreversible. Neither known natural sources nor water technologies, now or in the foreseeable future, have the capacity to general enough new usable water in needed quantities at an affordable cost.

Failing a solution of scarcity, both Israel and Jordan will have to curtail their social and economic development. The result will be heightened competition among riparians and among domestic sectors within each country for decreasing amounts of water with concomitant destabilizing consequences, not the least being a significant rise in the probability of an outbreak of warfare between Jordan and Isreal, which would almost certainly involve other Arab states.

Obviously, the stakes in a basin-wide solution to the problems of scarcity are very high for both Jordan and

Isreal. Between now and 2015, Jordan's population is projected to grow by 178 percent from the current 2.7 million to 7 million. That is a rate about 2.5 times higher than it should be in relation to the water and economic resources of the basin.

If this growth rate continues without an increase in water supplies, stringent conservation and dramatic changes in present habits of consumption, Jordan will be unable to support a population that large.

Even if Jordan eventually constructs the planned Unity Dam (assuming that the current U.S.-mediated negotiations between Jordan and Israel over the dam's construction succeed), Jordan will still suffer an annual water shortage.

Although Israel's population growth is significantly lower than that of Jordan and the Occupied Territories, Israelis consume five to six times more water per capita than their neighbors: 280-300 liters per capita per day (l/c/f).

Among the most politically charged implication of the basin's water shortage is whether Israel will be able to absorb successfully the anticipated one million Russian-Jewish emigres. At present, it is unlikely that there will be enough water on Israel's side of the basin to absorb a million people consuming water at the rate of 280 l/c/d.

The waters of the Occupied Territories are already being over-exploited at the rate of about 100 mcm/year. Allowing

large numbers of emigres to settle there would only intensify current problems.

Because of the current disparity in power among the Jordan basin's riparians--Jordan, Israel, and Syria--there appears to be no immediate prospect of water-based warfare. However, water issues are central to the strategic planning of all the basin's riparians; water has become significantly militarized and water problems contribute importantly to the basin's interriparian tensions. The potential for open conflict over the basin's diminishing water stocks is rising.

If current policies and patterns of consumption in Jordan and Israel persist, a mounting series of water crises will be touched off before the end of the decade, perhaps as ear as 1995-97, particularly if economic conditions deteriorate further or there is a drought (which is almost certain given the drought history of the basin).

The severity of the crisis could break present restraints on conflict. If that occurs, water will combine with other underlying forces of instability and hostility among the basin's riparians, and water-driven warfare will almost certainly ensue, spilling out into the region beyond the basin.

King Hussein has stated privately that although he could conceive of few reasons to go to war with Israel, he could

be compelled to fight over water despite the almost sure prospect of defeat.

Unless Israel and Jordan are able very quickly to devise effective policies for the reduction of water consumption, they will be unable to meet the developmental needs of their societies.

Consequently, rather than warfare among riparians in the immediate future (which is certainly possible), what is more likely to ensue from water-related crises in this decade is internal civil disorders, changes in regime, political radicalization, and instability. All of these developments would have a negative effect on U.S. interests.

The water in the Occupied Territories has become so integral to Israel that the delicate balance of Israel's water system has become dependent on the water system in the Territories.

In needy times, which is more and more the situation, Israel satisfies up to 35-40 percent of its water needs from the West Bank and Gaza; in the past, an average of one-quarter of the nation's supply has normally come from the Territories.

It is inconceivable that an Israeli government would ever give up any priority of the Occupied Territories without an effective plan, replete with a full array of guarantees and inducements, that gives Israel secure and permanent access

to sufficient quantities of the Territories' waters or guaranteed access to other comparable sources in the area (probably the Litani River in Lebanon.

In fact, owing to serious shortages, Israel is presently conducting a large-scale operation of trucking water to Israel from the Lithani River, which lies entirely within sovereign Lebanese territory.

Again, in this context, it is useful to recall the challenge that scarcity poses for Israel in its efforts to absorb a million emigres within five years without first mitigating her water problems.

It might eventually be possible to overcome Israel's security arguments for retention of the Territories, but the hydrological arguments will persist unless the water issue is settled. It is water, in the final analysis, that will determine the future of the Occupied Territories, and by extension, the issue of conflict or peace.

American Middle East interests are directly and substantial engaged by the hydropolitics of the Middle East. The U.S. is committed to a pivotal role in the peace-seeking process, and water issues in the Jordan basin are a basic determinant of whether that process will succeed or fail.

Jordan is a moderate Arab friend of the u.S. whose monarch has consistently sought peaceful, negotiated settlement of

the Arab-Israeli problem. If Jordan's water problems overwhelm the current regime, it will almost certainly be replaced by a more radical, hostile, confrontational one.

Not only would the U.S. have lost an important moderate friend, the changes of open warfare would be increased and the U.S. policy of protecting and maintaining Israel's security would become more difficult. These are the kinds of stakes the U.S. has in the region's water problems.

If the hydrological problems of the region are to be mitigated in time to avoid conflict, the U.S. must play an immediate, sustained, central and genuinely even-handed role, acting mainly as a facilitator/mediator, providing necessary inducements and guarantees for agreements, as well as mobilizing and working with other outside parties to assist in the effort.

Also, the U.S. must be prepared to provide, preferably in conjunction with other powers, sufficient, strictly dedicated financial resources to make possible the economic restructuring essential to solving the region's water problems without unbearable political and socio-economic hardships.

Obviously, the most suitable and effective solution to the basin's problems and indeed to the basins of the other river systems in the area would be basin-wide authorities with enough independence, power, expertise and funds to allocate

and regulate the sharing of water.

In the U.S., as in the mid-eastern countries, the issue of international fresh water use, allocation, preservation suffers badly from fragmentation. In this regard, there is something significant the United States can do to serve its own interest and simultaneously those of riparian nations globally. That is, the formation of a special interagency group encompassing both the executive and regulative branches to coordinate American policy formulation in the realm of international fresh water issues.

This group should serve functions of coordination, data collection, policy and project assessment, education, and review. It could also be an international data clearinghouse and a reservoir of international expertise.

Its purview should include a technological, political, socio-economic, strategic, and legal dimensions of international water use issues.

Thank you, Mr. Chairman.

[The statement of Thomas Naff follows:]

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RPTS STEIN

DCMN HALL

Mr. HAMILTON. Thank you very much. We will proceed to questions under the five-minute rule.

I have in front of me several statements, and I just want to get your reaction to them all, by leaders in the Middle East, one from a Minister of State for Foreign Affairs in Egypt who says that the next war in the Middle East will be over the waters of the Nile, not politics.

A director of Israel's Agricultural Ministry declared that if the people of the region are not clever enough to discuss a mutual solution to the problem of water scarcity, war is unavoidable.

And then a director of Jordan's Water Research Center says the Middle East is living on a water time bomb. It could explode at any time.

What about it? I take it from your statement, Dr. Naff, that would agree with those assessments?

Mr. NAFF. Not entirely. It makes it sound as though we are on the precipice of warfare, and that isn't the case. For example, in the Jordan Basin, if Syria and Jordan and Israel were more closely matched in power and interest and status, we probably would be at war by now over water.

But the fact is there is that disparity. There is another factor mitigating against immediate warfare; that all of the

parties concerned don't want to go to war over water, and in fact in a number of combinations, usually in bilateral combinations, they are all talking to each other and they are talking about the water problem.

Mr. HAMILTON. So you find those statements an exaggeration?

Mr. NAFF. Yes, but not impossible.

Mr. HAMILTON. Dr. Waterbury, Dr. Kolars, how do you respond to those assessments?

Mr. KOLARS. I think that Dr. Naff is correct that we don't have to worry about it tomorrow, but within the decade. I think it might not be the Nile, it might be another source. I believe that probably the most stressed country at the present time is Jordan and that its resources are fast being depleted.

Mr. HAMILTON. That is your assessment too, isn't it, Dr. Naff?

Mr. NAFF. Yes.

Mr. KOLARS. On the other hand, the whole question of the Euphrates River is a very, very important one. It has made the headlines very recently because of the new developments there and the shutting off of the river in January for 30 days. This may bring the Arab states closer together and give them some focal point upon which to reach agreement on a number of things.

On the other hand, this might place them in opposition Turkey, and this would be unfortunate.

Mr. HAMILTON. So if you look at the Nile, the Euphrates Tigris, and the Jordan, the most difficult immediate problem is the Jordan?

Mr. KOLARS. Yes, sir. If you will refer to the statement, on the last page there is a quotation from the Israeli press which makes that very evident, that no solution to the West Bank can be found unless the water problem is solved.

Mr. HAMILTON. Dr. Waterbury, do you want to give us your assessment? Do you agree with Dr. Kolars and Dr. Naff?

Mr. WATERBURY. I think in the way they have weighted the three situations, yes. I would comment on the remark by the Egyptian Minister of State for Foreign Affairs on the possibility of war in the Nile, I am not quite sure what he has in mind. There have been these rumors of some Israeli efforts with the Europeans to construct a large dam somewhere on the Blue Nile.

This periodically surfaces. I frankly don't take them terribly seriously. I don't think relative to the other two basins that there is any kind of immediate conflict situation emerging in the Nile.

Mr. HAMILTON. If you look at the sources of our water problems, is it a combination of factors that bring it on or

does one or two stand out for you? Obviously there are limited amounts of water. Several of you mentioned the fact that we have had very poor management of the water that is there. You have got explosive population growth, urbanization, agricultural requirements, a lot of things that enter into the water problem.

Does anything stand out or is it really a combination of these things and others as well?

Mr. NAFF. Basically it is not enough water, and since water is so cross-cutting an issue--it is involved in virtually all socioeconomic and political policymaking in one degree or another--it has to be a combination.

Mr. HAMILTON. But the countries themselves are not efficient in their use of water, is that correct too?

Mr. NAFF. No, they aren't. It is not that they are altogether inefficient either. It is just that they are not as efficient as the crisis and the scarcity requires them to be.

Mr. HAMILTON. Is it true that two thirds of the water supply allocated to the cities and towns in Egypt is lost through inefficient use--that much?

Mr. NAFF. In Jordan it is 40 to 45 percent that is lost.

Mr. HAMILTON. Egyptian farmers are using twice as much water as necessary because they have a very primitive irrigation system?

Mr. WATERBURY. Mr. Chairman, I think those figures on Egypt might be somewhat exaggerated. There is tremendous wastage, but I think the essential point is to keep in mind that agriculture consumes vastly more water than urban and industrial populations.

Mr. HAMILTON. That is true in this country, of course.

Mr. WATERBURY. We are reading about it in California. So some of this urban wastage may not be as significant as inefficient use in agriculture. This is where big savings could be made.

Mr. HAMILTON. Mr. Gilman.

Mr. GILMAN. Thank you, Mr. Chairman.

Are there many regional agreements right now in place with regard to the sharing of the Jordanian River between Israel and Jordan? It seems to me there was an old agreement--

Mr. NAFF. The Johnson Plan.

Mr. GILMAN. Is that in place and still being followed? Adhered to?

Mr. NAFF. No. It is often referred to. The Johnson Plan was never formalized, but all parties involved, there was an informal tacit agreement to stay more or less within the bounds of the Johnson Plan until 1967. After 1967, more and more of that plan was set aside.

For example, Jordan presently takes no water whatsoever from the Jordan River. It is consumed entirely by Israel.

The only water that Jordan gets from Jordan River is a small residue that is so polluted that it is not usable. The only source of fresh surface water available to Jordan in any quantity is the Yarmuk River, which has a flow of about 450 MCM per year, and Israel takes 100 MDM of that. Syria takes about 180, and consequently there is not enough left in the river for Jordan to fill the Unity Dam if they do build it.

Hence the current negotiations between Israel and Jordan.

Mr. GILMAN. Who has been negotiating?

Mr. NAFF. It has been mediated by our government, going on quietly for three years now. The Jordanians agreed in September of 1987 with Syria to build the dam. Syria's agreement, the quid pro quo was Syria would get the hydroelectric energy from the dam, and now the negotiation between Jordan and Israel revolves around how much water the Israelis will get. The Jordanians want to give them 60 to 70 MCMs per year. The Israelis insist on keeping the current 100 MCM.

The Johnson Plan allocated to Israel 17 to 25 MCM per yea originally, depending on the season, whether it is winter or summer. Israel needs that water to replenish the Coastal Plain Aquifer, which is being overpumped, and to replace water in Lake Kinneret and to send water up to the Golan to expand the settlements there. So they feel they need at least 100 MCM. The Jordanians say we can't give you that

because we won't have enough water for the dam, and much of Jordan's future is based on that dam.

Mr. GILMAN. Who or what branch of our government has been negotiating?

Mr. NAFF. In the beginning it was being done through USAID and out of the embassy in Jordan. At the present time I don't know what is happening because the talks are dormant. As far as I know, currently there isn't much going on. I am not absolutely up to date on it, Mr. Congressman.

Mr. GILMAN. Well, based on what you are saying then, there just won't be enough water for the dam itself because of what Syria is taking out--

Mr. NAFF. And Israel. What Syria is taking out is the water that rises--there is a small branch of the Yarmuk that rises in Syria and Syria is taking that water and sends down a residue of 132 MCM per year. After that goes down, the flow in the river is 400 million cubic meters per year. If Israel takes out 100 MCM per year and Syria takes 180 MCM per year, that doesn't leave, if you do the arithmetic, add those two and subtract it from 450, that doesn't leave 200 million cubic meters to capture behind the dam.

Mr. GILMAN. Is Syria part of the negotiations?

Mr. NAFF. Not directly. The Jordanians talk to the Syrians, and to the Israelis through the U.S., and the U.S. I presume talks to all three parties.

But the Syrians are threatening that if the Jordanians give away too much, then their deal will be off. So King Hussein is caught between a rock and a hard place on the issue unless it is successfully mediated.

Mr. GILMAN. Has the U.N. had any role in this?

Mr. NAFF. Not that I know of.

Mr. GILMAN. Are there any international requirements on water distribution, any international criteria?

Mr. NAFF. You have raised a serious problem, because international law on freshwater issues is rudimentary and fairly ineffectual. It has been effective only when prior treaties have been in place and law can be improved for mediating issues. But presently there is not body of international law that is being applied here. There is international law on these issues, but it is not very effective.

Mr. GILMAN. Thank you.

Mr. HAMILTON. Mr. Smith.

Mr. SMITH. It is the last part of your statement that is where I would like to dwell. Why is it that any of these international fora are not effective, any of the international existing bureaucracies that are set up to handle these? How come they are not at all effective in dealing with any of these problems?

You say that Jordan speaks to the Israelis through the

U.S. Why can't the Jordanians and the Israelis speak directly? We are not asking the Iraqis to do that. What seems to be the problem? Just the usual diplomatic problem that exists currently?

Mr. NAFF. Yes. It is basically a political problem. If Jordan were to open public negotiations with Israel over this, then Jordan, the regime there I think would have a serious reaction from its own public and among the other Arab states.

Mr. SMITH. So as far as you know, there is not private conversation?

Mr. NAFF. Sure there is. But there is the fact that there is a belief in Jordan, in many of the Arab states that the most effective way to get the Israelis to listen is through U.S. mediation.

RPTS STEIN

DCMN HALL

Mr. SMITH. Water experts from 11 Arab states met in Oman in April?

Mr. NAFF. Correct.

Mr. SMITH. In 1989 or 1990?

Mr. NAFF. 1989.

Mr. SMITH. And they treat obviously water security as essential to their national and military interest and security the same way that everyone would. Most of the Arab states that were represented at the region or all agreed with it, but what is the ramifications of it if a year and two months afterwards there is still no real forum currently considering all of these problems for the Arab states and nobody finding a solution at this moment?

Mr. NAFF. Well, partly it is because water problems are really complex and difficult. They are very recalcitrant of easy and quick solution. For example, to change the habits of consumption of any country is really hard, a big problem, and it takes time and it also takes really courageous political leadership. And that doesn't exist everywhere.

Mr. SMITH. There is no enforcement in many of these countries, you couldn't enforce it anyway. Even if you had rules, how, in some of these countries where the central government has no sway in the desert, how would you control

agricultural overuse or illegal use?

Mr. NAFF. There are ways of doing that partly by price. Also all the governments have laws on the books that say water belongs to the government, and it is the government that delivers the water. But there is a lot of cheating in the system, you are right. It is difficult to regulate effectively or 100 percent.

Mr. SMITH. Does anybody have any solutions, at least in the near term, to some of these problems without being able to get into the long-term solutions? Is there anybody proposing certain things which would be significantly helpful other than the normal conservation and the other kinds of things, changing habits?

Mr. KOLARS. As I mentioned earlier, the Turks have suggested this peace pipeline which would be able to bring supplementary, not total replacement water, to Jordan and to countries to the south, cities to the south. However, they have never been able to discuss the role of Israel in this for obvious reasons, even though Israel would have to play some part in guaranteeing the safety of the pipeline or perhaps being a recipient of some of the water.

Mr. SMITH. Where would the pipeline come across?

Mr. KOLARS. Through Syria and Jordan and run straight down the west side of the peninsula. I have seen several different maps in the Turkish press and with the Brown &

Root people in the U.S. who have been proposing this, one of which came across Iraq and down the east side of the peninsula.

Another map I have seen simply goes through Syria and parallels the Iraqi border down to the east side of the peninsula again.

Each pipeline is estimated to cost in present dollars about $10 billion apiece. This is not as large a sum as you might think, because Brown & Root suggest that they could deliver water for one third the cost per cubic meter that desalination would. It would pay for itself. There is water in Turkey, I am certain, though perhaps it would have to be a little different from what is suggested now.

Mr. SMITH. You mean the source of the water?

Mr. KOLARS. Yes. They suggested the Seyhan and Jeyhan Rivers, and they don't have enough water in them, but the Golesu has enough water to supply the needs. It would be 50 miles of additional pipeline.

Mr. SMITH. The problem is, Professor Naff, you mentioned I think that Turkey reduced its water flow for 30 days?

Mr. KOLARS. I did that, sir. This was on the Euphrates River, and there are two elements to this. There is the technological element and the political element. That was to begin filling the reservoir behind the Attaturk Dam. The reservoir holds about 84 billion cubic meters and think that

they got in 3 to 5 percent of that by letting it go for 30 days. They didn't come anywhere close to filling the reservoir in this first turn on the river.

Mr. SMITH. What happens in the event that they realize their plans completely? I think Professor Naff said that water into Syria could reduce by 40 percent and maybe up to 80 percent in Iraq.

Mr. KOLARS. This is again a very real possibility, and the Iraqis and the Syrians for the first time have begun talking seriously together.

Mr. SMITH. With the Turks?

Mr. KOLARS. With the Turks, and they have also begun to establish some slight detente because of the water problem between Syria and Iraq, which have been rather hostile to each other, and they are attempting to have three-party talks with the Turks.

There is a technical commission which is at work now, but diplomatic meeting of the three countries has had more difficulty. The Turks say this is a technical problem, the Syrians and Iraqis feel that it is tied to other matters.

It has been suggested that one of the reasons that President Ozal made the statement he did and that the water was turned off was to perhaps pressure the Syrians into preventing KKK--these are a Kurdish political group which practice extreme terrorism on the Turkish side of the

border, they are trying to destabilize the area there by raids on their own villages--and it has been suggested that this was in a sense a light tap of the stick to let the Syrians know that the Turks might do more if the Syrians didn't help control the Kurdish terrorists coming across the border.

Mr. SMITH. Thank you, Mr. Chairman.

Mr. HAMILTON. Mr. Lukens.

RPTS STEIN

DCMN HALL

Mr. LUKENS. Thank you, Mr. Chairman. I understand it is currently estimated that Israel current usage, and I don't mean to pick on Israel--I think she is probably the most advanced technologically in water usage, she probably uses water as wisely as anybody in the Mideast can--but it is my understanding that she is currently using 10 percent more annually than she can replace, and she is the best of the nations, is that a correct statement?

With that in mind, it says that by the year 2000, Israeli and West Bank demand for water will outstrip resources by 20 percent if nothing is done.

My question is this: If they are doing the best, Israel and the West Bank, and the most advanced technologically and the others are far behind, what is the first, most immediate step to take, and what role can the U.S. play specifically in starting to address the potential solutions to this awesome problem?

Mr. NAFF. Well, as I said, the most effective solution would be the creation of a basinwide independent authority to regulate the use of water. For political reasons, that is not likely to happen. Short of that, agreement, bilateral agreement, between the basin's riparians on the sharing of water which could be mediated by the U.S.--and in

this respect that is one thing the U.S. could do--to encourage discussions of sharing of water.

The third thing that the U.S. could do would be to provide inducements and encouragement to the nations to improve their water technology and to improve the conservation and the way that they use water. In this regard, the U.S. can act as a facilitator. It can provide certain amounts of strictly dedicated funds for that purpose. It can provide the expertise as well.

Mr. LUKENS. May I interrupt? I think I understand the general approach that the countries would use. My question is more political in nature.

How can we accelerate any agreement between any two meaningful countries in terms of water usage and water resource management? What is the first step for us? Would it be Israel and Egypt? What countries make the best marriage to start?

I am look for some answer somewhere.

Mr. KOLA One thing about Israel and Egypt, and I thi Professor Wa ry could address that, Egypt is in no position to ise Nile water, because there are seven people on t atchment there, and they have to get agreement g those people before they can promise Nile water some re else.

Mr. LUKENS. Where can we start to effect some kind of

model against which the other nations can measure their own situation as it becomes more severe?

DCMN MILTON

Mr. NAFF. I can tell you where under the Jordan basin. There is already a start on that.

Israel has for some years been preventing Jordan from cleaning out the intake to the East Gor main canal, the main water carrier in Jordan. When the Jordanians have gone out to clear out the rocks and silt, the Israelis have brought up troops and there have been exchanges of gunfire over the issue.

Three years ago the United States mediated an agreement largely because USAID experts agreed with the Jordanians, who said to the Israelis, ''Your claim that cleaning out that intake is not diverting Israeli water from the river,'' but since that agreement, the Israelis have reimposed restrictions on the Jordanians cleaning that out.

That is the main water carrier of Jordan and Jordan has got to have that water, and if we could mediate an agreement on that one issue alone that is long term, so that each time the silt and the stones build up the Jordanians are allowed to do it under strict observation so that it doesn't affect Israel, that would really help because there is a peculiar paradox about water issues and that is something that I call super-ordinary national interests.

Historically, water has tended to encourage negotiated settlement where other issues would quickly degenerate into warfare because water is essential to life to everybody, and there is a global feeling that people ought not to take other people's water because they need it to live.

In certain limited circumstances, and in the short term, water issues, if you make them small enough and are doable, water issues tend to be negotiated; and what is interesting is when you have successfully negotiated one of these water issues, the general impact is it has a salutary effect on other issues because the actors tend to change their perception of one another. ''Look, we have succeeded in doing this.''

Mr. LUKENS. Would it be possible for Dr. Waterbury to address the issue?

Mr. WATERBURY. I would like to mention something that has existed been Egypt and the Sudan since 1959 called the Permanent Joint Technical Commission on the Nile. It combines Egyptian and Sudanese engineers and hydrological experts. It meets four times a year, rotating between Khartoom and Cairo. It is the technical regulator for the 1959 agreement between Egypt and the Sudan on the use of the Nile water.

Egypt and the Sudan have gone through turbulent times, yet that commission has always met and done its technical job

and built up, as Professor Naff suggests, a kind of level of confidence and credibility between the two countries. I don't know if this can be a model in a situation where two of the major users do not recognize each other diplomatically.

Sudan and Egypt always had diplomatic relations. But it is a kind of low-level institution that keeps a constant focus on water issues on a quarterly basis, and has never failed to meet in 30-odd years.

Mr. LUKENS. One quick question. Then it has been very successful?

Mr. WATERBURY. I would regard among problems affecting sovereign nations, this is a fairly remarkable organization.

Mr. LUKENS. Thank you.

Mr. HAMILTON. There is no technological fix in sight, and I have in mind desalinization and maybe other things I don't know about, is that correct?

Mr. KOLARS. The problem of desalinization is difficult when at the present time it is too expensive. It works very well for cities and Riad is now receiving water from the Gulf and Abha on the Red Sea is receiving water from the Red Sea. It works well for domestic uses, urban populations.

Studies indicate that about 40 kilometers of Nile water

that was used, John Allen's study, 37 were used for agriculture and three cubic kilometers, three billion cubic meters, met all the needs of the people.

Mr. HAMILTON. You say desalinization works for cities?

Mr. KOLARS. Yes, in other words, for small amounts because it is expensive. But it is a magnitude greater for agriculture, and you have to take into account pumping costs.

