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AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT PAPER FACESHEET

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3 COUNTRY ENTITY: Yemen Arab Republic

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7. PROJECT TITLE (Maximum 40 characters): Taiz Water and Sewerage Construction

8 ESTIMATED FY OF PROJECT COMPLETION: FY 81

9. ESTIMATED DATE OF OBLIGATION — A. INITIAL FY: 77; B. QUARTER: 4 (Enter 1, 2, 3, or 4); C. FINAL FY: [ ]

10 ESTIMATED COSTS ($000 OR EQUIVALENT $1 - 4.5 Rials

A. FUNDING SOURCE	FIRST FY B. FX	FIRST FY C. L/C	FIRST FY D. TOTAL	LIFE OF PROJECT E. FX	LIFE OF PROJECT F. L/C	LIFE OF PROJECT G. TOTAL
AID APPROPRIATED TOTAL	8,350	1,650	10,000	8,350	1,650	10,000
GRANT	(8,350)	(1,650)	(10,000)	(8,350)	(1,650)	(10,000)
LOAN	( )	( )	( )	( )	( )	( )
OTHER U.S. 1						
OTHER U.S. 2						
HOST COUNTRY YARG	6,392	39,020	45,412	6,392	39,020	45,412
OTHER DONOR(S) ADFAED	10,000	-	10,000	10,000	-	10,000
TOTALS	24,742	40,670	65,412	24,742	40,670	65,412

11. PROPOSED BUDGET APPROPRIATED FUNDS ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE C. GRANT	PRIMARY TECH. CODE D. LOAN	E. 1ST FY 77 F. GRANT	E. 1ST FY 77 G. LOAN	H. 2ND FY — I. GRANT	H. 2ND FY — J. LOAN	K. 3RD FY — L. GRANT	K. 3RD FY — M. LOAN
(1) Health	501	540		10,000					
(2)									
(3)									
(4)									
TOTALS									

A. APPROPRIATION	N. 4TH FY — O. GRANT	N. 4TH FY — P. LOAN	Q. 5TH FY — R. GRANT	Q. 5TH FY — S. LOAN	LIFE OF PROJECT T. GRANT	LIFE OF PROJECT U. LOAN
(1) Health					10,000	
(2)						
(3)						
(4)						
TOTALS						

12. IN-DEPTH EVALUATION SCHEDULED — MM 06 YY 82

13. DATA CHANGE INDICATOR. WERE CHANGES MADE IN THE PID FACESHEET DATA, BLOCKS 12, 13, 14, OR 15 OR IN PRP FACESHEET DATA BLOCK 12? IF YES, ATTACH CHANGED PID FACESHEET.

[1] 1 NO 2 YES

14. ORIGINATING OFFICE CLEARANCE

SIGNATURE

TITLE: Director, NE/CD

DATE SIGNED: MM DD YY

15. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION: MM DD YY

AID 1330-4 (3-78)

TABLE OF CONTENTS

ANNEXES

A. Statutory Checklist

B. Logical Framework

C. 611(e) Certification

D. KMWS Organization Chart

E. Training Program for Taiz Water and Sewerage System Staff

F. Taiz Water and Sewerage System Balance Sheet

G. Taiz Water and Sewerage System Pro Forma Balance Sheet

H. Taiz Water and Sewerage System Pro Forma Source and Use of Funds Statement

I. Taiz Water and Sewerage System Income Statements

J. Environmental Assessment

I. Summary and Recommendations

A. Grantee: Yemen Arab Republic Government (YARG)

B. Implementing Agency: National Water and Sewerage Authority (NWSA)

C. Proposed Amount of Grant: $10.0 million

D. Purpose of the Grant: To assist in financing the construction of a water and sewerage system which will provide adequate services to the population of Taiz, Yemen through 1990.

E. Description of the Project: The project consists of well field development, renovating and expanding an existing water system and constructing a new sewerage facility. Other inputs are procurement of materials and equipment, engineering supervision of the construction work and financing the training of NWSA's staff.

F. Other Donors: The Abu Dhabi Fund for Arab Economic Development (ADFAED)

G. Issues: None

H. Recommendation: Authorization of a grant in the amount of $10,000,000.

Project Committee

J. Paul Guedet,	Project Officer
Eugene Morris,	International Development Intern
James Cassanos,	Engineer
Joan Silver,	Social Analysis
Garber Davidson,	General Counsel
Edward Glaeser,	Desk Officer

II. Introduction

2.01 The Yemen Arab Republic (YAR), located in the southwest corner of the Arabian peninsula, is bordered on the north and northeast by Saudi Arabia, on the south and southeast by the People's Democratic Republic of Yemen and on the west by the Red Sea. There are three distinct geographical regions; the central highlands, the coastal plains and the eastern plateau which has a desert climate. The estimated population is about 6.5 million with an annual growth rate of approximately 2.2 percent. Most of the people are settled tribesmen who live in small towns and villages scattered throughout the central highlands and the coastal plains. Rural people are primarily engaged in raising livestock and farming. About 10 percent of the population is considered urban, residing primarily in the three main cities of Sana, Taiz and Hodeida. The YAR is one of the least-developed countries in the world with a per capita income of about $210 in 1975. This economic condition is partially caused by three major factors: (1) relatively isolated from the rest of the world until the mid 1960's; (2) dearth of natural resources; and (3) critical shortages of educational facilities, social infrastructure and trained people. The Government is taking measures to develop the agricultural sector, to build training institutions, introduce modern administrative practices and improve the living conditions in the cities and rural areas. Many of the cities and villages are without adequate potable water.

2.02 The country relies solely on groundwater for its water supply because of a lack of permanent sources of surface water. Some of the river beds have substantial water flows during the summer rains, but this source quickly disappears after the short rainy season. Most of the people in Yemen obtain their water supplies from shallow wells or from water vendors. In the main urban centers limited piped water is provided by local cooperative organizations and private water vendors. As a partial result of inadequate water, Yemen has one of the highest mortality rates in the world. One of the Government's objectives is to improve the quality and increase the quantity of water in an effort to curtail water-related disease in Taiz.

III. Project Background

A. History and Development

3.01 AID's initial assistance to the YAR was in the early 1960's when the Yemen Arab Republic Government (YARG) requested financial assistance to develop the first municipal water system in Taiz,

the second largest city in Yemen. AID financed the construction of a water system capable of supplying water to the population of Taiz, then estimated at 20,000 persons. In addition to building this system, AID financed technical training for Yemenis and established the National Public Water Supply and Sanitation Department. To commemorate AID's efforts the YARG renamed the water system the Kennedy Memorial Water System (KMWS). Until the early 1970's this system provided an adequate supply and quality of water to the inhabitants of Taiz. At that time, however, consumer demand started to exceed available water supply. Since then, water volume has declined and operational costs have grown. With the increasing demand being placed on the water system, water supplies have been substantially curtailed, water contamination occurs and the system operates only two hours per day. Water shortages are widespread and the water table for the existing wells is declining. Inadequate water supplies and contaminated water pipes have resulted in water rationing and increasing maintenance costs.

3.02 As a result of this situation the YARG requested AID to finance a major renovation and expansion of the existing water system. In response to this request, an AID financed contract with James M. Montgomery Consulting Engineers, Inc. was signed on April 17, 1974 to study the economic, financial and engineering feasibility of expanding the system. The contractor's final report (April 30, 1975) determined that sufficient well fields could be developed to increase the water supply for the city's population. Following AID's review of the Montgomery report, an AID loan of $1,350,000 and grant funds amounting to $100,000 were authorized to finance an engineering design and a socio-economic study. Hazen and Sawyer Engineers completed the preliminary engineering design report in June 1977 and Haskins and Sells consultants have submitted a draft socio-economic study which includes suggested water/sewerage user rates for the proposed water and sewerage system.

3.03 The proposed project is estimated to cost $65.4 million. AID has allocated $10 million to finance additional well field development, engineering construction supervision and procurement of materials and equipment. Other donors, such as the Abu Dhabi Fund for Arab Economic Development (ADFAED), have expressed an interest in financing most of the project. Final design plans should be completed in November 1977, followed by an estimated 33 month construction project to renovate and expand the water and sewerage system. The project, when finished, will supply approximately 11.5 million cubic meters of water annually and provide adequate water and sewerage facilities to the city of Taiz through 1990.

3.04 In addition to the proposed project, AID is providing technical assistance for other water-related projects in Yemen. Under the Sana Emergency Water Supply Project, $460,000 in technical assistance and commodities have been supplied to increase the volume of potable water. By the time this project is completed (FY 77) water will be supplied to 50,000 people. This system will continue to serve the city, delivering water via public fountains, pending completion of the final enlarged Sana system. Project 017 has financed $462,000 in services and commodities for the rehabilitation of the Kennedy Memorial Water System (KMWS). Finally, a grant totalling almost $1 million is intended to finance a proposed project commencing in FY 78 or FY 79 to design 15 secondary cities water systems to be constructed beginning in 1980. It is expected that these systems will be established in the more populous rural market centers (5,000-20,000 population) and will provide both water and sewerage.

B. Other Donor Involvement in the Water Sector

3.05 Several donors are providing assistance to the YARG's water and sewerage sector. The most important donors in terms of financial contributions and personnel are the IBRD and USAID. Other donors participating in this sector are the Arab Fund, the Abu Dhabi Fund for Arab Economic Development (ADFAED), the Saudi Arabian Government and the UNDP. Following is a summary of water projects presently being carried out in Yemen through the assistance of foreign donors.

International Development Association (IDA)

3.06 A credit of $6.25 million initiated construction of Sana's first public water supply system in 1974. An additional credit of $10 million will finance the design and construction of an enlarged water supply system for Sana, as well as construction of the first phase of a sewerage system. The water supply system will serve the Sana population up to the year 1985 while the sewerage plan will cover the city's needs up to the year 2000. Initially the sewerage system will serve 50% of the population, mostly the poorest element of the population living in the old city. For the remaining parts of the city the Government will build public conveniences and will take other appropriate measures. The project is designed to permit further expansions of its capacity as demand increases and additional funds become available. In addition to construction, elements of this project that will directly assist NWSA are 1) supply of sewer maintenance and laboratory equipment; 2) consulting services for project design and construction supervision; and 3) feasibility studies for water supply and sewerage in two medium sized cities, Ibb and Dhamar. The Sana project should be completed in October 1977.

3.07 A credit of $8.1 million was approved in June 1975, for financing the construction of the water supply component in Hodeida. The project will provide water through house connections to 75% of the population in 1985 and provide safe, reliable supply through public taps to the remainder of the population. A sewerage component will provide for the collection and treatment of sewerage for those connected to the water supply system. Trunk water mains and the principal collector sewers will have hydraulic capacities which should be adequate to serve the population to the year 2000. Also included in the project are: purchase of maintenance equipment and vehicles; purchase of office equipment, furniture, calculators, drafting equipment; technical assistance for hiring and training personnel, management and administrative operations and engineering supervision.

Arab Fund

3.08 A proposed credit of $20.2 million will finance the construction of the sewerage works to complement the Hodeida water supply system. Estimated completion date is FY 1979. Also, a $17.1 million credit is intended to finance design, construction, engineering supervision and equipping of the enlarged Sana Water Supply System.

Saudi Arabian Government

3.09 Saudi Arabian Government proposes to finance the cost of Sana's sewerage connections as part of the overall $45 million IDA-AF loan in support of Sana second phase water-sewerage system. The Saudi Government's credit will be $14.5 million.

United Nations Development Program (UNDP)

3.10 UNDP will provide 36 man-months of training for civil engineers.

IV. Development Objectives

4.01 Although some change is taking place, YAR's economic structure continues to reflect its underdeveloped condition. Internal transport and communications still leave many parts of the country isolated from each other. Literacy rate is estimated at 15 percent of the population and most Government offices are not fully staffed with experienced personnel. Despite these constraints some progress has been made in setting up national institutions and introducing development planning. Recently, a Five Year Development Plan covering the period 1976/77 through 1980/81 was prepared.