Mr. HAMILTON. Why wouldn't that solve Cairo's problems?

Mr. KOLARS. It could, as a matter of fact, if they would bring it down from the sea. That is one of the possibilities.

Mr. HAMILTON. Is that just very, very expensive?

Mr. KOLARS. As long as they have the Nile flowing by the city, it doesn't occur to people. Why bother?

One other aspect of desalinization, that occurs at sea level and most use occurs above sea level. Sixteen to 18 percent of the energy used in Israel at the present time is used to pump water from Lake Kinret up to the national water carrier.

I would like to offer a technical solution in answer to Congressman Lukens' question. It occurs to me that if the United States could help negotiate a small and less expensive segment of the peace pipeline leading only to Jordan, only Syria, Jordan and Turkey would be involved. It

would be technologically very easy to do, require only three signatories on any such negotiation, and it might be an example of something that could then be extended to Israel or the Arab nations to the south.

Mr. HAMILTON. Did the Saudis spend $20 billion on that desalinization plant?

Mr. KOLARS. I am not sure of the exact amount. They have 20 percent of all the desalinization equipment in the world, and have research going on.

Mr. HAMILTON. Is it efficient?

Mr. KOLARS. It is efficient in the sense that it does the job, but it is not cost effective.

Mr. HAMILTON. It supplies what percentage of their total water consumption?

Mr. KOLARS. I am not sure. In Kuwait, for example, it supplies 100 percent.

Mr. HAMILTON. Desalinized water?

Mr. KOLARS. Yes.

Mr. HAMILTON. I am interested in your assessment of what priority American policy in the Middle East gives to these water problems and whether you think it is a high enough priority.

You have made a number of suggestions about what could be done in terms of the United States playing a mediating role. Are they doing it and if not, why aren't they doing it?

Mr. NAFF. They are doing it in a limited way. For one thing, you can't mediate unless the parties ask you to mediate and that is a limitation.

Mr. HAMILTON. That means the parties aren't interested in it?

Mr. NAFF. I don't know. I can't speak for the parties.

Mr. HAMILTON. If it is as serious a problem as you say, why aren't they interested in it?

Mr. NAFF. Some parties don't have sufficiently good relations with the United States to want them to come in. I don't think it is a high enough priority in formulation of American Middle East policy at present, although it is gaining more emphasis in agencies within the government.

Mr. HAMILTON. Are you aware of anything we are doing actively to deal with the water problems in the Middle East today?

Mr. NAFF. The negotiation between Jordan and Israel on the Yarmuk and USAID has been involved in various assistance to water projects in Jordan and in Egypt and in Israel.

Mr. HAMILTON. Are any areas rationing water?

Mr. NAFF. Almost all are.

Mr. HAMILTON. You have water rationing in almost all the areas?

Mr. NAFF. In the arid areas. I don't think there is water rationing in Turkey.

Mr. HAMILTON. On the Nile, Dr. Waterbury, you have the Israelis working with the Ethiopians on some dams on the Blue Nile; is that right?

Mr. WATERBURY. This is an allegation. I have no way of nothing whether it is true. That kind of rumor surfaces every two or three years.

Mr. HAMILTON. But to your knowledge there are no negotiations going on between the Israelis and the Ethiopians?

Mr. WATERBURY. To my knowledge, which is limited.

Mr. HAMILTON. That couldn't go on very far before you would know it, would it?

Mr. WATERBURY. I suspect not. It seems unlikely to me because any project that would be threatening to downstream neighbors would cost more money than Ethiopia could borrow. Anything that happens in the Ethiopian highlands is immediately registered in Cairo.

Mr. HAMILTON. Does the Blue Nile represent 85 percent--

Mr. WATERBURY. It varies with rainfall, but it is on average 60 percent of the annual discharge. it can be as much as 85.

Mr. HAMILTON. You have Ethiopia, the Sudan and Egypt all need water from the Nile?

Mr. WATERBURY. Right.

Mr. HAMILTON. Could those needs be met simply with more

efficient use of that water?

Mr. WATERBURY. Yes. I could give more of an answer than that if you want, but, yes.

Mr. HAMILTON. Well, what is the rest of your answer?

Mr. WATERBURY. Well, for Ethiopia it has very limited use of Blue Nile water at present and is unlikely, just given its own agricultural priorities, to ever draw very heavily on the Nile.

Sudan could make very heavy claims at some point, but those claims, which have been postponed for years because of political instability, might be met through much more efficient surface irrigation systems than they currently have.

Egypt, with great effort, could make major savings in its use of agricultural irrigation water.

Mr. HAMILTON. If you had stable governments and those governments negotiated rules and regulations for the Nile, it would put an even greater strain on resources; is that it?

Mr. WATERBURY. That is where one would like to go, a mutual understanding among the states.

My point was that if there are stable governments capable of negotiating such accords, they will also be capable of making claims on the Nile. They aren't now because they can't even get to that point.

Mr. HAMILTON. How is the Nile doing now? Is the flow down or up?

Mr. WATERBURY. The overall trend since the beginning of the 1980s has been down. I believe the flood of last September and August was a substantial flood.

But if you look at the trend line since the beginning of this century, it is a downward trend line. The average yield seems to be going down.

Mr. HAMILTON. And that has very serious ramifications for Egypt; their population is going up rapidly?

Mr. WATERBURY. Absolutely. But it is what Egyptian agriculture does that counts. Those additional people consume water, but not like an extra acre of rice or sugar cane.

Mr. HAMILTON. Mr. Smith.

Mr. SMITH. Let's talk about population growth. Given the scenario that you have painted and the limited, at best, effort at cooperation which exist between the various states that compete with these regions--you have the ones you talked about, Sudan, Ethiopia and Egypt, Jordan and Iraq, Israel, and their participation in that area, and then you have other places in the Arab world, Kuwait, which is using all desalinized water. I guess they are turning oil into water.

If the population growth continues on this trend, given the current rather minimal emphasis on this, is there a

linchpin area, a time frame at which point this is going to break down significantly?

When would you anticipate that given the current population growth and the need then to put more lands into agriculture for the purpose of feeding those people that come on stream, let alone the water they use?

Mr. NAFF. Using World Bank and U.N. numbers, projections would be somewhere between 2010 and 2020.

Mr. SMITH. That is only 20 years from now.

Mr. NAFF. That is right. Since World War II, the area's population has doubled and on present trends, just five countries--Egypt, Jordan, Israel, Syria, Turkey--the number should be sometime around 2015 that the total population around 230 million. That is a population larger than the water resources of the region covered by those countries can bear.

Mr. SMITH. Is that a recognition that exists in the minds of the people that are currently running those countries?

Mr. NAFF. No. Among policy makers--

Mr. SMITH. Yes.

Mr. NAFF. And leaders--interestingly, their actions, the answer has to be no. But their own experts, in all these countries they have good people. Their own experts are telling them that.

Mr. SMITH. is there anything that we can do at all, the

United States, besides trying to act as a broker?

Mr. NAFF. We give a lot of aid in that area and we have influence in the area, and I think that we can use that to help, to encourage certain kinds of activities. But that is very difficult.

We are dealing not just with very recalcitrant political problems, but we are also dealing with cultural problems as well and attitudes.

Mr. SMITH. I have no further questions.

Mr. HAMILTON. Mr. Lukens.

Mr. LUKENS. Thank you, Mr. Chairman.

I would just like to follow up with my search for additional micro solutions. What would be the next nation or nations most logical in signing on to the Egyptian-Sudanese agreement, or are there any nations that would benefit further down the Nile toward the source, and what pressures could be brought on them or what facts presented to them to convince them to participate?

Mr. WATERBURY. Egypt and the Sudan have both been very active for 15 years in trying to engineer a basin-wide agreement among all the nine riparian states in the Nile basin. The one that would most interest them I believe is Ethiopia.

Given the rather perilous state of the Mengista regime, it may be not the best bargaining partner those two countries

could have, but he may at this point be willing or he may be more willing than he has been to contemplate a partnership in managing the Nile.

The real problem in the Nile basin has been the tremendous imbalance in expertise as between Egypt on the one hand, and the upper Nile states in the White Nile basin, where they feel they do not have the knowledge of their own water resources to sit down at the table with Egypt and Sudan and not give away the farm.

So the Egyptians and Sudanese, I think, have been intelligent in trying to help build expertise in Rowanda, Uganda, Kenya, elsewhere, so that they will finally be in a position where they can sit down at the table and bargain intelligently over how these waters will be managed. It is a problem trying to have an equal playing field in terms of knowledge and expertise.

But the Egyptians have patiently moved and the minister of state in Egypt has been the prime mover to encourage the upper Nile states to come into some basin-wide accord. They have to have incentives to do so, and none of them are as dependent on the Nile as Egypt is.

So you have to find side payments for them. There may be other kinds of development projects that are associated with the Nile itself.

Mr. LUKENS. I thank the gentleman for that observation.

If I might ask about the U.N.'s role. Is there a U.N. role, and is it possible that the U.N. could put together a team of water experts representing those underdeveloped countries so that their interests would be protected at such a conference in order to accelerate the process?

Mr. WATERBURY. I think the U.N., the World Bank, the European Development Fund, all of which are periodically called upon to support large development schemes on rivers financially, can also be the catalyst, and the World Bank has been the catalyst in other river basins, to some kind of understanding establishing the rules of the game among these sovereign nations.

You have to have the financial stick behind it.

Mr. LUKENS. Do you think it is possible for them to pursue a more aggressive course? If the funding which is basic to any project is forthcoming, they could offer these lesser developed countries the expertise either from their organization of African states who represent them or the U.N., some international body of experts to represent their interests so we could accelerate the process of their coming to the table.

They are not at the table now?

Mr. WATERBURY. Not in an official capacity. They may do some of the technical work. The World Meteorological Organization has been the instrument through which the upper

Nile states have been building their own technical expertise in measurement and analysis of water resources. So they are there in the background. Whether they are at the table in any formal sense, I don't believe so.

Mr. LUKENS. Do you have other comments?

I am just searching for some small thread of hope to cling to that would see us take a role in accelerating this whole process. I just see it laying there dying for the most part.

Any other suggestions?

Mr. NAFF. I don't think it will die because the crisis will become so acute, that somebody is going to have to respond and do something about it.

As John said, the United Nations and the World Bank and various other international agencies are doing something, but the problem is so big, what is being done is piecemeal. They do something in response to a request by a given country.

There is not a lot of initiative being taken because, again, there is no specialized agency that deals with these issues exclusively like the one that I suggested perhaps the United States might set up, but could be equally well set up under United Nations auspices that would provide this kind of help and could perhaps take some initiatives.

But there are so many political problems that get in the

way, Mr. Lukens, that it is very difficult to sort of negotiate all of these shows. So it tends to be a fragmented process.

Mr. LUKENS. If I might just make one additional comment in the way of an overview, it seems to me that while I agree with the comments you have made how difficult it is politically, that it is absolutely vital that some agency step in now and either plan one of two routes, one for the emergency that is going to hit us in 20 years, and these people suddenly awaken to the fact there is not enough water for their population to survive and be prepared for that, a crisis management kind of thing, or--and I just detest this route--the more advanced nations of the world start pressing these people even to the point of suspending financial aid if they don't come to the table and start looking at a water management program immediately.

You are telling us we are looking at a crisis the proportion of which the world has never seen.

Mr. WATERBURY. Let me suggest something that I may not entirely believe, but maybe a lot of these areas are simply not well-suited for agriculture, and we should not impede the process of having them move away from an agricultural footing.

Egypt I would clearly except from that. But it is somewhat like the situation in Southern California and parts

of the Colorado basin. We are carrying water long distances to areas which may not be ideally suited over the long haul for agriculture, and maybe Israel and Jordan should look to a non-agricultural future rather than trying to get a technical fix allowing them to continue using water in ways that are not suited to their ecology.

Mr. LUKENS. I understand that Israel particularly has developed a system whereby water can be 85 percent pure as opposed to 90 or 97 percent pure, which makes it cost effective for agricultural purposes only.

Are you aware of that development? Is that an accurate statement? So for agricultural purposes sea water is bottomless in terms of those countries that have an ocean frontage. But for those countries that are landlocked, the problem is more severe?

Mr. KOLARS. It is very complicated because plants have a wide variety of salt tolerance and the Israelis are developing certain plants that have a higher salt tolerance and ways of preventing salts from accumulating in the soil. However, this is only a partial solution because human beings can't be expected to drink more salty water. So it is very partial.

Responding to the previous question, there is a very low profile detente, talks going on apparently between the Syrians and Iraqis at the present time. It seems to me that

we are looking at Turkey, Iraq, Jordan and possibly Syria and Israel, five of perhaps the strongest nations militarily in the whole area.

I don't know, and it is not for me to suggest, how it could be implemented, but if these talks could be encouraged, it seems to me that cooperation between Jordan, Turkey and Iraq would ensure the safety of, say, water pipelines in the Near East and things of that sort at least in Southwest Asia.

Mr. NAFF. Mr. Lukens, I believe that the option that you so detest is probably going to be the one that will bring action.

It makes no sense for people in the Middle East certain areas to be doing agriculture at all and no sense for them to be flushing their toilets with drinking water or flushing toilets at all where a lot of water is consumed. Those kinds of things I think can be changed on a technical basis, but I don't think it is going to happen until it reaches a point where it must be managed as a crisis, and I believe it is vital for us because of our interests in the region to be prepared for that, and perhaps by creating a special agency for that purpose or encouraging one in the United Nations.

Mr. LUKENS. I appreciate that.

I used the word ''detest'' which is a bit strong, but I don't like to offer immediate support for that because we

have so much anti-Americanism around the world and I am the last one who wants to stick our nose someplace where it doesn't belong.

But it seems this crisis is so immediate and awesome, Mr. Chairman, that we have to entertain every possible administrative method to bring it to the attention of those most affected.

Thank you.

Mr. HAMILTON. How far away are we from a crisis?

Mr. KOLARS. I think it depends on what area you are looking at. I think that Jordan is on the verge of one right now.

Mr. HAMILTON. Next year?

Mr. KOLARS. Yes, maybe this year. An example of that is they have tapped the El Azrak on Asis Springs 60 miles north of Aman, and that has essentially dried up now so that was just a drop in the bucket.

I think that 20-10 for a big crisis on the Euphrates River, I think is a good estimate. But there will probably be a small crisis about 1994 if the first irrigation return flow starts coming down the Khabur River into Syria from Turkey and perhaps polluting the Khabur to a serious extent.

Mr. NAFF. I agree that it is imminent in the Jordan basin. I am not sure it will happen tomorrow or in the coming year. I think somewhere between 1995 and 1997 is

more likely, certainly before the end of this decade.

One thing it has been discovered that the Pudici aquifer, which is the main aquifer in Jordan has less water by about 50 percent than originally thought. Instead of 100 PCM per year, it will yield 50, and that has to be transported 350 kilometers to the main population areas of Jordan. So that adds to the crisis.

I believe what we will see, as I said before, is not necessarily open warfare, but a lot of civil disorder and a lot of destabilizing forces at play largely as a result of the inability of Jordan and other countries to meet their economic development.

Mr. HAMILTON. And on the Nile?

Mr. WATERBURY. When you talk about a crisis, I have the image of somebody turning on their water faucet and no water comes out, and it won't be like that. If water becomes scarce either because the natural regime of the Nile changes and there isn't as much water or because upstream states use more, one will find that there are projects foregone such as desert reclamation, that certain parts of the irrigated surface have restricted water use or are removed from irrigation.

Supply and demand will reach an equilibrium I suspect without a noticeable crisis where suddenly people are in the streets saying, ''Where's our water?'' Adjustments can be

made, but they will be painful.

Mr. HAMILTON. We have a figure here that Saudi Arabia is using 90 percent of its nonreplenishable water supplies for agricultural products that could be imported at one tenth the cost. Does that sound reasonable to you? And they are the sixth largest wheat exporter today.

That is kind of crazy, isn't it?

Mr. KOLARS. Yes, it is. They give interest-free loans to the farmers. They provide them with water and land. They then buy the wheat from them at--in the past, it has been six to nine times the FOB price at Jedda or someplace like that.

Mr. HAMILTON. Why do they do it?

Mr. KOLARS. It is a matter of pride, self-sufficiency. However, it is very difficult to get a reading on this, but there are strong indications that the aquifers there are being depleted at a much more rapid rate than the ministry of agriculture is willing to suggest.

Mr. LUKENS. It is also of interest to me coming from a strong dairy state that they are now self-sufficient in dairy.

Mr. KOLARS. I don't think you have to worry. This will last a long time.

Mr. LUKENS. Cows do need water.

Mr. HAMILTON. Are the Saudis moving to conserve water in any significant way?

Mr. KOLARS. They are experimenting but I don't believe they are moving to conserve water at the present time.

Mr. HAMILTON. There is talk in Libya about an eighth wonder of the world project. How is that coming?

Mr. NAFF. A couple of civil engineers on our research project attended a presentation by the head engineer who made a presentation to experts on this project, and when they got his figures they went over the numbers and by their calculations, if water in sufficient quantities, the quantities that were claimed would be delivered in sufficient supply to build all of these rivers, in the pipeline that they are planning to build, that water would have to pass through that pipeline roughly at the speed of sound.

Mr. HAMILTON. So that project doesn't have too much promise, is that it?

Mr. NAFF. Not as it was presented.

Mr. KOLARS. Many years ago when relations were much better, I had the opportunity to visit Hufro oasis. At that time the drawdown was such that they were abandoning fields very rapidly. I think that the great man-made river will be lucky if it lasts to amortize the investment.

Mr. HAMILTON. On the Euphrates and the Tigres, Damascus actually threatened to go to war over that Ataturk dam, didn't they?

Mr. KOLARS. They have.

Mr. HAMILTON. That dam is one among many dams that would be constructed, 21 in all?

Mr. KOLARS. Yes.

Mr. HAMILTON. None of them constructed?

Mr. KOLARS. The 21 includes some on the Tigres, but three large dams are in place, the Kivan, Karkaya and Ataturk are in place.

Mr. HAMILTON. So three out of the 21 are constructed?

Mr. KOLARS. There are a number of smaller side dams constructed.

Mr. HAMILTON. What is the completion date for the entire project?

Mr. KOLARS. They said 2000 originally. On the diagram I project it at 2040 if every dam were to go into place.

Mr. HAMILTON. How is this going to affect Syria and Iraq?

Mr. KOLARS. If every dam and every irrigation project in Turkey went in place, it would reduce the natural flow of the Euphrates from what I figure to be 33 billion cubic meters per year, that entering Iraq would go down to less than five.

I don't think this will happen because all of these projects I don't think are attainable. But if you look at everything that is on the drawing boards, it could mean the end of the river in Iraq.

Mr. HAMILTON. So these projects, as each goes into place, cuts the water supply to both Syria an Iraq?

Mr. KOLARS. yes.

Mr. HAMILTON. They must be protesting it, then, pretty strongly?

Mr. KOLARS. Yes, sir.

Mr. HAMILTON. Are there any negotiations going on now between Syria, Iraq and Turkey?

Mr. KOLARS. Yes. There is a technical commission which has been meeting regularly. There have been attempts to form a tripartite council. I believe it has met a few times.

And also, the Turkish foreign minister has visited Bagdad and there are exchanges going on. They aren't very effective at the present time.

Mr. HAMILTON. And there is no immediate prospect for any kind of agreement?

Mr. KOLARS. I would hope so, but there are a number of difficulties to be worked out.

Mr. HAMILTON. Is the World Bank involved?

Mr. KOLARS. I don't know.

Mr. HAMILTON. Is the United States involved?

Mr. KOLARS. Not to my knowledge.

Mr. HAMILTON. is there enough water in the Euphrates for all three of these countries if they come to an agreement of

sharing?

Mr. KOLARS. There is certainly enough water to share, but not enough water for each country to realize its ambitions.

Mr. HAMILTON. How does the per capita consumption of water in these three countries run?

Mr. KOLARS. In Turkey there is no problem. There are ample supplies.

Syria does not depend so much for water consumption domestically on the Euphrates River because the Damascus and Aleppo--well, Aleppo is a case in point. It now draws all its water from Lake Assad and if the lake is diminished or polluted, it could mean hard times for Aleppo.

Mr. HAMILTON. That dam is on what river?

Mr. KOLARS. On the Euphrates, the major dam that the Syrians have. Damascus gets its water from the mountains to the west.

Mr. HAMILTON. Not from that--

Mr. KOLARS. The Orantes is a case in point. It flows north from the Bekaa Valley in Lebanon into Syria and through Hatai Province of Turkey where it reaches the sea. Hatai province is going to have a water shortage in the future.

The Syrians plan to build two dams on the Orantes River before it enters Turkey in the future. This will be a burr under the saddle for the Turks when that happens.

Mr. HAMILTON. Is it correct that the water consumption in the West Bank indicates that the Jewish settlers are using five times more water per capita than the Palestinians?

Mr. KOLARS. There are quotations in May 1999 the Jewish population uses 87.5 percent of the water from the West Bank and the Arabs are using 16.5 percent. This is from the Israeli press.

Mr. HAMILTON. You consider that an accurate figure?

Mr. KOLARS. There are a number of other estimates which are exactly in that same ball park.

Mr. HAMILTON. Are there restrictions on the use of water by Palestinians?

Mr. NAFF. Yes. Palestinians can't farm after 4 p.m. Palestinians can't dig a new well or repair a well that is proximate to an Israeli well. Palestinians cannot generate any new water.

Palestinians on the West Bank and Gaza consume on a per capita basis an average of 76 LCDs as compared to 300 LCDs by the settlers.

In some places on the West Bank of Gaza since the intafada, the Palestinian average has gone down to less than 44 LCDs, less than the United Nations reckons is necessary for maintaining minimal health standards.

Mr. HAMILTON. When the Jewish settlers go into the occupied territories, do they have restrictions on their use

of water?

Mr. NAFF. I don't know of any formal restrictions that have been placed.

Mr. HAMILTON. Do the Jewish and the Palestinians in the occupied territories pay the same amount for water?

Mr. NAFF. The settlers' water is subsidized. They do not. The Palestinians pay more for their water.

Mr. HAMILTON. Do you know what the difference is?

Mr. NAFF. I have the figure, but not in my head.

Mr. HAMILTON. It is about four times more?

Mr. NAFF. I don't know.

Mr. HAMILTON. If you have that information, we would like to have it, and perhaps you could call us and we will insert it into the record.

Mr. NAFF. Sure.

[The information follows:]

********* [COMMITTEE INSERT] ********

Mr. HAMILTON. And Gaza is consuming water much faster than it is being renewed?

Mr. NAFF. Yes. By about 70 MCM per year, and what is happening is that the Gaza aquifer is rapidly deteriorating. There is already water encroachment from the Mediterranean, and if that aquifer goes, that will have a very serious impact not only on the settlement, but could have an impact on the coastal plain aquifer in Israel, because there is a fairly strong likelihood, but not an absolutely proven one, that there is interchange there. That coastal plain aquifer is an Israeli aquifer. It is one of the two main aquifers.

Mr. HAMILTON. Is there any indication there of seepage of salt water?

Mr. NAFF. Not for certain yet. But there is serious deterioration in the aquifer and it is reaching what is known as the red line. That is why water is being pumped from Lake Kinret to replace that water and the water from the Khamuk is being pumped to replace Lake Kinret.

Mr. HAMILTON. Has anything been done to correct the problems?

Mr. NAFF. Plans have been made to replenish that water and some efforts have been made to replenish it, but there is such a shortage that the effort has been diminished significantly and frequently interrupted.

Mr. HAMILTON. Jordan is under water rationing now?

Mr. NAFF. Yes.

Mr. HAMILTON. Is that the whole country?

Mr. NAFF. Both urban and rural areas.

Mr. HAMILTON. What are they doing immediately in the short term to try to get away from rationing?

Mr. NAFF. Well, they are trying to generate new water from various sources, but that is very limited. They are trying to improve the delivery system of water. They have reorganized their water bureaucracy to make it more efficient, and they are also going over as rapidly as they can to drip irrigation.

They are trying to re-line the water carriers and the irrigation systems. But they have very limited funds to do that and limited manpower.

Mr. HAMILTON. Israel is using water from the Jordan River and from the Sea of Galilee?

Mr. NAFF. Yes.

Mr. HAMILTON. How polluted is the water south of the Sea of Galilee which Jordan might be able to use?

Mr. NAFF. It is too polluted for Jordan to use.

You have raised an important point here. We haven't talked about the problem of water quality, which is as serious an issue as water quantity, certainly in the river basins that we have all talked about. That must be addressed simultaneously.

There are already serious outbreaks of water-borne disease because of this pollution and it also diminishes the amount of water that is available. And unless that is addressed along with the population problems--all are interconnected.

Mr. HAMILTON. Pollution comes from agricultural runoff and inadequate sewage systems and that sort of thing?

Mr. NAFF. That is right, and industrial use and human offal.

Mr. HAMILTON. Where is the greatest problem of pollution in this area?

Mr. NAFF. In the Jordan basin?

Mr. HAMILTON. The whole region. Do we have a big problem with pollution on the Nile?

Mr. WATERBURY. No, although it is tremendous agricultural runoff in Egypt itself. But the Nile itself is reasonably clean.

My colleague points out the problem of the snails and the disease vector that virtually all peasants who work in irrigated agriculture in the Nile basin have.

Mr. KOLARS. The pollution problem that is coming up on the Euphrates is that the Hubler, the major stream in northern Syria, I believe will be seriously polluted once the agricultural projects north of the border dependent upon water from the Ataturk reservoir come on line. This will begin in 1991 if everything goes according to schedule, and

will probably reach serious proportions by 1995-1996. And the errant is similar.

One of the most interesting cases, though, is that of the Lepo itself, the city being so dependent upon the waters from Lake Assad, and so it is in jeopardy at the present time if anything happens to Lake Assad.

Mr. HAMILTON. Gentlemen, thank you very much. We appreciate your contributions this morning, and the subcommittee stands adjourned.

[Whereupon, at 10:40 a.m., the subcommittee adjourned.]

* * * SPEAKER LISTING * * *

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STATEMENTS OF:

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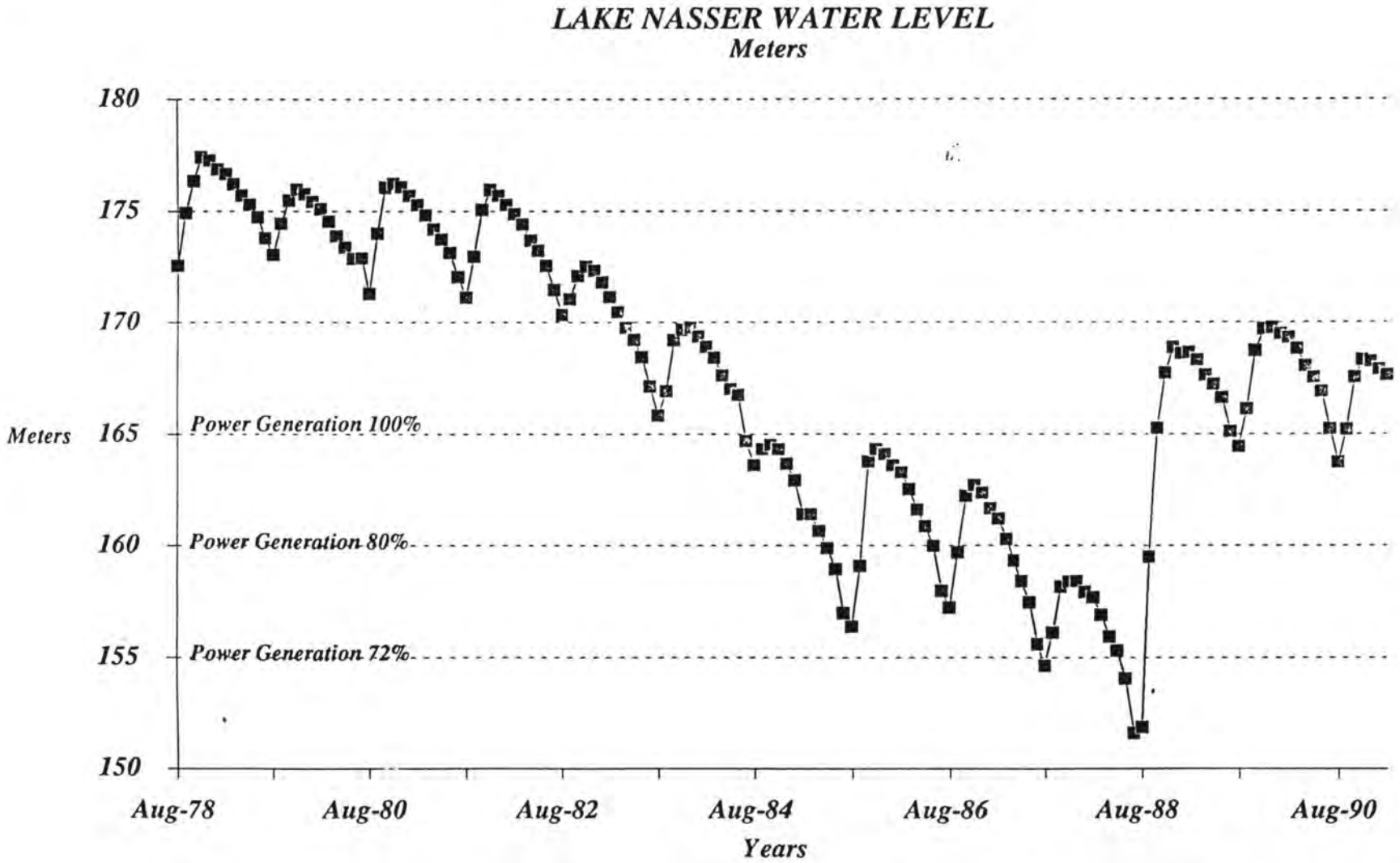
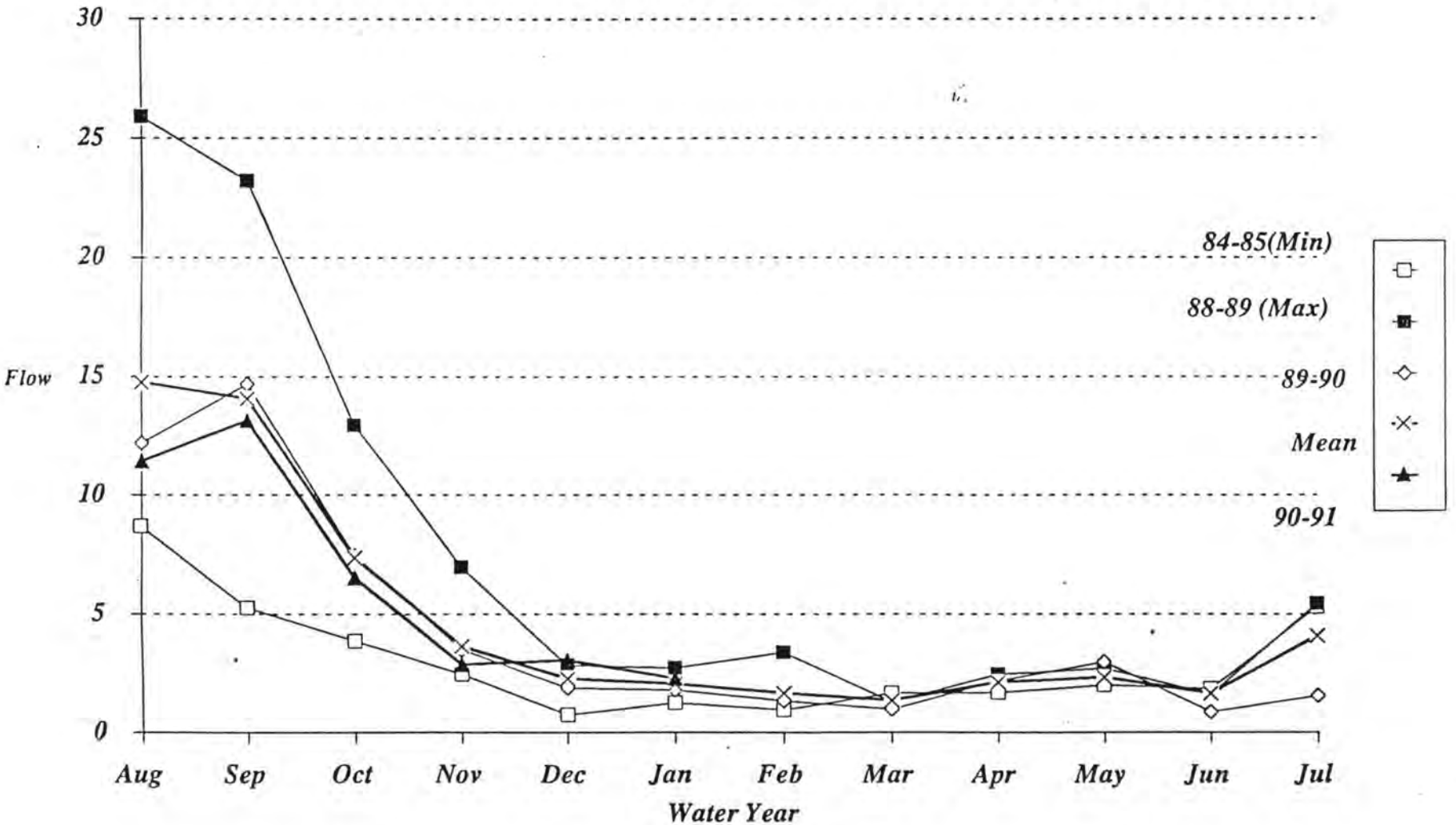
28% of Egypt's power needs



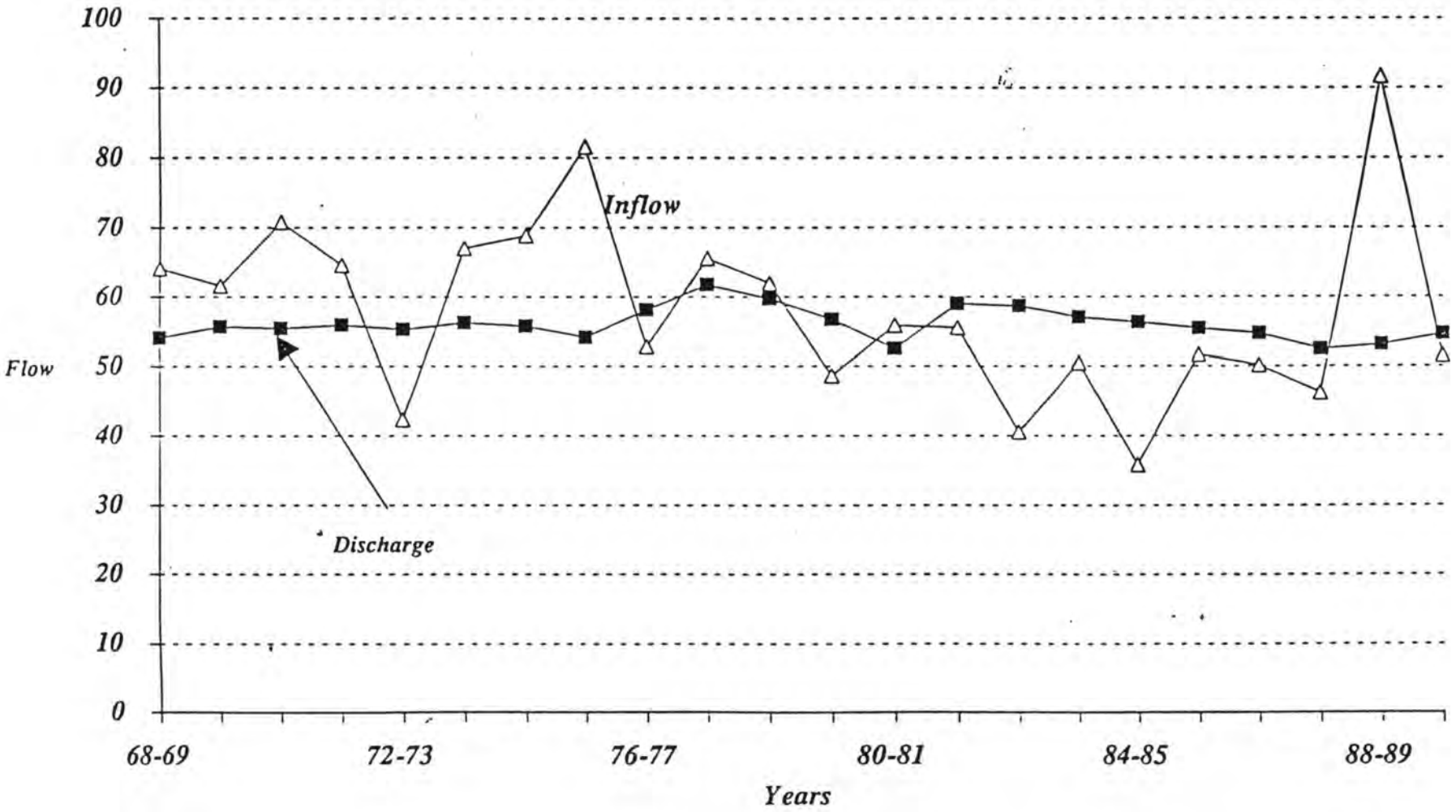
NET INFLOW TO LAKE NASSER

(Billion cubic meters)



NET INFLOW AND DISCHARGE AT ASWAN DAM

(Flow in billion cubic meters)



LAKE NASSER WATER LEVEL

Meters

Year	*AUG*	*SEP*	*OCT*	*NOV*	*DEC*	*JAN*	*FEB*	*MAR*	*APR*	*MAY*	*JUN*	*JUL*
68-69	*145.70*	*151.50*	*154.30*	*156.35*	*156.50*	*156.37*	*156.13*	*155.25*	*154.45*	*154.39*	*153.77*	*151.70*
69-70	*151.11*	*156.38*	*160.73*	*161.23*	*161.10*	*160.69*	*160.43*	*159.77*	*158.86*	*158.38*	*157.36*	*155.48*
70-71	*153.82*	*158.50*	*163.45*	*164.56*	*164.87*	*164.70*	*164.43*	*164.11*	*163.41*	*163.00*	*162.27*	*160.72*
71-72	*159.70*	*163.08*	*166.70*	*167.55*	*167.62*	*167.52*	*167.37*	*166.95*	*166.22*	*165.85*	*164.97*	*163.60*
72-73	*162.49*	*163.56*	*164.56*	*165.26*	*165.04*	*164.66*	*164.13*	*163.47*	*162.51*	*161.88*	*160.96*	*159.55*
73-74	*158.20*	*161.43*	*164.77*	*166.18*	*166.24*	*166.00*	*165.77*	*165.19*	*164.33*	*163.64*	*162.88*	*161.60*
74-75	*161.80*	*165.93*	*169.21*	*170.61*	*170.53*	*170.37*	*170.17*	*169.68*	*168.88*	*168.43*	*162.77*	*166.47*
75-76	*165.60*	*169.34*	*173.80*	*175.61*	*175.70*	*175.63*	*175.49*	*175.15*	*174.70*	*174.27*	*173.75*	*172.94*
76-77	*172.43*	*174.43*	*176.22*	*176.51*	*176.32*	*176.06*	*175.63*	*175.15*	*174.42*	*173.95*	*173.41*	*172.37*
77-78	*171.72*	*174.71*	*176.52*	*176.97*	*177.21*	*176.82*	*176.48*	*176.01*	*172.22*	*174.50*	*173.83*	*172.94*
78-79	*172.55*	*174.91*	*176.35*	*177.41*	*177.26*	*176.88*	*176.66*	*176.19*	*175.68*	*175.29*	*174.73*	*173.78*
79-80	*173.03*	*174.42*	*175.47*	*175.95*	*175.76*	*175.42*	*175.08*	*174.52*	*173.88*	*173.38*	*172.86*	*171.89*
80-81	*171.29*	*174.00*	*176.06*	*176.22*	*176.07*	*175.68*	*175.29*	*174.83*	*174.18*	*173.73*	*173.12*	*172.05*
81-82	*171.13*	*172.95*	*175.07*	*175.95*	*175.70*	*175.29*	*174.87*	*174.40*	*173.69*	*173.23*	*172.55*	*171.45*
82-83	*170.34*	*171.04*	*172.10*	*172.49*	*172.32*	*171.79*	*171.14*	*170.46*	*169.77*	*169.24*	*168.46*	*167.16*
83-84	*165.84*	*166.94*	*169.22*	*169.68*	*169.77*	*169.39*	*168.93*	*168.43*	*167.64*	*167.03*	*166.77*	*164.70*
84-85	*163.60*	*164.32*	*164.51*	*164.34*	*163.67*	*162.92*	*161.39*	*161.39*	*160.64*	*159.89*	*158.93*	*156.98*
85-86	*156.38*	*159.08*	*163.78*	*164.34*	*164.10*	*163.61*	*163.29*	*162.53*	*161.61*	*160.86*	*159.98*	*157.96*
86-87	*157.23*	*159.68*	*162.22*	*162.70*	*162.37*	*161.66*	*161.20*	*160.29*	*159.32*	*158.40*	*157.45*	*155.61*
87-88	*154.62*	*156.10*	*158.16*	*158.37*	*158.41*	*157.92*	*157.68*	*156.90*	*155.93*	*155.30*	*154.06*	*151.60*
88-89	*151.88*	*159.50*	*165.26*	*167.76*	*168.89*	*168.63*	*168.69*	*168.33*	*167.67*	*167.26*	*166.64*	*165.12*
89-90	*164.45*	*166.13*	*168.75*	*169.71*	*169.78*	*169.50*	*169.34*	*168.84*	*168.08*	*167.57*	*166.93*	*165.24*
90-91	*163.75*	*165.22*	*167.56*	*168.34*	*168.26*	*167.92*	*167.67*					
No. of pt.	*23*	*23*	*23*	*23*	*23*	*23*	*23*	*22*	*22*	*22*	*22*	*22*
Mean	***155.43***	***158.17***	***160.75***	***161.55***	***161.53***	***161.20***	***160.85***	***167.63***	***166.73***	***166.34***	***165.38***	***164.13***
Min	*145.70*	*151.50*	*154.30*	*156.35*	*156.50*	*156.37*	*156.13*	*155.25*	*154.45*	*154.39*	*153.77*	*151.60*
Max	*173.03*	*174.91*	*176.52*	*177.41*	*177.26*	*176.88*	*176.66*	*176.19*	*175.68*	*175.29*	*174.73*	*173.78*

DISCHARGE BELOW ASWAN DAM

(billion cubic meter)

Year	*AUG*	*SEP*	*OCT*	*NOV*	*DEC*	*JAN*	*FEB*	*MAR*	*APR*	*MAY*	*JUN*	*JUL*	*TOTAL*
68-69	6.10	4.17	3.80	3.39	3.24	2.90	3.70	3.97	3.66	4.87	6.57	7.71	54.08
69-70	6.07	4.20	3.81	3.64	3.39	3.06	3.98	4.99	3.92	5.42	6.52	6.72	55.72
70-71	6.11	4.29	3.75	3.60	3.25	3.55	3.79	4.28	3.94	5.48	6.49	6.97	55.50
71-72	6.22	4.45	3.78	3.67	3.30	3.43	4.02	4.24	4.04	5.30	6.54	7.00	55.99
72-73	6.30	4.24	3.74	3.62	3.02	3.62	3.52	4.38	4.00	5.26	6.59	7.00	55.29
73-74	6.38	4.23	3.85	3.93	3.58	2.82	3.96	4.54	4.12	5.24	6.62	7.02	56.29
74-75	6.26	4.03	3.91	4.06	3.51	3.19	3.86	4.53	4.19	5.08	6.42	6.74	55.78
75-76	6.64	3.88	3.69	3.72	3.48	3.54	3.59	4.02	3.89	4.82	6.27	6.69	54.23
76-77	5.88	4.03	4.03	3.93	4.03	3.91	3.66	4.59	4.08	6.86	6.45	6.66	58.11
77-78	5.84	4.16	4.34	4.19	4.91	4.45	4.32	5.23	5.40	5.66	6.32	6.93	61.75
78-79	5.86	4.50	4.50	4.49	4.49	3.83	4.31	4.60	4.35	5.20	6.55	7.05	59.73
79-80	5.94	4.56	4.03	3.80	3.83	3.53	4.03	4.41	4.14	5.03	6.43	7.02	56.75
80-81	5.98	4.45	3.91	3.90	3.90	3.62	3.93	0.43	4.11	4.92	6.40	7.06	52.61
81-82	6.06	4.56	4.34	4.20	4.34	4.34	4.03	4.48	4.22	5.04	6.48	6.91	59.00
82-83	6.11	4.56	4.34	4.20	4.34	4.36	3.92	4.41	4.31	4.77	6.51	6.90	58.73
83-84	6.22	4.43	4.05	3.89	3.86	3.81	4.11	4.34	4.16	4.81	6.51	6.90	57.09
84-85	6.15	4.60	4.50	3.75	3.66	3.21	4.04	3.96	4.07	4.88	6.68	6.89	56.39
85-86	6.13	4.50	4.17	3.73	3.68	3.08	3.82	4.02	4.02	4.80	6.84	6.73	55.52
86-87	6.13	4.56	4.08	3.48	3.57	2.90	3.74	3.94	3.94	4.69	6.94	6.82	54.79
87-88	5.84	4.57	3.79	3.27	3.26	2.45	3.42	3.69	3.96	4.86	6.72	6.65	52.48
88-89	5.96	4.37	3.53	3.23	3.12	2.49	2.22	3.95	4.08	5.11	7.23	7.88	53.17
89-90	6.13	4.40	3.39	3.25	3.10	2.50	3.47	4.11	4.20	7.15	6.86	6.18	54.73
90-91	6.18	4.35	3.44	3.21	3.07	2.30							
No.of prt.	23	23	23	23	23	23	22	22	22	22	22	22	22
Mean	***5.84***	***4.16***	***3.80***	***3.61***	***3.52***	***3.24***	***3.79***	***4.14***	***4.13***	***5.24***	***6.59***	***6.93***	***56.08***
Min	5.84	3.88	3.39	3.23	3.02	2.45	2.22	0.43	3.66	4.69	6.27	6.18	52.48
Max	6.64	4.60	4.50	4.49	4.91	4.45	4.32	5.23	5.40	7.15	7.23	7.88	61.75

NET INFLOW TO LAKE NASSER

(billion cubic meter)