Under the new plan, long-term develcpmental goals are: increase agricultural production to achieve self-sufficiency in food; expand transport and communications infrastructure to improve economic and social integration; support a modest industrialization program which includes water and sewerage projects; education and manpower development to improve professional skills and Government institution building. Besides these objectives, the Government will attempt to increase the average annual rate of GDP to 7.2 percent in real terms. Of the total planned outlay of YRs 7 billion ($1.6 million), 32 percent is allocated to housing, 31 percent to transport and communication, 14 percent to agricultural and 10 percent to industry, which includes water and sewerage projects.

V. Public Health

5.01 Unquantifiable man hours are lost and average productivity is low for laborers because of various illnesses, particularly gastrointenstinal sicknesses. Ninety percent of the population is reputed to suffer from worms and gastrointestinal diseases are widespread among all age groups. Diarrhea is virtually a continuous complaint of all of the population. There is general agreement among doctors that poor sanitation is the chief cause of disease in Taiz. Bilharzia and infectious hepatitis are common. Cholera epidemics have averaged one a year over the past five years. According to the United Nations Health Center, there were 265 recorded cases and 21 deaths in 1972 and in 1973 records indicate that 196 cases and 12 deaths occurred.

5.02 Among contagious water borne diseases, only typhoid has not presented a major problem. Substantial inoculation programs against polio and cholera have been carried out. There is, however, agreement among doctors that insufficient attention is given to preventive medicine. Local doctors believe that 70 percent of all diseases occurring frequently in Taiz are water-related.

VI. Water Supply and Sewerage

6.01 Water has always been a scarce commodity and has hindered development of both urban and rural areas. Yemenis have been forced to exercise great ingenuity in obtaining and conserving water. Average annual rainfall ranges from 7 to 25 inches in various parts of the country except for the desert area of the Tihama and in the eastern part of the country where rainfall is much lower. In some major areas, there are less than 30 days of rain per year. Consequently, there are no permanent sources of

surface water of any significance. The major rivers usually flow during the summer rains, but normally none have perennial water. Sites for storage of water are scarce. Thus, even in areas of relatively abundant rainfall, water must be obtained from underground sources by drilling wells to considerable depths and at substantial cost. In many parts of the country it is not uncommon for people to walk a mile to obtain water, or else purchase it from vendors at very high prices. There are only very limited hydrological data available for most of the country, but recent drilling experiences indicate that water supplies for most of the rural communities can be assured by drilling wells up to 1,000 feet deep.

6.02 In the cities of Yemen the need for water is acute. There are springs in and around Sana and Taiz, but they do not yield sufficient water to supply these cities. Modern city water systems were unknown in Yemen until the mid-1960's when the Kennedy Municipal Water System was completed in Taiz. At that time, no water systems existed in any of the other cities. Traditionally, urban populations have relied on unprotected wells or spring water delivered through open channels and, therefore, subject to contamination. While there are no health statistics, it is clear that at least some of the frequently observed cases of illness are caused by unclean water. Skin diseases are common, gastrointestinal diseases are widespread and diarrhea is a continuous complaint of most of the population of Taiz.

6.03 Taiz is the second largest city in the country, with a population estimated at 104,000 people It receives an average of 24 inches of rainfall annually, but for the five months from November to March, a total of only 2 inches of rain can be expected. There are no surface water supplies available during these periods. The traditional source of water for most of the population has been water from the springs at the base of Jebel Sabr mountain, south of Taiz, conveyed to the city by gravity in open canals and, therefore, not potable by the time it reaches Taiz. The first change occurred when the United States Government financed a system of pipes and public standpipes throughout the city in 1961, using the springs as a source of water and incorporating two existing storage tanks. While this represented a distinct improvement, there was still considerable inconvenience and sanitary hazard in transporting the water from the public faucets to the dwellings. From 1962 to 1965 AID financed the design and installation of a piped water system which was eventually designated the Kennedy Memorial Water System. At that time, the population of Taiz was between 20,000 and 25,000. The source

of supply consisted of four wells with a capacity of slightly over one million cubic gallons per day, plus three additional wells intended for future expansion of the system. The installation was completed in September 1965 at a cost of about $4.5 million.

6.04 Approximately 71 percent of the present population of Taiz is connected to the water mains of the Kennedy System. However, during the past several years water demand has exceeded supply. The water system has suffered from a lack of replacement parts, insufficient maintenance and the water capacity declined to a third of its design level. One of the first projects the Government asked AID to undertake when assistance to Yemen was resumed in 1973, was the rehabilitation of the Taiz water system. The services of a technician and commodities provided by AID in response to that request returned the system to its original design capacity by early 1974, i.e. service for a population of up to 20,000 with possibilities for expansion to serve up to 40,000 people. However, that ultimate capacity is substantially below minimal needs of the present population and grossly inadequate for a substantially larger city which may, assuming a growth of 9 percent per annum, reach 183,000 and 281,000 for the years 1985 and 1990 respectively. In the old city, many households now have to rely on either unsanitary public outlets supplied from springs, or water carriers who draw their supplies from those same contaminated public sources. Within the service area of the Kennedy System the increased demand forces intermittent interruption of service, resulting in contaminated matter filtering into the mains during period of lowered water pressure.

6.05 Since late 1967 a decreasing groundwater level in the original well field has caused production difficulties, even though the system has been enlarged by drilling new wells and connecting two other well fields in 1968/69. Despite these improvements, it has not been possible to keep pace with the growth in the demand for water. Water demand has increased because consumers are using greater quantities of water and the population is expanding. The water system now has to serve a larger area and pump water to higher elevations than was originally expected.

6.06 Presently, water is supplied to the city of Taiz from the Hougfa, Houban and Hongala well fields at the rate of 1.3 million cubic meters per year. To ensure that all customers receive some water, a system of rationing has been instituted, resulting in the transmission lines to various areas of the city being open for approximately two hours only each day. Breakdowns in the system are common because the plant is over extended. When

disruption to the water system occurs, parts of the city are without water for several days. Annual water production needs for the years 1985, 1990 and 1995 are estimated to be 6.0, 11.5 and 14.4 million cubic meters, respectively. Those quantities of water would serve about 90 percent of the city's population projected for those years. That service would be at a level of 80 to 90 liters/per capita/per day (lcpd) compared to a present estimated water usage of approximately 45 lcpd. Even the higher level is small compared to usage in Western countries, but water conservation has always been necessary in water-short Taiz.

6.07 There are few industrial water users and water-wasting domestic appliances are rarely used. The expansion of commercial and industrial installations requiring large quantities of water are discouraged. The chemical content and quality of water has been deteriorating rapidly since 1964. Total solids in 1974 were 1049 mg/l and are now 2150 mg/l with a nitrate concentration of 170 mg/l. The absence of an adequate sanitary sewer system in Taiz coupled with an insufficient water supply, which is fully pressurized only intermittently (approximately 2 hours/day), create a serious health hazard. It is worth mentioning that the present water supply system has to be frequently turned off in various areas of the city for the purpose of rationing water. When this occurs, negative pressures are created within the distribution system pipes. This in turn allows the entry of liquid wastes through pipeline leaks. The liquid waste originates from cesspools and from the surface where waste is discharged directly into the streets from abutting residences. Reports contain conclusive evidence that the present Taiz water system is inadequate and that the construction of additional and dependable sources of water supply should be initiated as soon as possible.

6.08 Although Taiz has the only wastewater collection system in the country, its effect on the city's sewage disposal problem is minimal. The system, 9 km long, has 263 connections and serves only about 3,800 people in a service area with a population of about 12,500. Ninety five percent of Taiz's houses are not connected to the sewerage system and the occupants of these houses discharge wastes directly onto streets or into cesspools. Raw sewage is collected by the existing system and discharged into natural drainage areas surrounding the city. This compounds the city's health problems and increases the incidence of diseases caused by raw untreated sewage and contaminated water lines.

6.09 While firm statistics are not available, various types of water-related diseases and cholera are reported to occur frequently, notably in areas near the river beds where raw sewage is discharged. Concrete pipe used in the sewerage system in manufactured locally and considered poor. Current practices for the installation of sewer pipe do not conform to acceptable construction standards. No attempt is made to insert mortar into pipe joints and no grade

or alignment control determined. Pipe is installed without proper trench bedding and trench backfill includes rocks of all sizes and is not compacted.

VII. National Water and Sewerage Authority

7.01 In November 1973 the Government established the National Water and Sewerage Authority (NWSA) to be responsible for planning and managing water supply and sewerage systems in urban centers. NWSA is an independent Government organization that has financial and managerial autonomy. It is managed by a seven member board consisting of the Minister of Public Works and Municipalities, the Deputy Minister of Public Works, the Deputy Minister of Treasury, the Director General of NWSA, the head of Municipal Affairs and two persons who represent the private sector. The board is responsible to the Government Council of Ministers whose approval is required for establishing or changing water and sewerage rates and other charges such as connection fees. Long-term debt incurred by NWSA from sources other than the Government must be approved by the Council of Ministers. The Director General of NWSA is responsible for managing NWSA and reports to the Council of Ministers. Presently, NWSA manages water and sewerage systems in Sana, Hodeida and Taiz. These operations are placing a strain on NWSA's staff. Recruitment of qualified personnel should be pursued and training programs are required for existing staff. AID's Water Systems Management project has been initiated to provide training to certain categories of NWSA's professional staff. The proposed project will undertake to train staff for the overall management and operations of the Taiz Water and Sewerage System.

VIII. Project Analysis

A. Project Description and Technical Analysis

8.01 The existing water and sewerage system supplies water to about 71 percent of the population, for an average of 2 hours per day and handles sewerage for only 3,800 households. This combined system is both inefficient to operate and costly to maintain. Under the proposed project this system would be renovated and expanded to provide 11.5 million cubic meters of water which would be sufficient to supply Taiz with potable water. By 1990, water lines will be connected to 90 percent of the households and 70 percent of the households will be connected to the sewerage facility. The expanded system should improve personal and environmental sanitary conditions in Taiz. This is based on the assumptions that the system will be adequately maintained and

operated, and that basic personal and household hygiene practices are followed. Ultimately, the project should assist in decreasing morbidity in the majority of the population and especially in vulnerable pre-school aged children. See Annex B for the project's logical framework summary of the sector goal, project purpose, inputs and outputs.

8.02 The majority of the construction work will be earth excavation and pipeline installation. This work will be difficult and expensive because of underground rock, steep terrain and narrow passageways through streets and along the water transmission line right-of-way. Other items to be incorporated into the project are pumping stations, secondary water distribution lines, sewerage collection pipes, treatment ponds, chlorination facilities and water tanks. When the project is completed, water from the well field will be pumped into a central storage tank near the field and at an elevation of approximately 1326 meters. From the control tank the water will flow a distance of 18 kilometers through 600mm (diameter) steel pipes to the main storage yard positioned at an elevation of 1275 meters in Taiz.

8.03 The water distribution system will consist of polyvinyl-chloride (PVC) and steel pipes varying from 150mm up to 500mm in diameter, totalling 20,540 meters of pipe. Most of the pipe, (12,340 meters) will be 300mm and 400mm diameter steel pipe. Five storage tanks with a total capacity of 24,270 cubic meters of water will be installed in the city. Small pumping booster stations will be in areas of the city where houses are at a higher elevation than the storage tanks. All pumping stations, except one standby facility, are designed to include a reserve pumping unit. To meet an increase in water demand after 1990, each station will be constructed to accommodate an additional pump to permit the system to increase capacity to about 40 million cubic meters of water.

8.04 Sewer lines are designed to accomodate the maximum flows of waste during peak periods. The minimum velocity and grade will prevent desposition of grit and organic material as well as control problems of hydrogen sulfides and acid generation. Generally, pipelines will be laid with sand or granular material for bedding. PVC pipes will be backfilled with sand or granular material to a minimum of 0.3 meter above the crown of the pipe. Manholes will be installed at the upstream end of sewers, at sewer junctions, at changes in horizontal and vertical alignment, at changes in sewer diameter and wherever required to comform with maximum spacing. Manholes will be constructed of reinforced concrete pipe or of concrete blocks. If a sewer line must be laid adjacent to a water main, then the two pipes will be placed in a manner that the sewer line would be at least 0.45 meter below the water main.