Year	*AUG*	*SEP*	*OCT*	*NOV*	*DEC*	*JAN*	*FEB*	*MAR*	*APR*	*MAY*	*JUN*	*JUL*	*TOTAL*
68-69	*16.93*	*10.34*	*8.79*	*3.78*	*2.90*	*2.28*	*1.56*	*2.05*	*3.52*	*3.43*	*2.05*	*6.47*	*64.10*
69-70	*18.13*	*16.40*	*5.33*	*3.24*	*2.15*	*2.28*	*2.00*	*2.29*	*2.58*	*2.69*	*1.74*	*2.77*	*61.60*
70-71	*17.91*	*19.62*	*7.64*	*4.72*	*2.64*	*2.58*	*2.64*	*1.88*	*2.55*	*3.07*	*1.66*	*3.91*	*70.82*
71-72	*16.79*	*17.44*	*7.06*	*3.94*	*2.91*	*2.84*	*2.39*	*1.47*	*2.66*	*2.13*	*1.69*	*3.28*	*64.60*
72-73	*9.89*	*7.75*	*6.26*	*2.83*	*1.65*	*1.71*	*1.25*	*1.16*	*1.94*	*2.41*	*2.36*	*3.11*	*42.32*
73-74	*15.95*	*15.47*	*8.96*	*4.16*	*2.67*	*1.99*	*1.87*	*1.44*	*1.71*	*2.67*	*2.48*	*7.64*	*67.01*
74-75	*20.53*	*16.99*	*9.93*	*3.72*	*2.82*	*2.33*	*1.75*	*1.11*	*2.34*	*2.42*	*1.40*	*3.51*	*68.85*
75-76	*20.34*	*24.22*	*13.06*	*4.19*	*3.12*	*2.81*	*1.82*	*1.68*	*1.65*	*2.17*	*2.24*	*4.29*	*81.59*
76-77	*15.80*	*13.39*	*5.60*	*2.90*	*2.63*	*1.67*	*1.17*	*0.79*	*1.65*	*2.16*	*1.44*	*3.66*	*52.86*
77-78	*20.49*	*13.68*	*6.77*	*5.53*	*2.76*	*2.61*	*1.78*	*1.12*	*1.66*	*2.21*	*1.89*	*5.10*	*65.60*
78-79	*17.71*	*12.06*	*10.31*	*3.66*	*2.39*	*2.64*	*1.77*	*1.90*	*2.11*	*2.50*	*1.65*	*3.30*	*62.00*
79-80	*12.97*	*10.01*	*6.53*	*2.81*	*2.06*	*1.76*	*1.12*	*1.11*	*1.63*	*2.47*	*1.89*	*4.32*	*48.68*
80-81	*18.88*	*15.18*	*4.77*	*3.09*	*1.86*	*1.59*	*1.53*	*1.05*	*1.83*	*1.87*	*1.33*	*2.91*	*55.89*
81-82	*14.44*	*15.36*	*8.92*	*2.90*	*2.21*	*2.16*	*1.59*	*0.86*	*1.92*	*1.78*	*1.41*	*2.05*	*55.60*
82-83	*9.13*	*9.35*	*6.17*	*3.40*	*1.89*	*1.43*	*0.97*	*1.44*	*2.03*	*1.53*	*1.35*	*1.89*	*40.58*
83-84	*10.36*	*13.60*	*6.02*	*4.28*	*2.22*	*1.85*	*2.06*	*1.17*	*3.22*	*1.92*	*0.80*	*3.03*	*50.53*
84-85	*8.66*	*5.28*	*3.89*	*2.47*	*0.77*	*1.26*	*0.97*	*1.68*	*1.70*	*2.02*	*1.86*	*5.33*	*35.89*
85-86	*13.38*	*13.31*	*6.14*	*2.87*	*1.99*	*1.99*	*1.28*	*1.06*	*1.71*	*2.18*	*0.97*	*4.83*	*51.71*
86-87	*13.94*	*12.38*	*5.66*	*2.39*	*2.28*	*1.43*	*1.00*	*1.02*	*1.30*	*2.14*	*2.23*	*4.44*	*50.21*
87-88	*9.41*	*9.96*	*4.37*	*3.38*	*1.90*	*1.73*	*1.39*	*1.23*	*2.41*	*1.88*	*1.33*	*7.24*	*46.23*
88-89	*25.91*	*23.21*	*12.96*	*7.00*	*2.87*	*2.74*	*3.40*	*1.31*	*2.48*	*2.72*	*1.63*	*5.47*	*91.70*
89-90	*12.20*	*14.68*	*7.47*	*3.53*	*1.89*	*1.81*	*1.35*	*0.99*	*2.20*	*2.99*	*0.88*	*1.55*	*51.53*
90-91	*11.42*	*13.13*	*6.55*	*2.88*	*1.69*	*1.32*							
No. of prt.	*23*	*23*	*23*	*23*	*23*	*23*	*22*	*22*	*22*	*22*	*22*	*22*	*22*
Mean	***14.77***	***13.46***	***7.07***	***3.51***	***2.20***	***1.98***	***1.67***	***1.36***	***2.13***	***2.33***	***1.65***	***4.10***	*58.18*
Min	*8.66*	*5.28*	*3.89*	*2.39*	*0.77*	*1.26*	*0.97*	*0.79*	*1.30*	*1.53*	*0.80*	*1.55*	*35.89*
Max	*25.91*	*24.22*	*13.06*	*7.00*	*3.12*	*2.84*	*3.40*	*2.29*	*3.52*	*3.43*	*2.48*	*7.64*	*91.70*

LAKE NASSER GROSS STORAGE

(billion cubic meter)

Year	*AUG*	*SEP*	*OCT*	*NOV*	*DEC*	*JAN*	*FEB*	*MAR*	*APR*	*MAY*	*JUN*	*JUL*
68-69	*29.42*	*40.25*	*46.42*	*51.41*	*51.80*	*51.46*	*50.84*	*48.70*	*46.78*	*46.64*	*45.19*	*40.67*
69-70	*39.43*	*51.49*	*63.69*	*65.21*	*64.81*	*63.57*	*62.79*	*60.81*	*58.11*	*56.76*	*54.04*	*49.25*
70-71	*45.30*	*57.10*	*72.43*	*76.32*	*77.43*	*76.82*	*75.85*	*74.70*	*72.29*	*70.90*	*68.49*	*63.66*
71-72	*60.60*	*71.17*	*84.16*	*87.45*	*87.72*	*87.33*	*86.74*	*85.11*	*82.34*	*80.96*	*77.79*	*72.94*
72-73	*69.22*	*72.80*	*76.32*	*78.84*	*78.04*	*76.68*	*74.77*	*72.50*	*69.28*	*23.00*	*64.38*	*60.16*
73-74	*56.26*	*65.83*	*77.07*	*82.18*	*82.41*	*81.50*	*80.67*	*78.58*	*75.49*	*73.08*	*70.50*	*66.36*
74-75	*66.98*	*81.25*	*94.20*	*100.22*	*99.88*	*99.19*	*98.33*	*96.22*	*92.81*	*90.96*	*88.30*	*83.29*
75-76	*80.06*	*94.76*	*115.10*	*124.47*	*124.94*	*124.58*	*123.85*	*112.08*	*119.74*	*117.50*	*114.85*	*110.82*
76-77	*108.42*	*118.34*	*127.69*	*129.25*	*128.23*	*126.82*	*124.58*	*122.08*	*118.28*	*115.85*	*113.15*	*105.14*
77-78	*105.14*	*119.79*	*129.31*	*131.74*	*133.08*	*130.93*	*129.09*	*136.55*	*122.44*	*118.70*	*115.25*	*110.82*
78-79	*108.99*	*120.83*	*128.39*	*134.20*	*133.36*	*131.25*	*130.06*	*127.53*	*124.84*	*122.06*	*119.90*	*115.00*
79-80	*111.25*	*118.28*	*123.74*	*126.24*	*125.25*	*127.48*	*121.72*	*118.80*	*115.50*	*113.00*	*110.44*	*105.90*
80-81	*103.21*	*116.10*	*126.82*	*127.69*	*126.88*	*124.84*	*112.81*	*120.42*	*117.04*	*114.75*	*111.70*	*106.63*
81-82	*102.49*	*110.87*	*121.66*	*126.24*	*124.94*	*122.81*	*120.62*	*118.18*	*114.55*	*112.25*	*108.99*	*103.93*
82-83	*99.06*	*102.08*	*106.87*	*108.70*	*107.90*	*105.46*	*102.53*	*99.58*	*96.61*	*94.33*	*91.09*	*85.92*
83-84	*80.92*	*85.07*	*94.25*	*96.22*	*96.61*	*94.98*	*93.01*	*90.96*	*87.80*	*85.42*	*82.53*	*76.82*
84-85	*72.94*	*75.45*	*76.14*	*75.52*	*73.18*	*70.74*	*68.79*	*65.71*	*63.43*	*61.17*	*58.30*	*53.48*
85-86	*51.49*	*58.74*	*73.55*	*75.52*	*74.66*	*72.97*	*71.89*	*69.35*	*66.39*	*64.08*	*61.47*	*55.60*
86-87	*53.70*	*60.51*	*68.33*	*69.91*	*68.82*	*66.55*	*65.12*	*62.37*	*59.46*	*56.82*	*54.27*	*49.56*
87-88	*47.19*	*50.76*	*56.15*	*56.74*	*56.35*	*55.95*	*54.87*	*52.84*	*50.37*	*45.82*	*45.84*	*40.46*
88-89	*41.05*	*60.00*	*78.84*	*92.03*	*92.03*	*91.74*	*92.03*	*90.55*	*87.91*	*86.31*	*83.93*	*78.33*
89-90	*75.92*	*81.99*	*92.28*	*96.35*	*96.65*	*95.45*	*94.76*	*92.64*	*89.53*	*87.52*	*85.03*	*78.76*
90-91	*73.45*	*78.69*	*87.48*	*90.59*	*90.27*	*88.89*	*87.39*					
No. of pt.	*22*	*23*	*23*	*23*	*23*	*23*	*23*	*22*	*22*	*22*	*22*	*22*
Mean	***73.1382***	***78.8461***	***88.4091***	***91.8457***	***91.5204***	***90.3957***	***88.5097***	***90.7393***	***87.7722***	***83.5401***	***82.9741***	***77.8864***
Min	*29.42*	*40.25*	*46.42*	*51.41*	*51.80*	*51.46*	*50.84*	*48.70*	*46.78*	*23.00*	*45.19*	*40.46*
Max	*111.25*	*120.83*	*129.31*	*134.2*	*133.36*	*131.25*	*130.06*	*136.55*	*124.84*	*122.06*	*119.9*	*115*

One Hundred First Congress

Congress of the United States

Committee on Foreign Affairs

House of Representatives

Washington, DC 20515

June 29, 1990

Professor John Waterbury
Woodrow Wilson School
Princeton University
Princeton, New Jersey 08540

Dear Professor Waterbury:

Attached is a transcript containing your remarks from the June 26th hearing before the Subcommittee on Europe and the Middle East on Middle East Water Issues in the 1990s.

Your cooperation in making any necessary corrections and returning the transcript to me by Friday, July 13, 1990 would be appreciated. If I do not receive it by the deadline, I will assume that you have no corrections and will send the transcript to GPO as it now appears.

If you have any questions contact me at 202-225-3345.

Sincerely,

Kristine Willie
Staff Assistant
Subcommittee on Europe
and the Middle East
B359 Rayburn House Office Building
Washington, D.C. 20515

RPTS STEIN

DCMN SWANNER

HEARING ON MIDDLE EAST WATER ISSUES

IN THE 1990s

Tuesday, June 26, 1990

House of Representatives,

Subcommittee on Europe and the Middle East,

Committee on Foreign Affairs,

Washington, D.C.

The subcommittee met, pursuant to call, at 9:00 a.m. in Room 2200, Rayburn House Office Building, Hon. Lee H. Hamilton [chairman of the subcommittee] presiding.

Present: Representatives Hamilton, Gilman, Smith, and Lukens.

Mr. HAMILTON. The meeting of the subcommittee will come to order. The Subcommittee on Europe and the Middle East meets today in open session to discuss Middle East water issues in the 1990s. This is the third hearing in a series of hearings on issues in the Middle East in the 1990s.

The subcommittee would like to examine a number of issues, including assessment and projections of the water shortages in the Middle East; potential international disputes relating to water sharing problems and riparian rights; how the water issue will affect the political and economic situation in the region in the coming years; and analysis of the problems related to the Nile, Jordan, and Euphrates-Tigris Rivers.

Our witnesses today are Professor John Waterbury, Woodrow Wilson School, Princeton University; Professor John Kolars, Department of Geography, University of Michigan; and Professor Thomas Naff, University of Pennsylvania.

Gentlemen, we welcome you before the subcommittee. Your prepared statements will be entered into the record in full. I would like to ask that you limit your opening remarks to five or ten minutes, so that we may turn quickly to questions from Members.

Professor Waterbury, you may proceed.

I think you are aware we have a special session of the Congress at 11:00 this morning, so we will have to adjourn

shortly before that, probably, in order to permit Members time to get to that. So I would like to ask you to make your opening statements relatively brief, if you would.

Professor Waterbury.

STATEMENT OF PROFESSOR JOHN WATERBURY, WOODROW WILSON SCHOOL, PRINCETON UNIVERSITY

Mr. WATERBURY. Mr. Chairman, there are nine sovereign nations that lay claim to some portion of the Nile Basin. In any efforts to bring about basin-wide coordination in the use of the river's waters, all nine would rightfully have some say, and conceivably veto power, as well.

However, only two countries in the system are dependent upon its waters for their livelihood and survival. Egypt, the downstream state, is utterly dependent upon the Nile for life itself and the food and hydropower that sustains its economy. Egypt does not add a single drop to the Nile; it can only take.

The Sudan, which, unlike Egypt, has substantial rainfed agriculture, is less dependent upon the river, but its betst soils all lie within the catchments of the Blue and White Niles, and they are ideally suited for irrigated cultivation.

The seven remaining countries either have abundant rainfall or other sources of river and lake water. They are relevant only in that they can, potentially, affect the size and quality of the discharge that ultimately reaches Sudan and Egypt.

Also given their location upstream or at the headwaters of the sources of the Blue and White Niles, they would have to be coaxed into any plans to use their territories for storage projects that would benefit mainly Egypt and the Sudan.

Of these seven countries, three are of crucial importance both for what they could do to alter the discharge of the river, although that is the most remote of all possibilities, and for what they could do to facilitate water storage on their territories.

They are Ethiopia, which controls Lake Tana and the headwaters of the Blue Nile and the Atbara, together providing about 60 percent of the total discharge of the Nile; and Uganda and Zaire, which share Lake Albert, now known as Lake Mobutu. This lake could one day be a major storage site for controlling the discharge of the White Nile.

At present, there is only one treaty binding any of the riparian states in the use of the Nile. It is the 1959 agreement signed by Egypt and the Sudan prior to construction of the Aswan High Dam.

These are the bare facts of the geopolitics of Basin. Let me turn to the dynamics of the situation. First, there is today no major problem facing any countries of the Basin so far as water supply is concerned. But that should not be

taken as good news.

The only reason why there is not a major problem is because most of the states in the Basin have been in chronic political disarray and hence incapable of financing and implementing the agricultural projects that would have laid new claims on Nile water.

Uganda has scarcely had a state since the collapse of Idi Amin, and Ethiopia and the Sudan have been in the throws of civil war for decades. Only Egypt has maintained a stable policy, and only Egypt is using the water available to it to the maximum.

Were it not for the political and economic collapse of some of the key actors, the supply situation could be truly grim. While it is always hazardous to make projections of climate and rainfall, it nonetheless appears to be the case that there is a secular decline in the amount of water annually discharged in the Nile system.

There is considerable variance around the mean, but the mean discharge trend is down. We don't know how long that may last, but in the coming decades, it would seem to make good sense to plan on less water.

For Egypt that has meant elaborating two strategies. One, that favored by most Egyptian leaders until recently, has been to pursue coordination with upstream neighbors in the While Nile Basin in order to store water, regulate

discharge, and reduce surface evaporation in the Sudd Swamps of the Southern Sudan.

This strategy led to the partial construction of the Jonglei Canal. A project that had to be abandoned after the Civil War flared up once again in the Southern Sudan after 1983. It is still Egypt's hope that one day, using Lake Mobutu for storage, there will be two canals through the Sudd Swamps, adding a net benefit of about 10 percent of the river's annual discharge.

Faced with the unending turmoil in the Sudan and Uganda and some indifference in Zaire, Egyptian leaders have begun to emphasize the second strategy. That is to increase the efficiency with which water is used in Egypt itself.

In some ways, this is a far more difficult challenge. It requires retraining the Egyptian peasant in the ways in which he or she uses irrigation water. It means lining thousands of miles of canals in order to reduce seepage. It means introducing costly drip irrigation systems and pursuing efforts to use drainage water for irrigation.

The effort would only make sense were Egypt to shift most of its agricultural base to the production of high value crops destined largely for export. There is really no alternative today to the pursuit of this strategy, but it is not one that can be implemented rapidly.

Let me close with a few observations concerning Ethiopia.

Mythology abounds as to Ethiopia's capacity to shut off the Blue Nile. The absence of storage sites that would not be subject to rapid siltation, the prohibitive cost of any possible projects, and the fact that Ethiopian agricultural development has been concentrated in the eastern watershed of the Highlands and in the south of the country would seem to make very remote any kind of project that could substantially reduce the flow of the Blue Nile and Atbara before they enter the Sudan.

Mr. Chairman, until the key countries of the basin enjoy stable government, there can be little progress toward negotiated understandings on basin-wide coordination in the management of the Nile. But were such governments to emerge, ready to take up the task of developing their countries, then the pressure on water available in the Nile could become acute.

Unlike the situation in the Jordan and Euphrates, however, that development is not close at hand.

Thank you.

[The statement of John Waterbury follows:]

******* INSERT 1-1 *******

Mr. HAMILTON. Thank you.

Dr. Kolars.

STATEMENT OF PROFESSOR JOHN KOLARS, DEPARTMENT OF GEOGRAPHY, UNIVERSITY OF MICHIGAN

Mr. KOLARS. Thank you, Mr. Chairman.

I would like to begin by laying out a little of the general problem within the Middle East and proceeding then to the Euphrates.

The Arabic speaking peoples of the Middle East and North Africa seem to face a crisis of such dimensions that all others which have gone before will seem simply by comparison. Water-related events in the Middle East (including North Africa) including growing domestic shortages and the possible unilateral control of international streams by one or another country, are being noted with increasing frequency by the world press.

Domestic security, food for growing populations, settlements of territorial disputes such as that over the West Bank and the Golen Heights, as well as the continued well-being of governments which have invested huge sums in development schemes dependent upon ample supplies of groundwater, are all at stake.

By examining in some detail one of the sources of water

upon which Middle Eastern people depend, another example should suffice to emphasize the urgency of the situation. Over 50 percent of all the population in the Middle East and North Africa, excluding the Maghreb, depend either upon water from rivers which cross an international boundary before reaching them or upon desalinized water and water drawn from deep wells.

More startling, two-thirds of all Arabic-speaking people in the same region depend upon river water which flows to them from non-Arabic-speaking countries, while another 24 percent live in areas with no perennial surface streams whatever.

That is, the latter must rely upon either well water from rapidly depleting sources or upon seawater which is expensive to purify in sufficient quantities and expensive to pump to its places of use.

These water dependent populations are increasing rapidly in number. World Bank data show a total population of 217.4 million in 1983 in the area under discussion. It is conservatively estimated that by the year 2000, less than a decade away, an additional 119.6 million will be added to this figure, a population increase of 55 percent.

I would add parenthetically that within the Nile Valley of Egypt, there are one million new Egyptians every eight to nine months. That is births over deaths. Not only will

these people need water to drink but water for industry and all the uses that occur within cities.

They also need irrigation water to grow as much of their food as possible before turning to what they may view as potentially unreliable imports.

Americans will appreciate this better if they consider arid West, the states of North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, Texas, Montana, Wyoming, Colorado, New Mexico cover 1,115,000 square miles. The Arabian peninsula south of the Jordanian-Iraqi borders has an area slightly larger of 1,160,000 square miles within which not a single permanent surface stream is found.

If we add riverless Libia, the Arabian world would toll 1,839,000 square miles. To match this in American, we would have to add all of the remaining western states plus Minnesota to the list.

Furthermore, one must remember that within these so-called arid American states are the sources of the Missouri, Colorado, Snake, Rio Grande, Platt Canadian, Pecos and Arkansas Rivers, as well as numerous other streams and, of course, the source of the Mississippi in Minnesota. I don't want to leave that out.

Let me say that the Euphrates River is a case in point. Petroleum-poor Turkey, driven by its need for new sources of energy, has turned to the hydroelectric potential of its

many rivers, the greatest of which is the Euphrates.

During the time when Arab oil was very expensive. Turks were importing up to $4 billion worth of petroleum a year, mostly from Arab states and Iran, and even now it will cost two-and-a-half million dollars, approximately.

With this end in mind, Turkey has undertaken a gigantic development program on that river. The Southeast Anatolia Development Project (Turkish acronym GAP) is intended not only to provide hydropower but also to earn foreign exchange to be raised on over a million hectares of land (1 ha equals 2.47 acres) irrigated with water drawn from the river.

If all these projects planned for GAP are to be realized, the flow of the river into Syria will be reduced by over 50 percent.

Turkey is well on its way to accomplishing a major part of GAP. The Keban Dam farthest upstream is already in place and producing electricity. Next downstream, the Karakaya Dam, which came on line in 1989, is also meant for hydroelectric production.

Biggest of all, the Ataturk Dam is nearing completion downstream from the other two. The Ataturk will be the fourth or fifth largest dams of its kind in the world and will be used not only to produce hydro-electricty but also the waters impounded on its reservoir could eventually irrigate more than 900,000 hectares.

Of this amount, 157,000 ha on the Harran Plain just north of the Syrian border are scheduled to receive water beginning in 1991. To complicate matters further, return flow from these fields may bring added pollution to Euphrates waters making them more difficult or impossible to reuse farther downstream.

Nor is this the entire story. Syria, the next downstream user, has similar needs for electricity and irrigation. It is attempting to meet these demands by means of the Tabqa (Ath-Thawra) Dam which it completed in 1974, as well as with several smaller dams on the main stream and along its major tributary in Syria, the Khabur River.

Perhaps 300,000 hectares of land will be irrigated in this way. Further depletion of river water plus further pollution is inevitable. The Euphrates third riparian partner is Iraq, farthest downstream and historically the first and largest user of the river's water. As many as a million hectares of irrigated land in this latter country may be jeopardized in the near future by shrinking supplies, as well as by increasing pollution from both upstream users.

Because as much as 98 percent of the Euphrates water has its source in Turkey and most texts allot 12 percent of the river's flow to Syrian tributaries, I can show that as much as 10 percent of that 12 percent originates from Syrian springs which have their catchments on the north in Turkey

where pumping of the groundwater could possibly diminish or staunch their flow.

Syria and Iraq find themselves in similar and unenviable situations when on January 13 of this year Turkey began filling it at a Turkey reservoir, the flow of the river into Syria and Iraq was reduced to a trickle for 30 days.

Turkey had previously guaranteed a continuous flow of 500 cubic meters per second across the border into Syria. Prior to January, this amount has been increased for a time to 750 cms, but the overall impact of the cutoff, according to the Syrians and the Iraqis was disastrous.

Electric power was curtailed in Syria, and both downstream countries had to ration river water for domestic and farm use. Moreover, this brief interruption of river flow accounted for only a tiny fraction (3 percent to 5 percent) of the reservoir's total capacity.

This is a point worriedly stressed by both the Iraqi and Syrian governments as to how the reservoir will be filled in the near future, so this seems to me to be a possible flashpoint in the while situation.

The Turks, on the other hand, have responded with an idea which I think has more merit than it is often given credit for; President Ozal's so-called peace pipeline, in which he proposes that the Turks would give surplus water, of which they have a large quantity, to their neighbors to the south

by means of twin pipelines, one which would go along the western side as far as Mecca and another which would go along the eastern side of the peninsular as far as Sharjah.

To date, the Arab nations which have been approached on this have shown very little interest, possibly because they feel it would be placing them in the hands of an ancient adversary.

On the other hand, the Turks certainly have been dependent upon the Arab oil nations for petroleum and for the loans, short-term loans to buy that petroleum. This, if one had time, one could go into the whole problem of delusion of the underground water resources upon which Saudi Arabia and other peninsula states must depend.

However, time is short, so I won't do that, and instead close by saying that there are ways out of this situation many similar to those suggested by Professor Waterbury, mostly the parsimonious use of water, and a realistic view of how these shortages can occur.

I call attention to our problems with the Oglalla aquifer on our great planes. In any event, the need for attention to this matter is extreme, and I don't think we have much time before a crisis emerges.

Thank you very much, Mr. Chairman.

[The statement of John Kolars follows:]

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Mr. HAMILTON. Thank you.

Dr. Naff.

RPTS STEIN

DCMN SWANNER

Mr. NAFF. Thank you, Mr. Chairman.

Mr. Chairman, it seems to me that the major implication of what my colleagues have been saying is in so arid a region of the Middle East, water is the ultimate survival issue, and in an area where trust is so low among the areas' nations and conflicts so rife, problems of water sharing are intensifying existing rivalries.

As usage demands increase, water scarcity and sharing will soon become the two most important issues in the Middle East. American and Middle Eastern policymakers will ignore or undervalue the issue of water only, at grave peril to their national interests.

The Jordan River Basin is an excellent case study of the exigency of water issues in the Middle East. The countries are involved in the Jordan River Basin. Jordan and Isreal are the primary riparians. Syria is also an interested party since a branch of the Yarmuk, a tributary to the Jordan, has its headwaters in Syria.

The threat of a water crisis in the Jordan River Basin has been growing more serious for some time. If it is not eased, it is highly probable that destabilizing domestic strife will erupt soon, most likely in Jordan first, with major regional and international repercussions.

Very serious problems of water scarcity and quality in the Jordan Basin are the basis for this crisis. The basin's principal riparians, Jordan and Isreal, have been consuming about 115 percent of their total usable water stocks.

The prognosis is for continuing water shortages and over-exploitation of water supplies in both the short and long term; that is, through 2015, unless immediate drastic and politically difficult basin-wide remedial actions are taken.

The effects of ongoing water deficits, already severe in the Jordan basin, are cumulative and can quickly become irreversible. Neither known natural sources nor water technologies, now or in the foreseeable future, have the capacity to general enough new usable water in needed quantities at an affordable cost.

Failing a solution of scarcity, both Israel and Jordan will have to curtail their social and economic development. The result will be heightened competition among riparians and among domestic sectors within each country for decreasing amounts of water with concomitant destabilizing consequences, not the least being a significant rise in the probability of an outbreak of warfare between Jordan and Isreal, which would almost certainly involve other Arab states.