If such pipe separation is not possible, the sewer level will be constructed to water main standards for materials, joints, and water tightness.

8.05 Although the existing sewers are of poor quality because of the workmanship and low strength of the concrete, they should be adequate for another ten years. These sewers, with only a few exceptions, will be incorporated into the proposed system. Public toilets will be located throughout the city and connected to the sewer lines.

8.06 The consultants recommended collecting the waste, treating it through trickling filteration and afterwards utilizing the treated waste for irrigating specific crops and grazing land. An alternative solution, and favored by NWSA, is employing oxidation ponds instead of trickling filter plant. Capital and operating costs are lower for oxidation ponds. However, the method requires greater quantities of land than the trickling filter system and could be more expensive. NWSA has made the decision for oxidation ponds and indicated that they will obtain the land required for the oxidation treatment method. The cost that the Government will eventually pay for right-of-way and oxidation pond land is unknown at this time. However, the project paper includes an amount of $1,770,000 to cover land costs.

8.07 Initially, however, it was expected that 10 wells of an average depth of 215 feet could supply the city water needs to 1985. However, results from drilling over the past 6 months, now indicate that the El Haima aquifer is thinner and covers less area than previously reported. Consequently, an increase in exploration and test hole drilling has occurred, with a corresponding increase in costs. This exploration has established two sites which will produce sufficient water, but require an increase in wells from the original estimate of 10 to 21 production wells. In addition, the consultants have made further studies and located other areas for future well fields to serve the city after 1990. These other fields have an estimated potential of 13.7 million cubic meters of water per year. This source would provide the city's water requirements to the year 2000.

8.08 Additional funding is required to complete the El Haima well field. Originally, AID loan 01 provided $450,000 for this well field development and procurement of materials for developing 10 production wells. The need for 11 additional production wells (total of 21 production wells) requires an additional $1,000,000. The AID $10 million grant will provide $1.0 million to cover this funding requirement. Both NWSA and USAID accept the consultants

determination that additional production wells are required to ensure adequate water supplies for the proposed water system expansion. The drilling operation was started in late 1976 and is the responsibility of NWSA. This work is being carried out with a rotary (T-4 IngerSoll Rand) type rig. In October, 1977 NWSA will add another similar rig and one cable tool (Speed Star 71) rig. If these additional drilling rigs are not made available to the project, then costs will increase and well field development will not be completed by October, 1978.

8.09 The project's estimated costs are $65.4 million, which include escalation and contingency provisions through the construction period. Following are the itemized costs for the main components of the project.

	Local Costs	Foreign Costs	Total Costs
Water System	$ 6,176,860	$ 6,950,140	$13,127,000
Sewerage System	13,206,612	4,603,645	17,810,257
Remedial Work to existing Water System	200,000	800,000	1,000,000
Well Field Development	100,000	900,000	1,000,000
Contractor Mobilization	815,000	2,185,000	3,000,000
Land, Equipment and Vehicles	1,770,000	700,000	2,470,000
Construction Supervision	1,500,000	2,300,000	3,800,000
Training Program	50,000	150,000	200,000
Subtotal	23,818,472	18,588,785	42,407,257
Escalation for Inflation (25%)/year	13,154,141	3,903,645	17,057,786
	36,972,613	22,492,430	59,465,043
10% Contingency	3,697,261	2,249,243	5,946,504
	$40,669,874	$24,741,673	$65,411,547

8.10 The Hazen and Sawyer June 1977 Report, as approved by NWSA and USAID in July, 1977 contains the preliminary design and estimated costs of the proposed project. These cost estimates were reviewed and approved by NWSA and USAID. Based on the above, it is the judgement of USAID that the project design is technically sound, the proposed project cost estimate is reasonable and therefore the requirements of 611a of the Foreign Assistance Act of 1961 are satisfied.

B. Management, Training, Operations and Maintenance

8.11 Until , the management of the water system was supervised by a General Director who was appointed by and answerable to the central government. Financing of capital improvements was provided by the Taiz cooperative, a local government public works and development agency. Early in 1976 the system was taken over by NWSA, which has assumed financial and policy responsibility for this project. See Annex D for the KMWS organization chart. Currently the management staff consists of a few people who are responsible for all managerial cisions. There is an obvious shortage of qualified personnel and little chance that sufficient staff can be recruited because of the noncompetitive salaries paid by NWSA compared to the private sector. Because of this situation the management has had problems maintaining the system and carrying out the overall planning and management of the organization. As a result of a deterioration in management capability, the duties of the staff have been reduced to managing the operations of the system on a day-to-day basis, without incorporating long range planning and budgetary practices. Maintenance now consists mainly of repairs to failed facilities rather than preventive maintenance procedures. The shortage of spare parts and materials have been compounded because supplies have been kept to a minimum to conserve cash. Most items are not replaced until they have been fully depleted. An inventory control and ordering system does not exist.

8.12 The technical and financial divisions are the core of the organization. The major disadvantage of this arrangement is the excessive responsibility placed on the technical manager. Eight different sections are reporting to the technical manager, varying from operational functions to maintenance and drilling new wells. These eight sections could more appropriately be divided into three functional divisions, i.e. operations, maintenance and exploration. At the present, no single section receives sufficient technical and managerial attention to perform satisfactory at all times.

8.13 Under the proposed project, a major training program will be introduced to prepare newly recruited personnel as well as to train present employees to carry out their assignments more efficiently. The intent of the training program is to present practical course instruction to improve the professional capabilities of the staff. It is proposed that all of the technical, vocational and general accounting courses be conducted in country. Staff requiring advanced management training and specialized engineering skills would be trained abroad. This procedure would provide on the job training at minimal cost and avoid losing permanent staff to overseas training programs. Candidates for training will be selected by NWSA, with USAID concurrence, using the criteria established under the ongoing AID financed Water Systems Management Project for NWSA (AID project 028). It is estimated that this training will cost $200,000 and will cover the positions listed in Annex E.