Obviously, the stakes in a basin-wide solution to the problems of scarcity are very high for both Jordan and

Isreal. Between now and 2015, Jordan's population is projected to grow by 178 percent from the current 2.7 million to 7 million. That is a rate about 2.5 times higher than it should be in relation to the water and economic resources of the basin.

If this growth rate continues without an increase in water supplies, stringent conservation and dramatic changes in present habits of consumption, Jordan will be unable to support a population that large.

Even if Jordan eventually constructs the planned Unity Dam (assuming that the current U.S.-mediated negotiations between Jordan and Israel over the dam's construction succeed), Jordan will still suffer an annual water shortage.

Although Israel's population growth is significantly lower than that of Jordan and the Occupied Territories, Israelis consume five to six times more water per capita than their neighbors: 280-300 liters per capita per day (l/c/f).

Among the most politically charged implication of the basin's water shortage is whether Israel will be able to absorb successfully the anticipated one million Russian-Jewish emigres. At present, it is unlikely that there will be enough water on Israel's side of the basin to absorb a million people consuming water at the rate of 280 l/c/d.

The waters of the Occupied Territories are already being over-exploited at the rate of about 100 mcm/year. Allowing

large numbers of emigres to settle there would only intensify current problems.

Because of the current disparity in power among the Jordan basin's riparians--Jordan, Israel, and Syria--there appears to be no immediate prospect of water-based warfare. However, water issues are central to the strategic planning of all the basin's riparians; water has become significantly militarized and water problems contribute importantly to the basin's interriparian tensions. The potential for open conflict over the basin's diminishing water stocks is rising.

If current policies and patterns of consumption in Jordan and Israel persist, a mounting series of water crises will be touched off before the end of the decade, perhaps as ear as 1995-97, particularly if economic conditions deteriorate further or there is a drought (which is almost certain given the drought history of the basin).

The severity of the crisis could break present restraints on conflict. If that occurs, water will combine with other underlying forces of instability and hostility among the basin's riparians, and water-driven warfare will almost certainly ensue, spilling out into the region beyond the basin.

King Hussein has stated privately that although he could conceive of few reasons to go to war with Israel, he could

be compelled to fight over water despite the almost sure prospect of defeat.

Unless Israel and Jordan are able very quickly to devise effective policies for the reduction of water consumption, they will be unable to meet the developmental needs of their societies.

Consequently, rather than warfare among riparians in the immediate future (which is certainly possible), what is more likely to ensue from water-related crises in this decade is internal civil disorders, changes in regime, political radicalization, and instability. All of these developments would have a negative effect on U.S. interests.

The water in the Occupied Territories has become so integral to Israel that the delicate balance of Israel's water system has become dependent on the water system in the Territories.

In needy times, which is more and more the situation, Israel satisfies up to 35-40 percent of its water needs from the West Bank and Gaza; in the past, an average of one-quarter of the nation's supply has normally come from the Territories.

It is inconceivable that an Israeli government would ever give up any priority of the Occupied Territories without an effective plan, replete with a full array of guarantees and inducements, that gives Israel secure and permanent access

to sufficient quantities of the Territories' waters or guaranteed access to other comparable sources in the area (probably the Litani River in Lebanon.

In fact, owing to serious shortages, Israel is presently conducting a large-scale operation of trucking water to Israel from the Lithani River, which lies entirely within sovereign Lebanese territory.

Again, in this context, it is useful to recall the challenge that scarcity poses for Israel in its efforts to absorb a million emigres within five years without first mitigating her water problems.

It might eventually be possible to overcome Israel's security arguments for retention of the Territories, but the hydrological arguments will persist unless the water issue is settled. It is water, in the final analysis, that will determine the future of the Occupied Territories, and by extension, the issue of conflict or peace.

American Middle East interests are directly and substantial engaged by the hydropolitics of the Middle East. The U.S. is committed to a pivotal role in the peace-seeking process, and water issues in the Jordan basin are a basic determinant of whether that process will succeed or fail.

Jordan is a moderate Arab friend of the u.S. whose monarch has consistently sought peaceful, negotiated settlement of

the Arab-Israeli problem. If Jordan's water problems overwhelm the current regime, it will almost certainly be replaced by a more radical, hostile, confrontational one.

Not only would the U.S. have lost an important moderate friend, the changes of open warfare would be increased and the U.S. policy of protecting and maintaining Israel's security would become more difficult. These are the kinds of stakes the U.S. has in the region's water problems.

If the hydrological problems of the region are to be mitigated in time to avoid conflict, the U.S. must play an immediate, sustained, central and genuinely even-handed role, acting mainly as a facilitator/mediator, providing necessary inducements and guarantees for agreements, as well as mobilizing and working with other outside parties to assist in the effort.

Also, the U.S. must be prepared to provide, preferably in conjunction with other powers, sufficient, strictly dedicated financial resources to make possible the economic restructuring essential to solving the region's water problems without unbearable political and socio-economic hardships.

Obviously, the most suitable and effective solution to the basin's problems and indeed to the basins of the other river systems in the area would be basin-wide authorities with enough independence, power, expertise and funds to allocate

and regulate the sharing of water.

In the U.S., as in the mid-eastern countries, the issue of international fresh water use, allocation, preservation suffers badly from fragmentation. In this regard, there is something significant the United States can do to serve its own interest and simultaneously those of riparian nations globally. That is, the formation of a special interagency group encompassing both the executive and regulative branches to coordinate American policy formulation in the realm of international fresh water issues.

This group should serve functions of coordination, data collection, policy and project assessment, education, and review. It could also be an international data clearinghouse and a reservoir of international expertise.

Its purview should include a technological, political, socio-economic, strategic, and legal dimensions of international water use issues.

Thank you, Mr. Chairman.

[The statement of Thomas Naff follows:]

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RPTS STEIN

DCMN HALL

Mr. HAMILTON. Thank you very much. We will proceed to questions under the five-minute rule.

I have in front of me several statements, and I just want to get your reaction to them all, by leaders in the Middle East, one from a Minister of State for Foreign Affairs in Egypt who says that the next war in the Middle East will be over the waters of the Nile, not politics.

A director of Israel's Agricultural Ministry declared that if the people of the region are not clever enough to discuss a mutual solution to the problem of water scarcity, war is unavoidable.

And then a director of Jordan's Water Research Center says the Middle East is living on a water time bomb. It could explode at any time.

What about it? I take it from your statement, Dr. Naff, that would agree with those assessments?

Mr. NAFF. Not entirely. It makes it sound as though we are on the precipice of warfare, and that isn't the case. For example, in the Jordan Basin, if Syria and Jordan and Israel were more closely matched in power and interest and status, we probably would be at war by now over water.

But the fact is there is that disparity. There is another factor mitigating against immediate warfare; that all of the

parties concerned don't want to go to war over water, and in fact in a number of combinations, usually in bilateral combinations, they are all talking to each other and they are talking about the water problem.

Mr. HAMILTON. So you find those statements an exaggeration?

Mr. NAFF. Yes, but not impossible.

Mr. HAMILTON. Dr. Waterbury, Dr. Kolars, how do you respond to those assessments?

Mr. KOLARS. I think that Dr. Naff is correct that we don't have to worry about it tomorrow, but within the decade. I think it might not be the Nile, it might be another source. I believe that probably the most stressed country at the present time is Jordan and that its resources are fast being depleted.

Mr. HAMILTON. That is your assessment too, isn't it, Dr. Naff?

Mr. NAFF. Yes.

Mr. KOLARS. On the other hand, the whole question of the Euphrates River is a very, very important one. It has made the headlines very recently because of the new developments there and the shutting off of the river in January for 30 days. This may bring the Arab states closer together and give them some focal point upon which to reach agreement on a number of things.

On the other hand, this might place them in opposition to Turkey, and this would be unfortunate.

Mr. HAMILTON. So if you look at the Nile, the Euphrates, Tigris, and the Jordan, the most difficult immediate problem is the Jordan?

Mr. KOLARS. Yes, sir. If you will refer to the statement, on the last page there is a quotation from the Israeli press which makes that very evident, that no solution to the West Bank can be found unless the water problem is solved.

Mr. HAMILTON. Dr. Waterbury, do you want to give us your assessment? Do you agree with Dr. Kolars and Dr. Naff?

Mr. WATERBURY. I think in the way they have weighted the three situations, yes. I would comment on the remark by the Egyptian Minister of State for Foreign Affairs on the possibility of war in the Nile, I am not quite sure what he has in mind. There have been these rumors of some Israeli efforts with the Europeans to construct a large dam somewhere on the Blue Nile.

This periodically surfaces. I frankly don't take them terribly seriously. I don't think relative to the other two basins that there is any kind of immediate conflict situation emerging in the Nile.

Mr. HAMILTON. If you look at the sources of our water problems, is it a combination of factors that bring it on or

does one or two stand out for you? Obviously there are limited amounts of water. Several of you mentioned the fact that we have had very poor management of the water that is there. You have got explosive population growth, urbanization, agricultural requirements, a lot of things that enter into the water problem.

Does anything stand out or is it really a combination of these things and others as well?

Mr. NAFF. Basically it is not enough water, and since water is so cross-cutting an issue--it is involved in virtually all socioeconomic and political policymaking in one degree or another--it has to be a combination.

Mr. HAMILTON. But the countries themselves are not efficient in their use of water, is that correct too?

Mr. NAFF. No, they aren't. It is not that they are altogether inefficient either. It is just that they are not as efficient as the crisis and the scarcity requires them to be.

Mr. HAMILTON. Is it true that two thirds of the water supply allocated to the cities and towns in Egypt is lost through inefficient use--that much?

Mr. NAFF. In Jordan it is 40 to 45 percent that is lost.

Mr. HAMILTON. Egyptian farmers are using twice as much water as necessary because they have a very primitive irrigation system?

Mr. WATERBURY. Mr. Chairman, I think those figures on Egypt might be somewhat exaggerated. There is tremendous wastage, but I think the essential point is to keep in mind that agriculture consumes vastly more water than urban and industrial populations.

Mr. HAMILTON. That is true in this country, of course.

Mr. WATERBURY. We are reading about it in California. So some of this urban wastage may not be as significant as inefficient use in agriculture. This is where big savings could be made.

Mr. HAMILTON. Mr. Gilman.

Mr. GILMAN. Thank you, Mr. Chairman.

Are there many regional agreements right now in place with regard to the sharing of the Jordanian River between Israel and Jordan? It seems to me there was an old agreement--

Mr. NAFF. The Johnson Plan.

Mr. GILMAN. Is that in place and still being followed? Adhered to?

Mr. NAFF. No. It is often referred to. The Johnson Plan was never formalized, but all parties involved, there was an informal tacit agreement to stay more or less within the bounds of the Johnson Plan until 1967. After 1967, more and more of that plan was set aside.

For example, Jordan presently takes no water whatsoever from the Jordan River. It is consumed entirely by Israel.

The only water that Jordan gets from Jordan River is a small residue that is so polluted that it is not usable. The only source of fresh surface water available to Jordan in any quantity is the Yarmuk River, which has a flow of about 450 MCM per year, and Israel takes 100 MDM of that. Syria takes about 180, and consequently there is not enough left in the river for Jordan to fill the Unity Dam if they do build it.

Hence the current negotiations between Israel and Jordan.

Mr. GILMAN. Who has been negotiating?

Mr. NAFF. It has been mediated by our government, going on quietly for three years now. The Jordanians agreed in September of 1987 with Syria to build the dam. Syria's agreement, the quid pro quo was Syria would get the hydroelectric energy from the dam, and now the negotiation between Jordan and Israel revolves around how much water the Israelis will get. The Jordanians want to give them 60 to 70 MCMs per year. The Israelis insist on keeping the current 100 MCM.

The Johnson Plan allocated to Israel 17 to 25 MCM per year originally, depending on the season, whether it is winter or summer. Israel needs that water to replenish the Coastal Plain Aquifer, which is being overpumped, and to replace water in Lake Kinneret and to send water up to the Golan to expand the settlements there. So they feel they need at least 100 MCM. The Jordanians say we can't give you that

because we won't have enough water for the dam, and much of Jordan's future is based on that dam.

Mr. GILMAN. Who or what branch of our government has been negotiating?

Mr. NAFF. In the beginning it was being done through USAID and out of the embassy in Jordan. At the present time I don't know what is happening because the talks are dormant. As far as I know, currently there isn't much going on. I am not absolutely up to date on it, Mr. Congressman.

Mr. GILMAN. Well, based on what you are saying then, there just won't be enough water for the dam itself because of what Syria is taking out--

Mr. NAFF. And Israel. What Syria is taking out is the water that rises--there is a small branch of the Yarmuk that rises in Syria and Syria is taking that water and sends down a residue of 132 MCM per year. After that goes down, the flow in the river is 400 million cubic meters per year. If Israel takes out 100 MCM per year and Syria takes 180 MCM per year, that doesn't leave, if you do the arithmetic, add those two and subtract it from 450, that doesn't leave 200 million cubic meters to capture behind the dam.

Mr. GILMAN. Is Syria part of the negotiations?

Mr. NAFF. Not directly. The Jordanians talk to the Syrians, and to the Israelis through the U.S., and the U.S. I presume talks to all three parties.

But the Syrians are threatening that if the Jordanians give away too much, then their deal will be off. So King Hussein is caught between a rock and a hard place on the issue unless it is successfully mediated.

Mr. GILMAN. Has the U.N. had any role in this?

Mr. NAFF. Not that I know of.

Mr. GILMAN. Are there any international requirements on water distribution, any international criteria?

Mr. NAFF. You have raised a serious problem, because international law on freshwater issues is rudimentary and fairly ineffectual. It has been effective only when prior treaties have been in place and law can be improved for mediating issues. But presently there is not body of international law that is being applied here. There is international law on these issues, but it is not very effective.

Mr. GILMAN. Thank you.

Mr. HAMILTON. Mr. Smith.

Mr. SMITH. It is the last part of your statement that is where I would like to dwell. Why is it that any of these international fora are not effective, any of the international existing bureaucracies that are set up to handle these? How come they are not at all effective in dealing with any of these problems?

You say that Jordan speaks to the Israelis through the

U.S. Why can't the Jordanians and the Israelis speak directly? We are not asking the Iraqis to do that. What seems to be the problem? Just the usual diplomatic problem that exists currently?

Mr. NAFF. Yes. It is basically a political problem. If Jordan were to open public negotiations with Israel over this, then Jordan, the regime there I think would have a serious reaction from its own public and among the other Arab states.

Mr. SMITH. So as far as you know, there is not private conversation?

Mr. NAFF. Sure there is. But there is the fact that there is a belief in Jordan, in many of the Arab states that the most effective way to get the Israelis to listen is through U.S. mediation.

RPTS STEIN

DCMN HALL

Mr. SMITH. Water experts from 11 Arab states met in Oman in April?

Mr. NAFF. Correct.

Mr. SMITH. In 1989 or 1990?

Mr. NAFF. 1989.

Mr. SMITH. And they treat obviously water security as essential to their national and military interest and security the same way that everyone would. Most of the Arab states that were represented at the region or all agreed with it, but what is the ramifications of it if a year and two months afterwards there is still no real forum currently considering all of these problems for the Arab states and nobody finding a solution at this moment?

Mr. NAFF. Well, partly it is because water problems are really complex and difficult. They are very recalcitrant of easy and quick solution. For example, to change the habits of consumption of any country is really hard, a big problem, and it takes time and it also takes really courageous political leadership. And that doesn't exist everywhere.

Mr. SMITH. There is no enforcement in many of these countries, you couldn't enforce it anyway. Even if you had rules, how, in some of these countries where the central government has no sway in the desert, how would you control

agricultural overuse or illegal use?

Mr. NAFF. There are ways of doing that partly by price. Also all the governments have laws on the books that say water belongs to the government, and it is the government that delivers the water. But there is a lot of cheating in the system, you are right. It is difficult to regulate effectively or 100 percent.

Mr. SMITH. Does anybody have any solutions, at least in the near term, to some of these problems without being able to get into the long-term solutions? Is there anybody proposing certain things which would be significantly helpful other than the normal conservation and the other kinds of things, changing habits?

Mr. KOLARS. As I mentioned earlier, the Turks have suggested this peace pipeline which would be able to bring supplementary, not total replacement water, to Jordan and to countries to the south, cities to the south. However, they have never been able to discuss the role of Israel in this for obvious reasons, even though Israel would have to play some part in guaranteeing the safety of the pipeline or perhaps being a recipient of some of the water.

Mr. SMITH. Where would the pipeline come across?

Mr. KOLARS. Through Syria and Jordan and run straight down the west side of the peninsula. I have seen several different maps in the Turkish press and with the Brown &

Root people in the U.S. who have been proposing this, one of which came across Iraq and down the east side of the peninsula.

Another map I have seen simply goes through Syria and parallels the Iraqi border down to the east side of the peninsula again.

Each pipeline is estimated to cost in present dollars about $10 billion apiece. This is not as large a sum as you might think, because Brown & Root suggest that they could deliver water for one third the cost per cubic meter that desalination would. It would pay for itself. There is water in Turkey, I am certain, though perhaps it would have to be a little different from what is suggested now.

Mr. SMITH. You mean the source of the water?

Mr. KOLARS. Yes. They suggested the Seyhan and Jeyhan Rivers, and they don't have enough water in them, but the Golesu has enough water to supply the needs. It would be 50 miles of additional pipeline.

Mr. SMITH. The problem is, Professor Naff, you mentioned I think that Turkey reduced its water flow for 30 days?

Mr. KOLARS. I did that, sir. This was on the Euphrates River, and there are two elements to this. There is the technological element and the political element. That was to begin filling the reservoir behind the Attaturk Dam. The reservoir holds about 84 billion cubic meters and think that

they got in 3 to 5 percent of that by letting it go for 30 days. They didn't come anywhere close to filling the reservoir in this first turn on the river.

Mr. SMITH. What happens in the event that they realize their plans completely? I think Professor Naff said that water into Syria could reduce by 40 percent and maybe up to 80 percent in Iraq.

Mr. KOLARS. This is again a very real possibility, and the Iraqis and the Syrians for the first time have begun talking seriously together.

Mr. SMITH. With the Turks?

Mr. KOLARS. With the Turks, and they have also begun to establish some slight detente because of the water problem between Syria and Iraq, which have been rather hostile to each other, and they are attempting to have three-party talks with the Turks.

There is a technical commission which is at work now, but diplomatic meeting of the three countries has had more difficulty. The Turks say this is a technical problem, the Syrians and Iraqis feel that it is tied to other matters.

It has been suggested that one of the reasons that President Ozal made the statement he did and that the water was turned off was to perhaps pressure the Syrians into preventing KKK--these are a Kurdish political group which practice extreme terrorism on the Turkish side of the

border, they are trying to destabilize the area there by raids on their own villages--and it has been suggested that this was in a sense a light tap of the stick to let the Syrians know that the Turks might do more if the Syrians didn't help control the Kurdish terrorists coming across the border.

Mr. SMITH. Thank you, Mr. Chairman.

Mr. HAMILTON. Mr. Lukens.

RPTS STEIN

DCMN HALL

Mr. LUKENS. Thank you, Mr. Chairman. I understand it is currently estimated that Israel current usage, and I don't mean to pick on Israel--I think she is probably the most advanced technologically in water usage, she probably uses water as wisely as anybody in the Mideast can--but it is my understanding that she is currently using 10 percent more annually than she can replace, and she is the best of the nations, is that a correct statement?

With that in mind, it says that by the year 2000, Israeli and West Bank demand for water will outstrip resources by 20 percent if nothing is done.

My question is this: If they are doing the best, Israel and the West Bank, and the most advanced technologically and the others are far behind, what is the first, most immediate step to take, and what role can the U.S. play specifically in starting to address the potential solutions to this awesome problem?

Mr. NAFF. Well, as I said, the most effective solution would be the creation of a basinwide independent authority to regulate the use of water. For political reasons, that is not likely to happen. Short of that, agreement, bilateral agreement, between the basin's riparians on the sharing of water which could be mediated by the U.S.--and in

this respect that is one thing the U.S. could do--to encourage discussions of sharing of water.

The third thing that the U.S. could do would be to provid inducements and encouragement to the nations to improve their water technology and to improve the conservation and the way that they use water. In this regard, the U.S. can act as a facilitator. It can provide certain amounts of strictly dedicated funds for that purpose. It can provide the expertise as well.

Mr. LUKENS. May I interrupt? I think I understand the general approach that the countries would use. My question is more political in nature.

How can we accelerate any agreement between any two meaningful countries in terms of water usage and water resource management? What is the first step for us? Would it be Israel and Egypt? What countries make the best marriage to start?

I am look for some answer somewhere.

Mr. KOLA One thing about Israel and Egypt, and I thi Professor Wa ry could address that, Egypt is in no position to ise Nile water, because there are seven people on t atchment there, and they have to get agreement g those people before they can promise Nile water some re else.

Mr. LUKENS. Where can we start to effect some kind of

model against which the other nations can measure their own situation as it becomes more severe?

DCMN MILTON

Mr. NAFF. I can tell you where under the Jordan basin. There is already a start on that.

Israel has for some years been preventing Jordan from cleaning out the intake to the East Gor main canal, the main water carrier in Jordan. When the Jordanians have gone out to clear out the rocks and silt, the Israelis have brought up troops and there have been exchanges of gunfire over the issue.

Three years ago the United States mediated an agreement largely because USAID experts agreed with the Jordanians, who said to the Israelis, ''Your claim that cleaning out that intake is not diverting Israeli water from the river,'' but since that agreement, the Israelis have reimposed restrictions on the Jordanians cleaning that out.

That is the main water carrier of Jordan and Jordan has got to have that water, and if we could mediate an agreement on that one issue alone that is long term, so that each time the silt and the stones build up the Jordanians are allowed to do it under strict observation so that it doesn't affect Israel, that would really help because there is a peculiar paradox about water issues and that is something that I call super-ordinary national interests.

Historically, water has tended to encourage negotiated settlement where other issues would quickly degenerate into warfare because water is essential to life to everybody, and there is a global feeling that people ought not to take other people's water because they need it to live.

In certain limited circumstances, and in the short term, water issues, if you make them small enough and are doable, water issues tend to be negotiated; and what is interesting is when you have successfully negotiated one of these water issues, the general impact is it has a salutary effect on other issues because the actors tend to change their perception of one another. ''Look, we have succeeded in doing this.''

Mr. LUKENS. Would it be possible for Dr. Waterbury to address the issue?

Mr. WATERBURY. I would like to mention something that has existed been Egypt and the Sudan since 1959 called the Permanent Joint Technical Commission on the Nile. It combines Egyptian and Sudanese engineers and hydrological experts. It meets four times a year, rotating between Khartoom and Cairo. It is the technical regulator for the 1959 agreement between Egypt and the Sudan on the use of the Nile water.

Egypt and the Sudan have gone through turbulent times, yet that commission has always met and done its technical job

and built up, as Professor Naff suggests, a kind of level of confidence and credibility between the two countries. I don't know if this can be a model in a situation where two of the major users do not recognize each other diplomatically.

Sudan and Egypt always had diplomatic relations. But it is a kind of low-level institution that keeps a constant focus on water issues on a quarterly basis, and has never failed to meet in 30-odd years.

Mr. LUKENS. One quick question. Then it has been very successful?

Mr. WATERBURY. I would regard among problems affecting sovereign nations, this is a fairly remarkable organization.

Mr. LUKENS. Thank you.

Mr. HAMILTON. There is no technological fix in sight, and I have in mind desalinization and maybe other things I don't know about, is that correct?

Mr. KOLARS. The problem of desalinization is difficult when at the present time it is too expensive. It works very well for cities and Riad is now receiving water from the Gulf and Abha on the Red Sea is receiving water from the Red Sea. It works well for domestic uses, urban populations.

Studies indicate that about 40 kilometers of Nile water

that was used, John Allen's study, 37 were used for agriculture and three cubic kilometers, three billion cubic meters, met all the needs of the people.

Mr. HAMILTON. You say desalinization works for cities?

Mr. KOLARS. Yes, in other words, for small amounts because it is expensive. But it is a magnitude greater for agriculture, and you have to take into account pumping costs.

Mr. HAMILTON. Why wouldn't that solve Cairo's problems?

Mr. KOLARS. It could, as a matter of fact, if they would bring it down from the sea. That is one of the possibilities.

Mr. HAMILTON. Is that just very, very expensive?

Mr. KOLARS. As long as they have the Nile flowing by the city, it doesn't occur to people. Why bother?

One other aspect of desalinization, that occurs at sea level and most use occurs above sea level. Sixteen to 18 percent of the energy used in Israel at the present time is used to pump water from Lake Kinret up to the national water carrier.