8.14 Estimated operations and maintenance costs for the proposed project range from $2.7 million in 1981 to $4.0 million in 1990 when the system is projected to reach full capacity. These figures include an amount which represents 33 percent of NWSA's overhead office and operational expenses. Personnel salaries for the Taiz staff are estimated at $600,000 in 1981 and $716,000 in 1990. In addition to operating personnel, construction crews are included to install secondary water and sewer lines, connect water and sewer lines to houses and to carry out general maintenance operations.

8.15 Electrical power for the system will be purchased from the Yemen Government Electric Company at a rate of 0.6 Rials/KWH ($0.133/KWH). Chlorination of the water supply is the only expected use of chemicals. The cost of maintenance materials excludes labor cost and reflects the estimated cost of actual materials such as mechanical equipment, valves and replacement pipes. Labor cost is included in the personnel salary figure.

C. Social Analysis

8.16 The population of Taiz was 95,000 as of August 1975, and at the current estimated rate of growth is now approximately 104,000. Average household size is 5.8 persons, with 29 percent of households consisting of 8 or more persons. Approximately 30 percent of households live with significantly overcrowded conditions--a density of more than 2 persons per room.

8.17 The population of Taiz is a young one. Some 29 percent are under seven years of age--the general age group on which our health/nutrition programs are to be focused. The under-eighteen group currently comprises 58 percent of the population.

8.18 The survey consultants describe as "poor" any households with a monthly income of less than 500 Rials ($111). Some 31 percent of households in Taiz fall into this group. When per capita income is used as an indicator of living standard, some 37 percent of households appear as poor, having monthly per capita incomes of less than 100 Rials ($22). This is equivalent to an annual per capita income of less than $264.00.

8.19 There is a significant middle income group in Taiz; approximately 34 percent of households earn between 500-1000 Rials per month. The 31 percent who earn over 1000 Rials per month can be considered rich; however, only 5 percent have incomes in excess of 3000 Rials ($665) month; more than 40 percent of the "rich" group earn less than 1500 Rials ($330) month. The existence of a large middle and upper income group in Taiz means a wider base of support for the improved water/sewerage system, than if income distribution were less evenly distributed.

8.20 Household expenditures for all income groups are concentrated on food and drink, with qat and tobacco second. Households with a monthly income of less than 300 Rials estimated they spent 63 percent of this income on food and drink, and 10 percent on qat and tobacco; those in the 300-500 Rials/month income group spent 58 percent and 13 percent respectively. More well-to-do households with monthly incomes of 1500 Rials spent 53 percent on food and drink and 13 percent on qat and tobacco.

8.21 The death rate for children under 3 years of age is at least 64/1000 based on the Haskins and Sells consultants' survey. Extrapolation from this figure indicates infant mortality to be in the range of 130-150/1000. This is not substantially below the figure for Yemen as a whole which is 152/1000. The infant mortality rate for Taiz is significantly higher than the nationwide rates for a number of other LDC's e.g., Jordan (100), Tunisia (128), Pakistan (132), Philippines (78).

8.22 Without indepth study of family habits, it is difficult to know how and what infants and young children are fed, however, there is no visible indication of a malnutrition problem in Taiz. Given the contaminated state of the water and the sanitary environment described above, it is a reasonable hypothesis that these are major contributors to the poor health conditions in Taiz.

8.23 The difficulties of obtaining an adequate supply of water in Taiz are indicated by the number of sources on which households must depend. Each household averages 1.2 water sources. Some 25 percent of households connected to the KMWS and 38 percent relying on wells supplemented their supply from other source(s), including also: Jabel Sabir (spring system), water carriers, taps, surface water.

8.24 Average per capita household consumption of water in Taiz is 40 litres daily. This is about 7.2 cubic meters per month per family. For a poor family, per capita consumption averages about 35 litres daily, or about 6.3 cubic meters/month. Overall, some 50 percent of households obtained 5 cubic meters or less per month; some 80 percent obtained 10 cubic meters or less.

8.25 Average monthly expenditure for water is 18 Rials; 11 Rials for poor families. Poor families, however, pay 4 percent of income for water, whereas the average family pays only 2 percent. These expenditure figures are deflated by the substantial number of households which pay nothing for water (20 percent overall, 30 percent of the poor). The average amounts actually paid by households are at least several Rials per month higher, which is important to consider in estimating willingness and ability to pay for improved service.

8.26 For businesses, average monthly water consumption was 7.5 cubic meters--about the same as for households. The average monthly bill was 15-16 Rials; about 4 percent of average profits (400 Rials). Public mosque water taps provided for minimal demand consumers, and were not a significant source of supply for businesses.

8.27 In terms of the percentage of the population presently served by KMWS, and the equity considerations, the utility has thus far done an excellent job. Approximately 71 percent of households and 45 percent of businesses had been connected by August of 1976. Some 19 percent of the connected households are in the "poor" category. Put another way, 55 percent of the "poor" households are already connected to KMWS. (KMWS' achievements already exceed the WHO standard for LDC's in 1980; 60 percent connected, 40 percent served by public taps.) The improved system would strive to maintain at least this level of equity.

8.28 With respect to current sewerage service, this is much less available and equalized than water service. Approximately 28 percent of households and 23 percent of business surveyed are connected. Some 7 percent of poor households are connected, as opposed to 32 percent of non-poor households. The poor also had a significantly lower percentage of toilet facilities.

8.29 The service objectives for the new system are to extend water service by private connection to at least 90 percent of households and 70 percent of businesses by 1990, maintaining at least the same equity levels as have thus far been achieved. Tap water should be avialable to the remainder who wish to make use of this. In addition, 70 percent of households and 60 percent of

businesses should be connected to the improved sewerage system by 1990. Such service levels are required not only to meet the health objectives of Yemen, but to bring in the necessary revenues to the system.