I would like to offer a technical solution in answer to Congressman Lukens' question. It occurs to me that if the United States could help negotiate a small and less expensive segment of the peace pipeline leading only to Jordan, only Syria, Jordan and Turkey would be involved. It

would be technologically very easy to do, require only three signatories on any such negotiation, and it might be an example of something that could then be extended to Israel or the Arab nations to the south.

Mr. HAMILTON. Did the Saudis spend $20 billion on that desalinization plant?

Mr. KOLARS. I am not sure of the exact amount. They have 20 percent of all the desalinization equipment in the world, and have research going on.

Mr. HAMILTON. Is it efficient?

Mr. KOLARS. It is efficient in the sense that it does the job, but it is not cost effective.

Mr. HAMILTON. It supplies what percentage of their total water consumption?

Mr. KOLARS. I am not sure. In Kuwait, for example, it supplies 100 percent.

Mr. HAMILTON. Desalinized water?

Mr. KOLARS. Yes.

Mr. HAMILTON. I am interested in your assessment of what priority American policy in the Middle East gives to these water problems and whether you think it is a high enough priority.

You have made a number of suggestions about what could be done in terms of the United States playing a mediating role. Are they doing it and if not, why aren't they doing it?

Mr. NAFF. They are doing it in a limited way. For one thing, you can't mediate unless the parties ask you to mediate and that is a limitation.

Mr. HAMILTON. That means the parties aren't interested in it?

Mr. NAFF. I don't know. I can't speak for the parties.

Mr. HAMILTON. If it is as serious a problem as you say, why aren't they interested in it?

Mr. NAFF. Some parties don't have sufficiently good relations with the United States to want them to come in. I don't think it is a high enough priority in formulation of American Middle East policy at present, although it is gaining more emphasis in agencies within the government.

Mr. HAMILTON. Are you aware of anything we are doing actively to deal with the water problems in the Middle East today?

Mr. NAFF. The negotiation between Jordan and Israel on the Yarmuk and USAID has been involved in various assistance to water projects in Jordan and in Egypt and in Israel.

Mr. HAMILTON. Are any areas rationing water?

Mr. NAFF. Almost all are.

Mr. HAMILTON. You have water rationing in almost all the areas?

Mr. NAFF. In the arid areas. I don't think there is water rationing in Turkey.

Mr. HAMILTON. On the Nile, Dr. Waterbury, you have the Israelis working with the Ethiopians on some dams on the Blue Nile; is that right?

Mr. WATERBURY. This is an allegation. I have no way of nothing whether it is true. That kind of rumor surfaces every two or three years.

Mr. HAMILTON. But to your knowledge there are no negotiations going on between the Israelis and the Ethiopians?

Mr. WATERBURY. To my knowledge, which is limited.

Mr. HAMILTON. That couldn't go on very far before you would know it, would it?

Mr. WATERBURY. I suspect not. It seems unlikely to me because any project that would be threatening to downstream neighbors would cost more money than Ethiopia could borrow. Anything that happens in the Ethiopian highlands is immediately registered in Cairo.

Mr. HAMILTON. Does the Blue Nile represent 85 percent--

Mr. WATERBURY. It varies with rainfall, but it is on average 60 percent of the annual discharge. it can be as much as 85.

Mr. HAMILTON. You have Ethiopia, the Sudan and Egypt all need water from the Nile?

Mr. WATERBURY. Right.

Mr. HAMILTON. Could those needs be met simply with more

efficient use of that water?

Mr. WATERBURY. Yes. I could give more of an answer than that if you want, but, yes.

Mr. HAMILTON. Well, what is the rest of your answer?

Mr. WATERBURY. Well, for Ethiopia it has very limited use of Blue Nile water at present and is unlikely, just given its own agricultural priorities, to ever draw very heavily on the Nile.

Sudan could make very heavy claims at some point, but those claims, which have been postponed for years because of political instability, might be met through much more efficient surface irrigation systems than they currently have.

Egypt, with great effort, could make major savings in its use of agricultural irrigation water.

Mr. HAMILTON. If you had stable governments and those governments negotiated rules and regulations for the Nile, it would put an even greater strain on resources; is that it?

Mr. WATERBURY. That is where one would like to go, a mutual understanding among the states.

My point was that if there are stable governments capable of negotiating such accords, they will also be capable of making claims on the Nile. They aren't now because they can't even get to that point.

Mr. HAMILTON. How is the Nile doing now? Is the flow down or up?

Mr. WATERBURY. The overall trend since the beginning of the 1980s has been down. I believe the flood of last September and August was a substantial flood.

But if you look at the trend line since the beginning of this century, it is a downward trend line. The average yield seems to be going down.

Mr. HAMILTON. And that has very serious ramifications for Egypt; their population is going up rapidly?

Mr. WATERBURY. Absolutely. But it is what Egyptian agriculture does that counts. Those additional people consume water, but not like an extra acre of rice or sugar cane.

Mr. HAMILTON. Mr. Smith.

Mr. SMITH. Let's talk about population growth. Given the scenario that you have painted and the limited, at best, effort at cooperation which exist between the various states that compete with these regions--you have the ones you talked about, Sudan, Ethiopia and Egypt, Jordan and Iraq, Israel, and their participation in that area, and then you have other places in the Arab world, Kuwait, which is using all desalinized water. I guess they are turning oil into water.

If the population growth continues on this trend, given the current rather minimal emphasis on this, is there a

linchpin area, a time frame at which point this is going to break down significantly?

When would you anticipate that given the current population growth and the need then to put more lands into agriculture for the purpose of feeding those people that come on stream, let alone the water they use?

Mr. NAFF. Using World Bank and U.N. numbers, projections would be somewhere between 2010 and 2020.

Mr. SMITH. That is only 20 years from now.

Mr. NAFF. That is right. Since World War II, the area's population has doubled and on present trends, just five countries--Egypt, Jordan, Israel, Syria, Turkey--the number should be sometime around 2015 that the total population around 230 million. That is a population larger than the water resources of the region covered by those countries can bear.

Mr. SMITH. Is that a recognition that exists in the minds of the people that are currently running those countries?

Mr. NAFF. No. Among policy makers--

Mr. SMITH. Yes.

Mr. NAFF. And leaders--interestingly, their actions, the answer has to be no. But their own experts, in all these countries they have good people. Their own experts are telling them that.

Mr. SMITH. is there anything that we can do at all, the

United States, besides trying to act as a broker?

Mr. NAFF. We give a lot of aid in that area and we have influence in the area, and I think that we can use that to help, to encourage certain kinds of activities. But that is very difficult.

We are dealing not just with very recalcitrant political problems, but we are also dealing with cultural problems as well and attitudes.

Mr. SMITH. I have no further questions.

Mr. HAMILTON. Mr. Lukens.

Mr. LUKENS. Thank you, Mr. Chairman.

I would just like to follow up with my search for additional micro solutions. What would be the next nation or nations most logical in signing on to the Egyptian-Sudanese agreement, or are there any nations that would benefit further down the Nile toward the source, and what pressures could be brought on them or what facts presented to them to convince them to participate?

Mr. WATERBURY. Egypt and the Sudan have both been very active for 15 years in trying to engineer a basin-wide agreement among all the nine riparian states in the Nile basin. The one that would most interest them I believe is Ethiopia.

Given the rather perilous state of the Mengista regime, it may be not the best bargaining partner those two countries

could have, but he may at this point be willing or he may be more willing than he has been to contemplate a partnership in managing the Nile.

The real problem in the Nile basin has been the tremendous imbalance in expertise as between Egypt on the one hand, and the upper Nile states in the White Nile basin, where they feel they do not have the knowledge of their own water resources to sit down at the table with Egypt and Sudan and not give away the farm.

So the Egyptians and Sudanese, I think, have been intelligent in trying to help build expertise in Rowanda, Uganda, Kenya, elsewhere, so that they will finally be in a position where they can sit down at the table and bargain intelligently over how these waters will be managed. It is a problem trying to have an equal playing field in terms of knowledge and expertise.

But the Egyptians have patiently moved and the minister of state in Egypt has been the prime mover to encourage the upper Nile states to come into some basin-wide accord. They have to have incentives to do so, and none of them are as dependent on the Nile as Egypt is.

So you have to find side payments for them. There may be other kinds of development projects that are associated with the Nile itself.

Mr. LUKENS. I thank the gentleman for that observation.

If I might ask about the U.N.'s role. Is there a U.N. role, and is it possible that the U.N. could put together a team of water experts representing those underdeveloped countries so that their interests would be protected at such a conference in order to accelerate the process?

Mr. WATERBURY. I think the U.N., the World Bank, the European Development Fund, all of which are periodically called upon to support large development schemes on rivers financially, can also be the catalyst, and the World Bank has been the catalyst in other river basins, to some kind of understanding establishing the rules of the game among these sovereign nations.

You have to have the financial stick behind it.

Mr. LUKENS. Do you think it is possible for them to pursue a more aggressive course? If the funding which is basic to any project is forthcoming, they could offer these lesser developed countries the expertise either from their organization of African states who represent them or the U.N., some international body of experts to represent their interests so we could accelerate the process of their coming to the table.

They are not at the table now?

Mr. WATERBURY. Not in an official capacity. They may do some of the technical work. The World Meteorological Organization has been the instrument through which the upper

Nile states have been building their own technical expertise in measurement and analysis of water resources. So they are there in the background. Whether they are at the table in any formal sense, I don't believe so.

Mr. LUKENS. Do you have other comments?

I am just searching for some small thread of hope to cling to that would see us take a role in accelerating this whole process. I just see it laying there dying for the most part.

Any other suggestions?

Mr. MAFF. I don't think it will die because the crisis will become so acute, that somebody is going to have to respond and do something about it.

As John said, the United Nations and the World Bank and various other international agencies are doing something, but the problem is so big, what is being done is piecemeal. They do something in response to a request by a given country.

There is not a lot of initiative being taken because, again, there is no specialized agency that deals with these issues exclusively like the one that I suggested perhaps the United States might set up, but could be equally well set up under United Nations auspices that would provide this kind of help and could perhaps take some initiatives.

But there are so many political problems that get in the

way, Mr. Lukens, that it is very difficult to sort of negotiate all of these shows. So it tends to be a fragmented process.

Mr. LUKENS. If I might just make one additional comment in the way of an overview, it seems to me that while I agree with the comments you have made how difficult it is politically, that it is absolutely vital that some agency step in now and either plan one of two routes, one for the emergency that is going to hit us in 20 years, and these people suddenly awaken to the fact there is not enough water for their population to survive and be prepared for that, a crisis management kind of thing, or--and I just detest this route--the more advanced nations of the world start pressing these people even to the point of suspending financial aid if they don't come to the table and start looking at a water management program immediately.

You are telling us we are looking at a crisis the proportion of which the world has never seen.

Mr. WATERBURY. Let me suggest something that I may not entirely believe, but maybe a lot of these areas are simply not well-suited for agriculture, and we should not impede the process of having them move away from an agricultural footing.

Egypt I would clearly except from that. But it is somewhat like the situation in Southern California and parts

of the Colorado basin. We are carrying water long distances to areas which may not be ideally suited over the long haul for agriculture, and maybe Israel and Jordan should look to a non-agricultural future rather than trying to get a technical fix allowing them to continue using water in ways that are not suited to their ecology.

Mr. LUKENS. I understand that Israel particularly has developed a system whereby water can be 85 percent pure as opposed to 90 or 97 percent pure, which makes it cost effective for agricultural purposes only.

Are you aware of that development? Is that an accurate statement? So for agricultural purposes sea water is bottomless in terms of those countries that have an ocean frontage. But for those countries that are landlocked, the problem is more severe?

Mr. KOLARS. It is very complicated because plants have a wide variety of salt tolerance and the Israelis are developing certain plants that have a higher salt tolerance and ways of preventing salts from accumulating in the soil. However, this is only a partial solution because human beings can't be expected to drink more salty water. So it is very partial.

Responding to the previous question, there is a very low profile detente, talks going on apparently between the Syrians and Iraqis at the present time. It seems to me that

we are looking at Turkey, Iraq, Jordan and possibly Syria and Israel, five of perhaps the strongest nations militarily in the whole area.

I don't know, and it is not for me to suggest, how it could be implemented, but if these talks could be encouraged, it seems to me that cooperation between Jordan, Turkey and Iraq would ensure the safety of, say, water pipelines in the Near East and things of that sort at least in Southwest Asia.

Mr. NAFF. Mr. Lukens, I believe that the option that you so detest is probably going to be the one that will bring action.

It makes no sense for people in the Middle East certain areas to be doing agriculture at all and no sense for them to be flushing their toilets with drinking water or flushing toilets at all where a lot of water is consumed. Those kinds of things I think can be changed on a technical basis, but I don't think it is going to happen until it reaches a point where it must be managed as a crisis, and I believe it is vital for us because of our interests in the region to be prepared for that, and perhaps by creating a special agency for that purpose or encouraging one in the United Nations.

Mr. LUKENS. I appreciate that.

I used the word ''detest'' which is a bit strong, but I don't like to offer immediate support for that because we

have so much anti-Americanism around the world and I am the last one who wants to stick our nose someplace where it doesn't belong.

But it seems this crisis is so immediate and awesome, Mr. Chairman, that we have to entertain every possible administrative method to bring it to the attention of those most affected.

Thank you.

Mr. HAMILTON. How far away are we from a crisis?

Mr. KOLARS. I think it depends on what area you are looking at. I think that Jordan is on the verge of one right now.

Mr. HAMILTON. Next year?

Mr. KOLARS. Yes, maybe this year. An example of that is they have tapped the El Azrak on Asis Springs 60 miles north of Aman, and that has essentially dried up now so that was just a drop in the bucket.

I think that 20-10 for a big crisis on the Euphrates River, I think is a good estimate. But there will probably be a small crisis about 1994 if the first irrigation return flow starts coming down the Khabur River into Syria from Turkey and perhaps polluting the Khabur to a serious extent.

Mr. NAFF. I agree that it is imminent in the Jordan basin. I am not sure it will happen tomorrow or in the coming year. I think somewhere between 1995 and 1997 is

more likely, certainly before the end of this decade.

One thing it has been discovered that the Pudici aquifer, which is the main aquifer in Jordan has less water by about 50 percent than originally thought. Instead of 100 PCM per year, it will yield 50, and that has to be transported 350 kilometers to the main population areas of Jordan. So that adds to the crisis.

I believe what we will see, as I said before, is not necessarily open warfare, but a lot of civil disorder and a lot of destabilizing forces at play largely as a result of the inability of Jordan and other countries to meet their economic development.

Mr. HAMILTON. And on the Nile?

Mr. WATERBURY. When you talk about a crisis, I have the image of somebody turning on their water faucet and no water comes out, and it won't be like that. If water becomes scarce either because the natural regime of the Nile changes and there isn't as much water or because upstream states use more, one will find that there are projects foregone such as desert reclamation, that certain parts of the irrigated surface have restricted water use or are removed from irrigation.

Supply and demand will reach an equilibrium I suspect without a noticeable crisis where suddenly people are in the streets saying, ''Where's our water?'' Adjustments can be

made, but they will be painful.

Mr. HAMILTON. We have a figure here that Saudi Arabia is using 90 percent of its nonreplenishable water supplies for agricultural products that could be imported at one tenth the cost. Does that sound reasonable to you? And they are the sixth largest wheat exporter today.

That is kind of crazy, isn't it?

Mr. KOLARS. Yes, it is. They give interest-free loans to the farmers. They provide them with water and land. They then buy the wheat from them at--in the past, it has been six to nine times the FOB price at Jedda or someplace like that.

Mr. HAMILTON. Why do they do it?

Mr. KOLARS. It is a matter of pride, self-sufficiency. However, it is very difficult to get a reading on this, but there are strong indications that the aquifers there are being depleted at a much more rapid rate than the ministry of agriculture is willing to suggest.

Mr. LUKENS. It is also of interest to me coming from a strong dairy state that they are now self-sufficient in dairy.

Mr. KOLARS. I don't think you have to worry. This will last a long time.

Mr. LUKENS. Cows do need water.

Mr. HAMILTON. Are the Saudis moving to conserve water in any significant way?

Mr. KOLARS. They are experimenting but I don't believe they are moving to conserve water at the present time.

Mr. HAMILTON. There is talk in Libya about an eighth wonder of the world project. How is that coming?

Mr. NAFF. A couple of civil engineers on our research project attended a presentation by the head engineer who made a presentation to experts on this project, and when they got his figures they went over the numbers and by their calculations, if water in sufficient quantities, the quantities that were claimed would be delivered in sufficient supply to build all of these rivers, in the pipeline that they are planning to build, that water would have to pass through that pipeline roughly at the speed of sound.

Mr. HAMILTON. So that project doesn't have too much promise, is that it?

Mr. NAFF. Not as it was presented.

Mr. KOLARS. Many years ago when relations were much better, I had the opportunity to visit Hufro oasis. At that time the drawdown was such that they were abandoning fields very rapidly. I think that the great man-made river will be lucky if it lasts to amortize the investment.

Mr. HAMILTON. On the Euphrates and the Tigres, Damascus actually threatened to go to war over that Ataturk dam, didn't they?

Mr. KOLARS. They have.

Mr. HAMILTON. That dam is one among many dams that would be constructed, 21 in all?

Mr. KOLARS. Yes.

Mr. HAMILTON. None of them constructed?

Mr. KOLARS. The 21 includes some on the Tigres, but three large dams are in place, the Kivan, Karkaya and Ataturk are in place.

Mr. HAMILTON. So three out of the 21 are constructed?

Mr. KOLARS. There are a number of smaller side dams constructed.

Mr. HAMILTON. What is the completion date for the entire project?

Mr. KOLARS. They said 2000 originally. On the diagram I project it at 2040 if every dam were to go into place.

Mr. HAMILTON. How is this going to affect Syria and Iraq?

Mr. KOLARS. If every dam and every irrigation project in Turkey went in place, it would reduce the natural flow of the Euphrates from what I figure to be 33 billion cubic meters per year, that entering Iraq would go down to less than five.

I don't think this will happen because all of these projects I don't think are attainable. But if you look at everything that is on the drawing boards, it could mean the end of the river in Iraq.

Mr. HAMILTON. So these projects, as each goes into place, cuts the water supply to both Syria an Iraq?

Mr. KOLARS. yes.

Mr. HAMILTON. They must be protesting it, then, pretty strongly?

Mr. KOLARS. Yes, sir.

Mr. HAMILTON. Are there any negotiations going on now between Syria, Iraq and Turkey?

Mr. KOLARS. Yes. There is a technical commission which has been meeting regularly. There have been attempts to form a tripartite council. I believe it has met a few times.

And also, the Turkish foreign minister has visited Bagdad and there are exchanges going on. They aren't very effective at the present time.

Mr. HAMILTON. And there is no immediate prospect for any kind of agreement?

Mr. KOLARS. I would hope so, but there are a number of difficulties to be worked out.

Mr. HAMILTON. Is the World Bank involved?

Mr. KOLARS. I don't know.

Mr. HAMILTON. Is the United States involved?

Mr. KOLARS. Not to my knowledge.

Mr. HAMILTON. is there enough water in the Euphrates for all three of these countries if they come to an agreement of

sharing?

Mr. KOLARS. There is certainly enough water to share, but not enough water for each country to realize its ambitions.

Mr. HAMILTON. How does the per capita consumption of water in these three countries run?

Mr. KOLARS. In Turkey there is no problem. There are ample supplies.

Syria does not depend so much for water consumption domestically on the Euphrates River because the Damascus and Aleppo--well, Aleppo is a case in point. It now draws all its water from Lake Assad and if the lake is diminished or polluted, it could mean hard times for Aleppo.

Mr. HAMILTON. That dam is on what river?

Mr. KOLARS. On the Euphrates, the major dam that the Syrians have. Damascus gets its water from the mountains to the west.

Mr. HAMILTON. Not from that--

Mr. KOLARS. The Orantes is a case in point. It flows north from the Bekaa Valley in Lebanon into Syria and through Hatai Province of Turkey where it reaches the sea. Hatai province is going to have a water shortage in the future.

The Syrians plan to build two dams on the Orantes River before it enters Turkey in the future. This will be a burr under the saddle for the Turks when that happens.

Mr. HAMILTON. Is it correct that the water consumption in the West Bank indicates that the Jewish settlers are using five times more water per capita than the Palestinians?

Mr. KOLARS. There are quotations in May 1999 the Jewish population uses 87.5 percent of the water from the West Bank and the Arabs are using 16.5 percent. This is from the Israeli press.

Mr. HAMILTON. You consider that an accurate figure?

Mr. KOLARS. There are a number of other estimates which are exactly in that same ball park.

Mr. HAMILTON. Are there restrictions on the use of water by Palestinians?

Mr. NAFF. Yes. Palestinians can't farm after 4 p.m. Palestinians can't dig a new well or repair a well that is proximate to an Israeli well. Palestinians cannot generate any new water.

Palestinians on the West Bank and Gaza consume on a per capita basis an average of 76 LCDs as compared to 300 LCDs by the settlers.

In some places on the West Bank of Gaza since the intafada, the Palestinian average has gone down to less than 44 LCDs, less than the United Nations reckons is necessary for maintaining minimal health standards.

Mr. HAMILTON. When the Jewish settlers go into the occupied territories, do they have restrictions on their use

of water?

Mr. NAFF. I don't know of any formal restrictions that have been placed.

Mr. HAMILTON. Do the Jewish and the Palestinians in the occupied territories pay the same amount for water?

Mr. NAFF. The settlers' water is subsidized. They do not. The Palestinians pay more for their water.

Mr. HAMILTON. Do you know what the difference is?

Mr. NAFF. I have the figure, but not in my head.

Mr. HAMILTON. It is about four times more?

Mr. NAFF. I don't know.

Mr. HAMILTON. If you have that information, we would like to have it, and perhaps you could call us and we will insert it into the record.

Mr. NAFF. Sure.

[The information follows:]

********** [COMMITTEE INSERT] ********

Mr. HAMILTON. And Gaza is consuming water much faster than it is being renewed?

Mr. NAFF. Yes. By about 70 MCM per year, and what is happening is that the Gaza aquifer is rapidly deteriorating. There is already water encroachment from the Mediterranean, and if that aquifer goes, that will have a very serious impact not only on the settlement, but could have an impact on the coastal plain aquifer in Israel, because there is a fairly strong likelihood, but not an absolutely proven one, that there is interchange there. That coastal plain aquifer is an Israeli aquifer. It is one of the two main aquifers.

Mr. HAMILTON. Is there any indication there of seepage of salt water?

Mr. NAFF. Not for certain yet. But there is serious deterioration in the aquifer and it is reaching what is known as the red line. That is why water is being pumped from Lake Kinret to replace that water and the water from the Khamuk is being pumped to replace Lake Kinret.

Mr. HAMILTON. Has anything been done to correct the problems?

Mr. NAFF. Plans have been made to replenish that water and some efforts have been made to replenish it, but there is such a shortage that the effort has been diminished significantly and frequently interrupted.

Mr. HAMILTON. Jordan is under water rationing now?

Mr. NAFF. Yes.

Mr. HAMILTON. Is that the whole country?

Mr. NAFF. Both urban and rural areas.

Mr. HAMILTON. What are they doing immediately in the short term to try to get away from rationing?

Mr. NAFF. Well, they are trying to generate new water from various sources, but that is very limited. They are trying to improve the delivery system of water. They have reorganized their water bureaucracy to make it more efficient, and they are also going over as rapidly as they can to drip irrigation.

They are trying to re-line the water carriers and the irrigation systems. But they have very limited funds to do that and limited manpower.

Mr. HAMILTON. Israel is using water from the Jordan River and from the Sea of Galilee?

Mr. NAFF. Yes.

Mr. HAMILTON. How polluted is the water south of the Sea of Galilee which Jordan might be able to use?

Mr. NAFF. It is too polluted for Jordan to use.

You have raised an important point here. We haven't talked about the problem of water quality, which is as serious an issue as water quantity, certainly in the river basins that we have all talked about. That must be addressed simultaneously.

There are already serious outbreaks of water-borne disease because of this pollution and it also diminishes the amount of water that is available. And unless that is addressed along with the population problems--all are interconnected.

Mr. HAMILTON. Pollution comes from agricultural runoff and inadequate sewage systems and that sort of thing?

Mr. NAFF. That is right, and industrial use and human offal.

Mr. HAMILTON. Where is the greatest problem of pollution in this area?

Mr. NAFF. In the Jordan basin?

Mr. HAMILTON. The whole region. Do we have a big problem with pollution on the Nile?

Mr. WATERBURY. No, although it is tremendous agricultural runoff in Egypt itself. But the Nile itself is reasonably clean.

My colleague points out the problem of the snails and the disease vector that virtually all peasants who work in irrigated agriculture in the Nile basin have.

Mr. KOLARS. The pollution problem that is coming up on the Euphrates is that the Hubler, the major stream in northern Syria, I believe will be seriously polluted once the agricultural projects north of the border dependent upon water from the Ataturk reservoir come on line. This will begin in 1991 if everything goes according to schedule, and

will probably reach serious proportions by 1995-1996. And the errant is similar.

One of the most interesting cases, though, is that of the Lepo itself, the city being so dependent upon the waters from Lake Assad, and so it is in jeopardy at the present time if anything happens to Lake Assad.

Mr. HAMILTON. Gentlemen, thank you very much. We appreciate your contributions this morning, and the subcommittee stands adjourned.

[Whereupon, at 10:40 a.m., the subcommittee adjourned.]

* * * SPEAKER LISTING * * *

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STATEMENTS OF:

INDEX OF INSERTS

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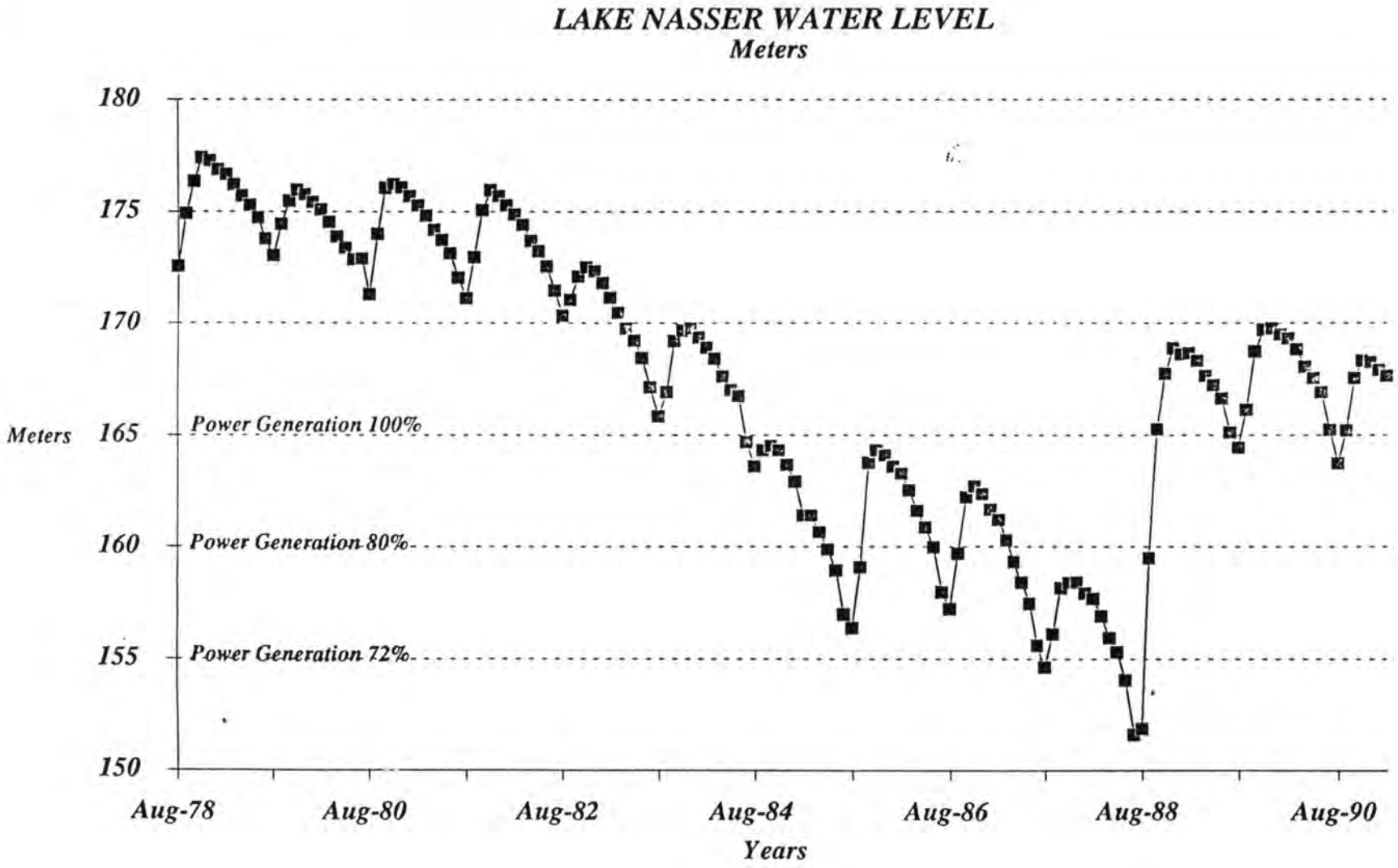
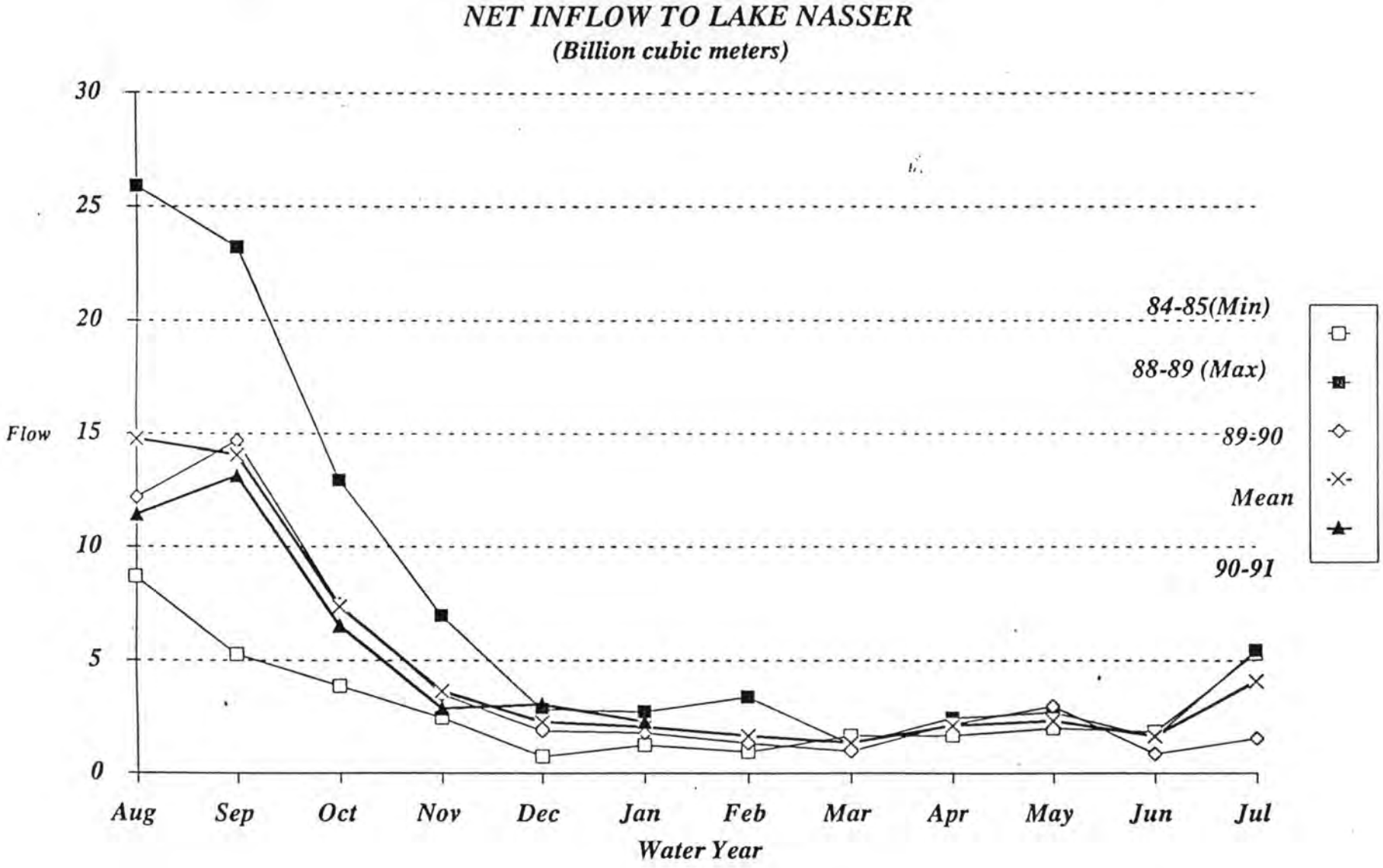
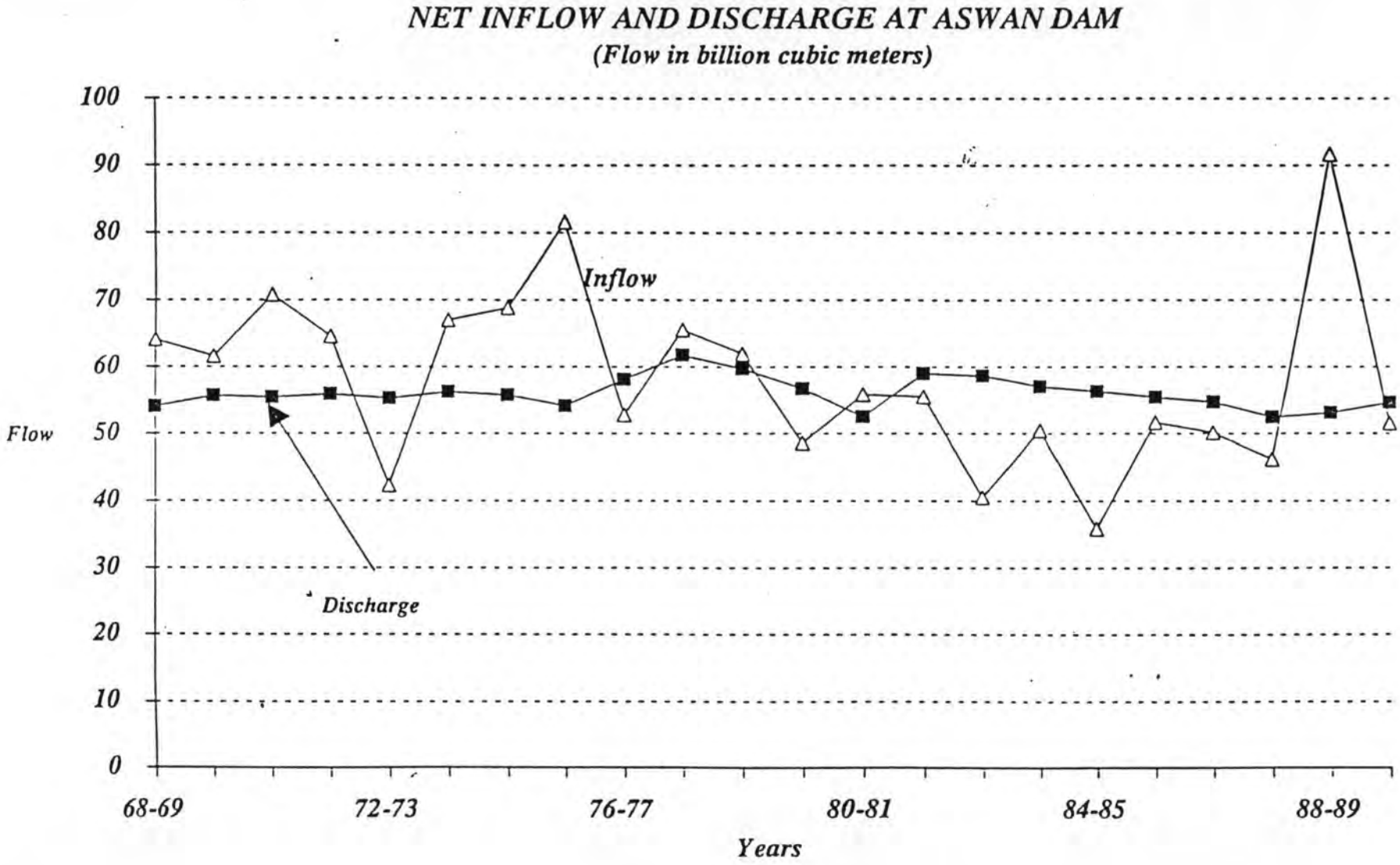
28% of Egypt's power needs




NET INFLOW TO LAKE NASSER
(Billion cubic meters)
30
25
20
15
10
5
0
Flow
84-85(Min)
88-89 (Max)
89-90
Mean
90-91
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Water Year


NET INFLOW AND DISCHARGE AT ASWAN DAM
(Flow in billion cubic meters)
100
90
80
70
60
50
40
30
20
10
0
Flow
Inflow
Discharge
68-69
72-73
76-77
80-81
84-85
88-89
Years

LAKE NASSER WATER LEVEL

Meters

Year	*AUG*	*SEP*	*OCT*	*NOV*	*DEC*	*JAN*	*FEB*	*MAR*	*APR*	*MAY*	*JUN*	*JUL*
68-69	*145.70*	*151.50*	*154.30*	*156.35*	*156.50*	*156.37*	*156.13*	*155.25*	*154.45*	*154.39*	*153.77*	*151.70*
69-70	*151.11*	*156.38*	*160.73*	*161.23*	*161.10*	*160.69*	*160.43*	*159.77*	*158.86*	*158.38*	*157.36*	*155.48*
70-71	*153.82*	*158.50*	*163.45*	*164.56*	*164.87*	*164.70*	*164.43*	*164.11*	*163.41*	*163.00*	*162.27*	*160.72*
71-72	*159.70*	*163.08*	*166.70*	*167.55*	*167.62*	*167.52*	*167.37*	*166.95*	*166.22*	*165.85*	*164.97*	*163.60*
72-73	*162.49*	*163.56*	*164.56*	*165.26*	*165.04*	*164.66*	*164.13*	*163.47*	*162.51*	*161.88*	*160.96*	*159.55*
73-74	*158.20*	*161.43*	*164.77*	*166.18*	*166.24*	*166.00*	*165.77*	*165.19*	*164.33*	*163.64*	*162.88*	*161.60*
74-75	*161.80*	*165.93*	*169.21*	*170.61*	*170.53*	*170.37*	*170.17*	*169.68*	*168.88*	*168.43*	*162.77*	*166.47*
75-76	*165.60*	*169.34*	*173.80*	*175.61*	*175.70*	*175.63*	*175.49*	*175.15*	*174.70*	*174.27*	*173.75*	*172.94*
76-77	*172.43*	*174.43*	*176.22*	*176.51*	*176.32*	*176.06*	*175.63*	*175.15*	*174.42*	*173.95*	*173.41*	*172.37*
77-78	*171.72*	*174.71*	*176.52*	*176.97*	*177.21*	*176.82*	*176.48*	*176.01*	*172.22*	*174.50*	*173.83*	*172.94*
78-79	*172.55*	*174.91*	*176.35*	*177.41*	*177.26*	*176.88*	*176.66*	*176.19*	*175.68*	*175.29*	*174.73*	*173.78*
79-80	*173.03*	*174.42*	*175.47*	*175.95*	*175.76*	*175.42*	*175.08*	*174.52*	*173.88*	*173.38*	*172.86*	*171.89*
80-81	*171.29*	*174.00*	*176.06*	*176.22*	*176.07*	*175.68*	*175.29*	*174.83*	*174.18*	*173.73*	*173.12*	*172.05*
81-82	*171.13*	*172.95*	*175.07*	*175.95*	*175.70*	*175.29*	*174.87*	*174.40*	*173.69*	*173.23*	*172.55*	*171.45*
82-83	*170.34*	*171.04*	*172.10*	*172.49*	*172.32*	*171.79*	*171.14*	*170.46*	*169.77*	*169.24*	*168.46*	*167.16*
83-84	*165.84*	*166.94*	*169.22*	*169.68*	*169.77*	*169.39*	*168.93*	*168.43*	*167.64*	*167.03*	*166.77*	*164.70*
84-85	*163.60*	*164.32*	*164.51*	*164.34*	*163.67*	*162.92*	*161.39*	*161.39*	*160.64*	*159.89*	*158.93*	*156.98*
85-86	*156.38*	*159.08*	*163.78*	*164.34*	*164.10*	*163.61*	*163.29*	*162.53*	*161.61*	*160.86*	*159.98*	*157.96*
86-87	*157.23*	*159.68*	*162.22*	*162.70*	*162.37*	*161.66*	*161.20*	*160.29*	*159.32*	*158.40*	*157.45*	*155.61*
87-88	*154.62*	*156.10*	*158.16*	*158.37*	*158.41*	*157.92*	*157.68*	*156.90*	*155.93*	*155.30*	*154.06*	*151.60*
88-89	*151.88*	*159.50*	*165.26*	*167.76*	*168.89*	*168.63*	*168.69*	*168.33*	*167.67*	*167.26*	*166.64*	*165.12*
89-90	*164.45*	*166.13*	*168.75*	*169.71*	*169.78*	*169.50*	*169.34*	*168.84*	*168.08*	*167.57*	*166.93*	*165.24*
90-91	*163.75*	*165.22*	*167.56*	*168.34*	*168.26*	*167.92*	*167.67*					
No. of pt.	*23*	*23*	*23*	*23*	*23*	*23*	*23*	*22*	*22*	*22*	*22*	*22*
Mean	***155.43***	***158.17***	***160.75***	***161.55***	***161.53***	***161.20***	***160.85***	***167.63***	***166.73***	***166.34***	***165.38***	***164.13***
Min	*145.70*	*151.50*	*154.30*	*156.35*	*156.50*	*156.37*	*156.13*	*155.25*	*154.45*	*154.39*	*153.77*	*151.60*
Max	*173.03*	*174.91*	*176.52*	*177.41*	*177.26*	*176.88*	*176.66*	*176.19*	*175.68*	*175.29*	*174.73*	*173.78*

DISCHARGE BELOW ASWAN DAM

(billion cubic meter)

Year	*AUG*	*SEP*	*OCT*	*NOV*	*DEC*	*JAN*	*FEB*	*MAR*	*APR*	*MAY*	*JUN*	*JUL*	*TOTAL*
68-69	6.10	4.17	3.80	3.39	3.24	2.90	3.70	3.97	3.66	4.87	6.57	7.71	54.08
69-70	6.07	4.20	3.81	3.64	3.39	3.06	3.98	4.99	3.92	5.42	6.52	6.72	55.72
70-71	6.11	4.29	3.75	3.60	3.25	3.55	3.79	4.28	3.94	5.48	6.49	6.97	55.50
71-72	6.22	4.45	3.78	3.67	3.30	3.43	4.02	4.24	4.04	5.30	6.54	7.00	55.99
72-73	6.30	4.24	3.74	3.62	3.02	3.62	3.52	4.38	4.00	5.26	6.59	7.00	55.29
73-74	6.38	4.23	3.85	3.93	3.58	2.82	3.96	4.54	4.12	5.24	6.62	7.02	56.29
74-75	6.26	4.03	3.91	4.06	3.51	3.19	3.86	4.53	4.19	5.08	6.42	6.74	55.78
75-76	6.64	3.88	3.69	3.72	3.48	3.54	3.59	4.02	3.89	4.82	6.27	6.69	54.23
76-77	5.88	4.03	4.03	3.93	4.03	3.91	3.66	4.59	4.08	6.86	6.45	6.66	58.11
77-78	5.84	4.16	4.34	4.19	4.91	4.45	4.32	5.23	5.40	5.66	6.32	6.93	61.75
78-79	5.86	4.50	4.50	4.49	4.49	3.83	4.31	4.60	4.35	5.20	6.55	7.05	59.73
79-80	5.94	4.56	4.03	3.80	3.83	3.53	4.03	4.41	4.14	5.03	6.43	7.02	56.75
80-81	5.98	4.45	3.91	3.90	3.90	3.62	3.93	0.43	4.11	4.92	6.40	7.06	52.61
81-82	6.06	4.56	4.34	4.20	4.34	4.34	4.03	4.48	4.22	5.04	6.48	6.91	59.00
82-83	6.11	4.56	4.34	4.20	4.34	4.36	3.92	4.41	4.31	4.77	6.51	6.90	58.73
83-84	6.22	4.43	4.05	3.89	3.86	3.81	4.11	4.34	4.16	4.81	6.51	6.90	57.09
84-85	6.15	4.60	4.50	3.75	3.66	3.21	4.04	3.96	4.07	4.88	6.68	6.89	56.39
85-86	6.13	4.50	4.17	3.73	3.68	3.08	3.82	4.02	4.02	4.80	6.84	6.73	55.52
86-87	6.13	4.56	4.08	3.48	3.57	2.90	3.74	3.94	3.94	4.69	6.94	6.82	54.79
87-88	5.84	4.57	3.79	3.27	3.26	2.45	3.42	3.69	3.96	4.86	6.72	6.65	52.48
88-89	5.96	4.37	3.53	3.23	3.12	2.49	2.22	3.95	4.08	5.11	7.23	7.88	53.17
89-90	6.13	4.40	3.39	3.25	3.10	2.50	3.47	4.11	4.20	7.15	6.86	6.18	54.73
90-91	6.18	4.35	3.44	3.21	3.07	2.30							
No.of prt.	23	23	23	23	23	23	22	22	22	22	22	22	22
Mean	***5.84***	***4.16***	***3.80***	***3.61***	***3.52***	***3.24***	***3.79***	***4.14***	***4.13***	***5.24***	***6.59***	***6.93***	***56.08***
Min	5.84	3.88	3.39	3.23	3.02	2.45	2.22	0.43	3.66	4.69	6.27	6.18	52.48
Max	6.64	4.60	4.50	4.49	4.91	4.45	4.32	5.23	5.40	7.15	7.23	7.88	61.75

NET INFLOW TO LAKE NASSER

(billion cubic meter)

Year	*AUG*	*SEP*	*OCT*	*NOV*	*DEC*	*JAN*	*FEB*	*MAR*	*APR*	*MAY*	*JUN*	*JUL*	*TOTAL*
68-69	16.93	10.34	8.79	3.78	2.90	2.28	1.56	2.05	3.52	3.43	2.05	6.47	64.10
69-70	18.13	16.40	5.33	3.24	2.15	2.28	2.00	2.29	2.58	2.69	1.74	2.77	61.60
70-71	17.91	19.62	7.64	4.72	2.64	2.58	2.64	1.88	2.55	3.07	1.66	3.91	70.82
71-72	16.79	17.44	7.06	3.94	2.91	2.84	2.39	1.47	2.66	2.13	1.69	3.28	64.60
72-73	9.89	7.75	6.26	2.83	1.65	1.71	1.25	1.16	1.94	2.41	2.36	3.11	42.32
73-74	15.95	15.47	8.96	4.16	2.67	1.99	1.87	1.44	1.71	2.67	2.48	7.64	67.01
74-75	20.53	16.99	9.93	3.72	2.82	2.33	1.75	1.11	2.34	2.42	1.40	3.51	68.85
75-76	20.34	24.22	13.06	4.19	3.12	2.81	1.82	1.68	1.65	2.17	2.24	4.29	81.59
76-77	15.80	13.39	5.60	2.90	2.63	1.67	1.17	0.79	1.65	2.16	1.44	3.66	52.86
77-78	20.49	13.68	6.77	5.53	2.76	2.61	1.78	1.12	1.66	2.21	1.89	5.10	65.60
78-79	17.71	12.06	10.31	3.66	2.39	2.64	1.77	1.90	2.11	2.50	1.65	3.30	62.00
79-80	12.97	10.01	6.53	2.81	2.06	1.76	1.12	1.11	1.63	2.47	1.89	4.32	48.68
80-81	18.88	15.18	4.77	3.09	1.86	1.59	1.53	1.05	1.83	1.87	1.33	2.91	55.89
81-82	14.44	15.36	8.92	2.90	2.21	2.16	1.59	0.86	1.92	1.78	1.41	2.05	55.60
82-83	9.13	9.35	6.17	3.40	1.89	1.43	0.97	1.44	2.03	1.53	1.35	1.89	40.58
83-84	10.36	13.60	6.02	4.28	2.22	1.85	2.06	1.17	3.22	1.92	0.80	3.03	50.53
84-85	8.66	5.28	3.89	2.47	0.77	1.26	0.97	1.68	1.70	2.02	1.86	5.33	35.89
85-86	13.38	13.31	6.14	2.87	1.99	1.99	1.28	1.06	1.71	2.18	0.97	4.83	51.71
86-87	13.94	12.38	5.66	2.39	2.28	1.43	1.00	1.02	1.30	2.14	2.23	4.44	50.21
87-88	9.41	9.96	4.37	3.38	1.90	1.73	1.39	1.23	2.41	1.88	1.33	7.24	46.23
88-89	25.91	23.21	12.96	7.00	2.87	2.74	3.40	1.31	2.48	2.72	1.63	5.47	91.70
89-90	12.20	14.68	7.47	3.53	1.89	1.81	1.35	0.99	2.20	2.99	0.88	1.55	51.53
90-91	11.42	13.13	6.55	2.88	1.69	1.32							
No. of prt.	23	23	23	23	23	23	22	22	22	22	22	22	22
Mean	**14.77**	**13.46**	**7.07**	**3.51**	**2.20**	**1.98**	**1.67**	**1.36**	**2.13**	**2.33**	**1.65**	**4.10**	**58.18**
Min	8.66	5.28	3.89	2.39	0.77	1.26	0.97	0.79	1.30	1.53	0.80	1.55	35.89
Max	25.91	24.22	13.06	7.00	3.12	2.84	3.40	2.29	3.52	3.43	2.48	7.64	91.70