8.30 The following sections discuss the feasibility of meeting these objectives from the standpoint of the citizens' willingness and ability to pay, and other constraints. This discussion reflects the tariff structure recommended by Haskins and Sells, and the assumptions and outcomes of their central analysis case as modified to reflect projected (rather than present) connection charges.

8.31 The use of the stepped tariff (3 Rials/cubic meter for the first 10 cubic meters, 6 Rials/cubic meter thereafter, of which 3 Rials/cubic meter will defray sewerage costs), is based on several principles: to create a progressive rate structure which enables poor families and small businesses in particular to obtain sufficient water for good health; to encourage all citizens to conserve water above the level required for good health; to assure that users of large quantities of water (who will also be the more affluent) contribute to the sewerage service in proportion; and to combine the costs of sewerage within the water tariff to the extent possible, given the population's greater appreciation of the need for water than sewerage.

8.32 Based on survey results defining income levels and attitudes, it appears reasonable to expect that the required service levels for water can be achieved, if not exceeded, including a continued high level of participation by poor families. Some 53 percent of poor households (and 84 percent of all households) have monthly incomes in excess of 300 Rials. In per capita terms, 58 percent of poor families (and 89 percent of the total population of Taiz) have per capita incomes in excess of 50 Rials per month. For a family of 6 this means 300 Rials per month household income. Such a family can obtain 10 cubic meters per month (56 lpcd) for 30 Rials, or 10 percent of income. This would represent a doubling of present monthly bills, but should nonetheless be within reach of most of those families earning at least 300 Rials per month.

8.33 Based on world-wide experience, 56 lpcd is an adequate allowance, particularly for households without water-borne sewerage; with sewerage, estimated daily use would be at least 80 lpcd.

8.34 With respect to businesses, 44 percent of those interviewed earned profits of at least 300 Rials per month, which should put water service within their reach in the same way as for households at this income level. The project target is, however, to

obtain a 70 percent connection level for businesses; given that 80 percent of businesses employ less than 3 persons, and a large number of these small businesses may continue to consume less than 10 cubic meters per month, it is possible that the target can nonetheless be achieved, e.g., 61 percent of businesses have profits in excess of 200 Rials per month--at the projected rate, they could obtain 7 cubic meters per month for 21 Rials.

8.35 For poor families and many businesses not already connected, the projected connection cost of 600 Rials would, however, be a major deterrent. The tariff consultants indicate that a program of (a) subsidized connections, and (b) deferred payments must therefore be made part of the utility's program if the desired number of connections is to be achieved.

8.36 Eligibility criteria for a subsidy and/or deferred payment plan would involve a combination of factors such as household income, size of household, and wealth. Poor families, approximately 500 Rials ($111) or less per month would receive free connections. Middle class families could arrange to pay connection costs on a deferred basis, but without any subsidy. While some families might need to reserve their water use while paying connection costs over a proposed two-year period, a sufficient proportion of the overall population, and of the poor in particular should find it possible to connect to the system under the plan proposed by the tariff consultants.

8.37 One possible deterrent to new connections, outside of the projected cost, is the reluctance of families in rented dwellings to connect. Nearly 60 percent of those not planning to connect to the improved system indicated this was their landlord's responsibility. (Currently the rate of connections is nearly 1/3 lower for rented dwellings.) This problem will be much more significant for sewerage, in that such a substantial portion of the city is not yet connected; recommendations for dealing with the problem are discussed at the end of the following section on sewerage service. Businesses would also be eligible for subsidies and deferral of connection costs, though a somewhat diffierent set of eligibility criteria will need to be refined, e.g., different income breakpoints, type of business, number of persons living on premises. In addition to the program of subsidies and deferred payments, the tariff consultants have recommended that shared water connections be permitted in order to reduce connection costs to consumers.

8.38 The proposed project targets for sewerage service, 70 percent of households and 60 percent of businesses by 1990, are lower than those for water. These targets, given the cost and health implications of the sewerage program, will predominantly

connect the large and more affluent water users who would most contaminate the environment. It is desirable, however, to connect poor families - particularly large ones - wherever possible. Despite these lower targets, the outlook for achieving them is less optimistic than for water service both because of the additional cost burden sewerage imposes and consumers' limited perception of the need for sewerage.

8.39 Assuming average daily water consumption of 83 litres per capita for sewered households, the monthly sewer charge of 20 Rials would raise the bill for an average family of 6 persons to 75.6 Rials. The survey showed that some 50 percent of households had monthly incomes in excess of 750 Rials, and 63 percent of households had per capita incomes in excess of 100 Rials (600 Rials per month for an average size family). Using 10 percent of income as a reasonable expectation of what households can afford to pay for water and sewerage, we estimate that 55 percent of households could support combined water and sewer service at the average level of water consumption.

8.40 The added cost of connection, 660 Rials will, however, be a significant deterrent. Even spread over 2 years, the monthly cost would be 30 Rials. Thus, a typical combined monthly bill could range from 80 Rials (if water consumption were limited to 10 cubic meters per month), to 105.6 Rials with average water consumption. It is questionable whether more than 40-45 percent of households could be expected to handle charges at these levels. It appears that connection subsidies would need to be extended into the middle income groups. Even with a 1/3 subsidy, it appears optimistic to expect more than 50 percent of households to afford sewerage connections. (An even smaller number could afford to get a water and sewerage connection at the same time; most families would probably defer sewerage if they could not make a lump sum payment for the water connection.)

8.41 If the target of 70 percent of households connected to sewer service by 1990 is to be achieved, it appears that the government should also subsidize sewer connections for families earning a monthly income of less than 500 Rials ($111). Middle income families should be allowed a longer payment period for deferred charges.

8.42 The same problems of cost versus income, perceived need, and deferral of responsibility to landlords as apply to households, also apply to businesses connecting to sewerage in Taiz. Similarly, the same concern and solutions apply to achieving the target level of connections.