LAKE NASSER GROSS STORAGE

(billion cubic meter)

Year	*AUG*	*SEP*	*OCT*	*NOV*	*DEC*	*JAN*	*FEB*	*MAR*	*APR*	*MAY*	*JUN*	*JUL*
68-69	*29.42*	*40.25*	*46.42*	*51.41*	*51.80*	*51.46*	*50.84*	*48.70*	*46.78*	*46.64*	*45.19*	*40.67*
69-70	*39.43*	*51.49*	*63.69*	*65.21*	*64.81*	*63.57*	*62.79*	*60.81*	*58.11*	*56.76*	*54.04*	*49.25*
70-71	*45.30*	*57.10*	*72.43*	*76.32*	*77.43*	*76.82*	*75.85*	*74.70*	*72.29*	*70.90*	*68.49*	*63.66*
71-72	*60.60*	*71.17*	*84.16*	*87.45*	*87.72*	*87.33*	*86.74*	*85.11*	*82.34*	*80.96*	*77.79*	*72.94*
72-73	*69.22*	*72.80*	*76.32*	*78.84*	*78.04*	*76.68*	*74.77*	*72.50*	*69.28*	*23.00*	*64.38*	*60.16*
73-74	*56.26*	*65.83*	*77.07*	*82.18*	*82.41*	*81.50*	*80.67*	*78.58*	*75.49*	*73.08*	*70.50*	*66.36*
74-75	*66.98*	*81.25*	*94.20*	*100.22*	*99.88*	*99.19*	*98.33*	*96.22*	*92.81*	*90.96*	*88.30*	*83.29*
75-76	*80.06*	*94.76*	*115.10*	*124.47*	*124.94*	*124.58*	*123.85*	*112.08*	*119.74*	*117.50*	*114.85*	*110.82*
76-77	*108.42*	*118.34*	*127.69*	*129.25*	*128.23*	*126.82*	*124.58*	*122.08*	*118.28*	*115.85*	*113.15*	*105.14*
77-78	*105.14*	*119.79*	*129.31*	*131.74*	*133.08*	*130.93*	*129.09*	*136.55*	*122.44*	*118.70*	*115.25*	*110.82*
78-79	*108.99*	*120.83*	*128.39*	*134.20*	*133.36*	*131.25*	*130.06*	*127.53*	*124.84*	*122.06*	*119.90*	*115.00*
79-80	*111.25*	*118.28*	*123.74*	*126.24*	*125.25*	*127.48*	*121.72*	*118.80*	*115.50*	*113.00*	*110.44*	*105.90*
80-81	*103.21*	*116.10*	*126.82*	*127.69*	*126.88*	*124.84*	*112.81*	*120.42*	*117.04*	*114.75*	*111.70*	*106.63*
81-82	*102.49*	*110.87*	*121.66*	*126.24*	*124.94*	*122.81*	*120.62*	*118.18*	*114.55*	*112.25*	*108.99*	*103.93*
82-83	*99.06*	*102.08*	*106.87*	*108.70*	*107.90*	*105.46*	*102.53*	*99.58*	*96.61*	*94.33*	*91.09*	*85.92*
83-84	*80.92*	*85.07*	*94.25*	*96.22*	*96.61*	*94.98*	*93.01*	*90.96*	*87.80*	*85.42*	*82.53*	*76.82*
84-85	*72.94*	*75.45*	*76.14*	*75.52*	*73.18*	*70.74*	*68.79*	*65.71*	*63.43*	*61.17*	*58.30*	*53.48*
85-86	*51.49*	*58.74*	*73.55*	*75.52*	*74.66*	*72.97*	*71.89*	*69.35*	*66.39*	*64.08*	*61.47*	*55.60*
86-87	*53.70*	*60.51*	*68.33*	*69.91*	*68.82*	*66.55*	*65.12*	*62.37*	*59.46*	*56.82*	*54.27*	*49.56*
87-88	*47.19*	*50.76*	*56.15*	*56.74*	*56.35*	*55.95*	*54.87*	*52.84*	*50.37*	*45.82*	*45.84*	*40.46*
88-89	*41.05*	*60.00*	*78.84*	*92.03*	*92.03*	*91.74*	*92.03*	*90.55*	*87.91*	*86.31*	*83.93*	*78.33*
89-90	*75.92*	*81.99*	*92.28*	*96.35*	*96.65*	*95.45*	*94.76*	*92.64*	*89.53*	*87.52*	*85.03*	*78.76*
90-91	*73.45*	*78.69*	*87.48*	*90.59*	*90.27*	*88.89*	*87.39*					
No. of pt.	*22*	*23*	*23*	*23*	*23*	*23*	*23*	*22*	*22*	*22*	*22*	*22*
Mean	*73.1382*	*78.8461*	*88.4091*	*91.8457*	*91.5204*	*90.3957*	*88.5097*	*90.7393*	*87.7722*	*83.5401*	*82.9741*	*77.8864*
Min	*29.42*	*40.25*	*46.42*	*51.41*	*51.80*	*51.46*	*50.84*	*48.70*	*46.78*	*23.00*	*45.19*	*40.46*
Max	*111.25*	*120.83*	*129.31*	*134.2*	*133.36*	*131.25*	*130.06*	*136.55*	*124.84*	*122.06*	*119.9*	*115*

House Committee on Foreign Affairs
Subcommittee on Europe and the Middle East

Testimony, June 26, 1990
Thomas Naff
University of Pennsylvania

Introduction

There is virtually no human artifact or commodity that is produced in the absence of water. Agriculture is impossible without it, and so are most manufacturing processes. Water resources in particular delineate the ability of any country to be productive and to feed its citizens. In so arid a region as the Middle East, water is the ultimate survival issue. In the Middle East, water cuts across and is a prime factor in all major socio-economic issues.

With trust so low among the area's nations and conflicts rife, problems of water sharing are intensifying existing rivalries. As usage demands increase, water scarcity and sharing will soon become the two most important issues in the Middle East. American and Middle Eastern policymakers will ignore or under value the issue of water only at grave peril to their national interests. The Jordan River basin is an excellent case study of the exigency of water problems in the Middle East.

Water and Conflict

Fresh water has always been a source of conflict. The word *rival* is derived from the Latin *rivalis*, meaning "one living on the opposite bank of a stream from another, or one using the same stream as another."

Why is water so susceptible to conflict? Generally, because it is essential to life, but specifically because water flows. Its unregulated flows are likely to be erratic, and in arid country, the consequences for any user unable to capture water the moment it is needed are likely to be dire. Also the unpredictable character of stream flow can create a tense environment of uncertainty that is disruptive of social relations. In the Middle East, water exhibits all of these elements of conflict.

Water Security and Foreign Affairs

As a contemporary issue of security and international relations, water displays certain distinguishing characteristics:

- Water is always a terrain security issue, especially when scarce, since all concerned parties feel compelled to control the ground on or under which water flows.

- The relationship between water dependency and security is perceived as absolute, i.e., as zero-sum, especially where two or more mutually antagonistic actors compete for the same water source.
- As a zero-sum security issue, water carries a constant potential for conflict.
- Because of its complexity, water tends to be dealt with piecemeal both domestically and internationally, thus tending to be fragmented as a strategic and foreign affairs issue.
- International law as a means of settling and regulating fresh water issues remains rudimentary and relatively ineffectual unless prior treaty agreements are in place.
- The strategic reality of water is that under severe shortage – which is the prognosis for the Jordan basin – water becomes a highly symbolic, contagious, aggregated, intense, salient, complicated, zero-sum-power-and-prestige-packed crisis issue, highly prone to conflict and extremely difficult to resolve.

Water and Conflict Resolution

One of the paradoxical qualities of hydro-political problems is that, despite their complexities and stubbornness, they exhibit a tendency in certain circumstances to encourage negotiations where other problems would degenerate into conflict. There is an underlying superordinate interest common to all riparians – water is essential to life – that sometimes can be made to override discords and produce agreements on water issues. In the short term, such accords are possible despite ongoing recalcitrant issues, and, if successfully negotiated, they can have a salutary impact on other problems.

The Jordan River Basin

Three countries are involved in the Jordan River basin. Jordan and Israel are the primary riparians; Syria is also an interested party since a branch of the Yarmuk, a tributary to the Jordan, has its headwaters in Syria.

The threat of a water crisis in the Jordan River basin has been growing more serious for some time. If it is not eased, it is highly probable that destabilizing domestic strife will erupt soon, most likely in Jordan first, with major regional and international repercussions.

Very serious problems of water scarcity and quality in the Jordan basin are the basis for this crisis. The basin's principal riparians, Jordan and Israel, have been consuming about 115% of their total usable water stocks. The prognosis is for continuing water shortages and over-exploitation of water supplies in both the short and long term, that is, through 2015, unless immediate drastic and politically difficult basin-wide remedial actions are taken.

The effects of ongoing water deficits, already severe in the Jordan basin, are cumulative and can quickly become irreversible. Neither known natural sources nor water technologies, now or in the foreseeable future, have the capacity to generate new usable water in needed quantities at an affordable cost. Failing a solution of scarcity, both Israel and Jordan will have to curtail their social and economic development. The result will be heightened competition among riparians and among domestic sectors within each country for decreasing amounts of water with concomitant destabilizing consequences, not the least being a significant rise in the probability of an outbreak of warfare between Jordan and Israel, which would almost certainly involve other Arab states.

Obviously, the stakes in a basin-wide solution to the problems of scarcity are very high for both Jordan and Israel. Between now and 2015 Jordan's population is projected to grow by 178% from the current 2.7 million to 7 million. That is a rate about 2.5 times higher than it should be in relation to the water and economic resources of the basin. If this growth rate continues without an increase in water supplies, stringent conservation, and dramatic changes in present habits of consumption, Jordan will be unable to support a population that large. Even if Jordan eventually constructs the planned Unity Dam (assuming that the current U.S.-mediated negotiations between Jordan and Israel over the dam's construction succeed), Jordan will still suffer an annual water shortage.

Although Israel's population growth is significantly lower than that of Jordan and the Occupied Territories, Israelis consume 5-6 times more water per capita than their neighbors: 280-300 liters per capita per day (l/c/d).

Among the most politically charged implication of the basin's water shortage is whether Israel will be able to absorb successfully the anticipated one million Russian-Jewish emigrés. At present, it is unlikely that there will be enough water on Israel's side of the basin to absorb a million people consuming water at the rate of 280 l/c/d. The waters of the Occupied Territories are already being over-exploited by about 100 mcm/yr. Allowing large numbers of emigrés to settle there would only intensify current problems.

Because of the current disparity in power among the Jordan basin's riparians – Jordan, Israel, and Syria – there appears to be no immediate prospect of water-based warfare. However, water issues are central to the strategic planning of all the basin's riparians; water has become significantly militarized and water problems contribute importantly to the basin's inter-riparian tensions. The potential for open conflict over the basin's diminishing water stocks is rising.

If current policies and patterns of consumption in Jordan and Israel persist, a mounting series of water crises will be touched off before the end of the decade (perhaps as early as 1995-1997), particularly if economic conditions deteriorate further or there is a drought, which is almost certain given the drought history of the basin. The severity of the crisis could break present restraints on conflict. If that occurs, water will combine with other underlying forces of instability and hostility among the basin's riparians, and water-driven warfare will almost certainly ensue, spilling out into the region beyond the basin. King Hussein has stated privately that although he could conceive of few reasons to go to war with Israel, he could be compelled to fight over water despite the almost sure prospect of defeat.

Unless Israel and Jordan are able very quickly to devise effective policies for the reduction of water consumption, they will be unable to meet the developmental needs of their societies. Whatever combination of actions might be taken, some degree of economic restructuring and a reduction in population growth must be a part of the process. Such alterations always result in social dislocation and hardship. Consequently, rather than warfare among riparians in the immediate future (which is certainly possible), what is more likely to ensue from water-related crises in this decade, is internal civil disorders, changes in regime, political radicalization, and instability. All of these developments would have a negative effect on U.S. interests.

Water and the Occupied Territories

The water in the Occupied Territories has become so integral to Israel that the delicate balance of Israel's water system has become dependent on the water system of the Territories. In needy times, which is more and more the situation, Israel satisfies up to 35-40% of its water needs from the West Bank and Gaza; in the past, an average of one-quarter of the nation's supply has normally come from the Territories. It is inconceivable that an Israeli government would ever give up any part of the Occupied Territories without an effective plan, replete with a full array of guarantees and inducements, that gives Israel secure and permanent access to sufficient quantities of the Territories' waters or guaranteed access to other comparable sources in the area (probably the Litani River in Lebanon). In fact, owing to serious shortages, it is reliably reported that Israel has been trucking water from the Litani River, which lies entirely within sovereign Lebanese territory, into Israel. Again, in this context, it is useful to recall the challenge that scarcity poses for Israel in its efforts to absorb a million emigres within five years without first mitigating her water problems.

It might eventually be possible to overcome Israel's security arguments for retention of the Territories, but the hydrological arguments will persist unless the water issue is settled. It is water, in the final analysis, that will

determine the future of the Occupied Territories – and by extension, the issue of conflict or peace.

Unless patterns of consumption change, sometime between 1995 and 2005 Israel, Jordan, and the Occupied Territories will begin to experience such acute and progressively worsening perennial water shortages and degradation of water quality that the effect can be likened to a situation in which the three areas were to run out of all renewable sources of fresh water. Clearly, the best solution to the hydropolitical problems of the Jordan basin (and for all the region's international river basins) would be creation of basin-wide authorities with enough independence, power, funding, and expertise to determine and regulate water usage among the riparians.

However, owing to insufficient financial resources, shortage of technical and managerial expertise, domestic and political constraints, paralysis of leadership, and deep-seated, even implacable, feelings of mistrust and hostility among the basin's actors, the leaders of Israel and Jordan will be unable to solve their water-related problems without outside assistance.

The Interconnectedness of Water Issues

It is an axiom of Middle Eastern affairs that all major situations or events in one sector of the region will ultimately have an impact on all other areas. No issue demonstrates this proposition better than water, which is integral to so many other issues. For example, the quintet of nations occupying the Jordan and Euphrates River basins – Jordan, Israel, Syria, Turkey, and Iraq – are linked by hydropolitical interests through Syria, which has riparian status in both basins, by strategic factors, by competing development schemes, by common hydroelectric needs, and by competition for scarce water resources. Turkey has proposed a so-called "peace pipeline" for the transport of water out of the Euphrates basin in Turkey to the Gulf region. But such a plan, though technically feasible, would be very costly and politically vulnerable because its route requires the acquiesence of Jordan, Israel, and Syria.

Perhaps the most telling illustration of the interconnectedness of water is the issue of the Unity Dam on the Yarmuk between Jordan and Israel. Without going into the background details of Unity, it is possible to demonstrate how this single issue, because of its hydraulic nature, has ramifications across basins, borders, and both socio-economic and strategic affairs. For Jordan, the construction of Unity Dam involves several questions critical to that nation's economic future and political stability: Whether Israel will obstruct the construction of Unity Dam on which Jordan is pegging much of its water security and future development; whether Syria will acquiesce to whatever Jordan and Israel agree on without pulling out of its accord with Jordan on Unity; future guaranteed allocations of Yarmuk water among its

riparians; the impact on Jordanian-U.S. relations of the American mediation efforts in the Jordanian-Israeli Unity Dam negotiations; whether Turkey will assume a pivotal role in the hydropolitics of the region. The future issues of importation of water from Turkey and Iraq are subsumed under these rubrics because both Syria and Israel will have to agree not to be obstructive, otherwise it is highly unlikely that Jordan would be assured a secure pipeline in the future. All of these issues are linked by the Unity Dam negotiations.

Construction of the Unity Dam constitutes Jordan's main hope for a politically stable and viable socio-economic future. Despite Unity's limitations, there is no other comparable option for Jordan. Therefore, Jordan must negotiate with Israel until a workable arrangement is reached. Military action, except in extremis, is not a viable choice. If the Israelis play their hand badly, they will lose much despite their riparian and military advantages. Creating a water-based political or economic crisis could destabilize Jordan, perhaps topple King Hussein's regime, and radicalize the government. Not only would that event add significantly to the forces of destabilization in the region, but Israel could be faced with another radical and militarily hostile neighbor.

Syria could gain much from a successful Unity negotiation; in addition to more electricity and water, Syria could win political credit in the Arab camp, more influence in Amman, possibly more U.S. economic cooperation, and a small improvement in its position vis a vis Turkey and the Euphrates. In hydropolitics, incremental advantages matter. Turkey looms important in the background of the Jordan-Israel-Syria talks because of her links with the negotiants and the mediator and because Turkey's good offices and influence – in part because of its upper riparian status on the Euphrates – are available to all of the principals (though the Syrians are not likely to make use of them).

The Unity negotiations offer the U.S. an extraordinary opportunity to advance its Middle East interests and pursuit of peace in the region. Although the inherent volatility of the water issue and the seemingly unmitigated enmity of some of the actors could overwhelm the American mediatory venture, if the U.S. plays its hand with great finesse, flexibility, equitability, and persistence, it could emerge from the Unity negotiations having achieved a major milestone in its Middle East policies and the possibility of parlaying a successful result into further exchanges over other issues.

U.S. Role in the Region's Hydropolitics

American Middle East interests are directly and substantially engaged by the hydropolitics of the Middle East. The U.S. is committed to a pivotal role in the peace-seeking process, and water issues in the Jordan basin are a

basic determinant of whether that process will succeed or fail. Jordan is a moderate Arab friend of the U.S. whose monarch has consistently sought peaceful, negotiated settlement of the Arab-Israeli problem. If Jordan's water problems overwhelm the current regime, it will almost certainly be replaced by a more radical, hostile, confrontational one. Not only would the U.S. have lost an important moderate friend, the chances of open warfare would be increased and the U.S. policy of protecting and maintaining Israel's security would become more difficult. These are the kinds of stakes the U.S. has in the region's water problems.

If the hydrological problems of the region are to be mitigated in time to avoid conflict, the U.S. must play an immediate, sustained, central, and genuinely even-handed role, acting mainly as a facilitator/mediator, providing necessary inducements and guarantees for agreements, as well as mobilizing and working with other outside parties to assist in the effort. Also, the U.S. must be prepared to provide – preferably in conjunction with other powers – sufficient, strictly dedicated financial resources to make possible the economic restructuring essential to solving the region's water problems without unbearable political and socio-economic hardships.

American influence with the principal users of the Jordan basin's waters is sufficiently strong that the U.S. could play a positive role. In addition to using its political and economic leverage, the U.S. can mobilize international diplomatic efforts to encourage a basin-wide agreement with inducements of economic aid and political support. Such actions, together with judiciously proferred water technology and expertise, could advance American interests in the basins and region simultaneously.

There are various short-term actions that Congress can take toward easing the water crisis in key parts of the Middle East, such as the Jordan River Basin. These actions are achievable and would have a salutary effect without having to await settlement of larger, recalcitrant political issues:

1) Provide technical expertise and appropriate water technology, especially in respect to return flow, extraction, and purification, as soon as possible.

2) Provide training, on site and in the U.S., on advanced techniques of conservation, irrigation, crop planning, and efficient water management.

3) Assist in the creation of local water research and training centers (such as the one at Jordan University) to encompass such programs as the use of effluents in agriculture, the development of marketable saline-tolerant crops, low-water-consumping crops, etc.

4) Encourage the investment of private capital in the infrastructure of Middle Eastern water establishments.

5) Support and encourage World Bank and United Nations agencies in their efforts to assist Middle Eastern nations with their water problems.

6) Consult with the European Community and Japan on devising joint efforts aimed at easing the most critical water problems in the region.

7) Use whatever influence the U.S. can to encourage the creation of basin-wide authorities for the management and allocation of water resources and discourage any of the region's riparians from using water as a political weapon.

8) In various ways, give official public acknowledgement of Congress's recognition of the urgency of water issues in the Middle East – for example, by having a report on the issue prepared and given wide dissemination and extensive media coverage.

9) In the various economic aid packages Congress makes available to Middle Eastern nations with water problems, earmark rigorously those funds that are to be spent exclusively on water-related projects.

10) All of these steps can be implemented through existing channels. However, as a means of highlighting its concern in the issue of water, Congress could devise special, high-visibility programs for some of these proposed actions. The best long-term means for dealing with these issues effectively would be to create a special interagency group, encompassing both the executive and legislative branches, to coordinate American policy formulation in the realm of international fresh water issues. This group should serve functions of coordination, data collection, policy and project assessment, education, and review. It could also be an international data clearinghouse and a reservoir of international expertise. Its purview should include the technological, political, socio-economic, strategic, and legal dimensions of international water use issues.

UNIVERSITY of PENNSYLVANIA

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June 27, 1990

Shibley Telhami
Subcommittee on Europe
and the Middle East
2187 Rayburn Building
U.S. House of Representatives
Washington, DC 20515

Dear Shibley,

Pursuant to our phone conversation of this morning, I am sending a proposed set of short-term actions the U.S. government can take toward easing the water crises in key regions of the Middle East, such as the Jordan River basin. These actions, in my opinion, are achievable without having to await settlement of the large, seemingly intractable, political issues.

The proposed actions are attached as (1) text for insertion into my statement of June 26 and (2) an addendum for distribution to members of the Subcommittee. You will see that the two differ only in the last sentence, which in the insertion text provides a lead-in for the last paragraph and in the addendum for Subcommittee members refers to my prepared text distributed on June 26.

I'm pleased that you are going to make copies of the addendum available to the Subcommittee members. If I can be of any further assistance, please let me know.

Sincerely,

[redacted]

Thomas Naff

House Committee on Foreign Affairs
Subcommittee on Europe and the Middle East

Addendum to Testimony, June 26, 1990

Thomas Naff
University of Pennsylvania

There are various short-term actions that Congress can take toward easing the water crisis in key parts of the Middle East, such as the Jordan River Basin. These actions are achievable and would have a salutary effect without having to await settlement of larger, recalcitrant political issues:

1) Provide technical expertise and appropriate water technology, especially in respect to return flow, extraction, and purification, as soon as possible.

2) Provide training, on site and in the U.S., on advanced techniques of conservation, irrigation, crop planning, and efficient water management.

3) Assist in the creation of local water research and training centers (such as the one at Jordan University) to encompass such programs as the use of effluents in agriculture, the development of marketable saline-tolerant crops, low-water-consumping crops, etc.

4) Encourage the investment of private capital in the infrastructure of Middle Eastern water establishments.

5) Support and encourage World Bank and United Nations agencies in their efforts to assist Middle Eastern nations with their water problems.

6) Consult with the European Community and Japan on devising joint efforts aimed at easing the most critical water problems in the region.

7) Use whatever influence the U.S. can to encourage the creation of basin-wide authorities for the management and allocation of water resources and discourage any of the region's riparians from using water as a political weapon.

8) In various ways, give official public acknowledgement of Congress's recognition of the urgency of water issues in the Middle East – for example, by having a report on the issue prepared and given wide dissemination and extensive media coverage.

9) In the various economic aid packages Congress makes available to Middle Eastern nations with water problems, earmark rigorously those funds that are to be spent exclusively on water-related projects.

10) All of these steps can be implemented through existing channels. However, as a means of highlighting its concern in the issue of water, Congress could devise special, high-visibility programs for some of these proposed actions. The best long-term means for dealing with these issues effectively would be to create an interagency group such as the one described in the final paragraph of my testimony of June 26, 1990.