8.43 Even if the cost of sewerage service and connections can be brought within reach of the desired portion of households and businesses in Taiz, there are two reasons to be further concerned

about achieving the targeted service level. One is that the tariff consultants indicate that the demand for sewerage is less than for water, (although the limited experience with sewerage in Taiz makes it difficult to project this). They suggest that an educational program, e.g., radio spots, school lectures, inserts with water bills, briefings during hospital/maternity vists, etc. may be necessary to raise public consciousness. An additional and marked problem is the degree to which households and businesses not connected to the sewer system deferred responsibility for doing so to their landlord. Some 28 percent of households not presently connected so deferred; almost 50 percent more than the number of households than were unwilling to connect for all other reasons combined. Thus, as in the case of water connections, a policy must be developed which identified the respective responsibilities of landlords and tenants.

8.44 The citizens of Taiz appear willing and able to fully support the improved water system, but it is questionable whether they can and will support the sewerage system to the extent required under current assumptions concerning its costs. The government must, therefore, be prepared to provide subsidies for household water and sewerage connections.

D. Financial Analysis and Plan

8.45 Presently the Taiz water system services 71 percent of the households with direct connections, charges a standard rate of 2 Rials ($.44)/cubic meter of water for households and 3 Rials ($.67) for industrial consumers. Customers are billed monthly. Water services are disconnected for customers in arrears three months or more; approximately 3 percent of customers are in this category. Reconnection charges are 10 Rials ($2.22) and over due debts must be paid in full. Initial connection fees total 300 Rials ($66.67).

8.46 The objectives of the proposed system are to connect 90 percent of households and 70 percent of businesses to the water system and 70 percent of households and 60 percent of businesses to the sewerage facilities by 1990. These objectives are established in an attempt to provide water and sewerage services to the greatest number of households and businesses in order to improve the overall living conditions, decrease the incidence of water-related diseases, and operate a viable system.

8.47 Haskins and Sells, water/sewerage tariff consultants, have recommended a progressive water rate of 3 Rials ($.67) per cubic meter for water consumption up to 10 cubic meters of water per month per family and small businesses, and 6 Rials ($1.33)

per cubic meter for all water consumption exceeding 10 cubic meters per month. Studies indicate that a family of six requires 10 cubic meters of water per month for minimal needs. Industrial users would be charged a constant rate of 6 Rials ($1.33) per cubic meter of water. Sewerage rates would be a flat rate of 20 Rials ($4.45) per month for each household and 30 Rials ($6.67) for businesses. A one time connection cost of 600 Rials ($133) and 660 Rials ($147) for water and sewerage respectively would be assessed for each household and business.

8.48 Since this water connection charge is double the existing rate, it is recommended that the Government subsidize this connection cost by paying the 600 Rials water connection and the 660 Rials sewerage connection for the poorest element of Taiz. This group is defined as all households earning less than 500 Rials ($111) per month, which represents approximately 31 percent of the population. Without this subsidy the poorest element of the population could not afford the connection fee and therefore would be deprived of water and sewerage services. Also, if this group did not participate, then the volume of water sold would be insufficient to amortize the project's cost over 20 years because of the high fixed costs. To reach the water and sewerage connection targets previously mentioned and to realize the benefits which would occur through improving public health and the living conditions of the inhabitants of Taiz, an amount of about $285,000 per annum is required as a Government subsidy to cover the cost of water and sewerage connections for the poorest families in Taiz. The remaining portion of water and sewerage customers would pay the full connection rate of 600 Rials for water and 660 Rials for sewerage, totalling 1260 Rials ($280). Customers would be allowed to repay this cost over 24 months at 52.50 Rials ($11.67) per month.

8.49 Currently, KMWS is not generating sufficient revenues from water sales to cover operating and maintenance costs. This, however, changes in 1978 when remedial construction work is completed on the original system. By 1979, income before depreciation and interest is positive. As the proposed system becomes operational, revenues will grow at a faster rate than operating expenses. However, from 1981 through 1985, net income will show declining annual deficits ranging from $2.5 million to $400,000. If depreciation expense, a non-cash item, is not included and only actual cash deficits are considered, then the deficits are $850,000 and $300,000 in 1981 and 1982 respectively. In 1986 the system is profitable after taking into account all expenses.

8.50 The sizable deficits incurred in the early years of the operation are attributable to high fixed costs and the system

operating at 31 percent to 65 percent capacity. Water and sewerage systems are characterized by large investments in fixed assets which generate high fixed costs. Therefore, profitability depends on the rate at which new customers can be added to the system and the additional volume of water purchased by existing consumers. The breakeven point for the system is approximately 6.1 million cubic meters of water. This assumes a debt/equity structure of 60/40 consisting of 20 year debt, 5 year grace period and at 4 percent interest.

8.51 Initially the Government will have to supply short-term working capital and increase it's equity participation to cover the early years of operation. The system would maintain a safer financial position during these years if lenders would allow the capitalization of interest charges for the first five years. This would permit a positive cash flow in the second year of operations.

8.52 As a measure of financial viability, return to average net fixed assets has been calculated. This indicator describes the profitability and productivity of assets. The rate base is determined by averaging the net fixed assets of two consecutive years. The income used in calculating the return does not include interest since we are interested in the true productivity of assets, regardless of the method of financing. The rate of return is negative the first two years, becomes positive in 1983 (0.6 percent) and grows to 10 percent by 1990, a very respectable return for a public utility. Also, by 1990 the accumulated deficit in retained earnings will be eliminated. This implies that no further government support will be needed and in fact, it will be possible for the Taiz Water and Sewerage System to pay a dividend to the Government. See Annexes F through I.

8.53 Following is the financial plan for the proposed project, with all figures shown in thousands of dollars.

	Local Costs	Foreign Costs	Total Costs
AID	$ 1,650	$ 8,350	$10,000
ADFAED	-	10,000	10,000
YARG & Other Donors	39,020	6,392	45,412
	$40,670	$24,742	$65,412

E. Economic Analysis

8.54 The most readily quantifiable benefits accruing to society from the project are measured by incremental revenue. These revenues include income from water sales, sewerage service charges, and connection fees for both water and sewerage lines. Incremental operation and maintenance expenses and annual compensation paid to farmers (who depend on water in the immediate area of the well field for irrigation purposes) are deducted to arrive at net benefits. Finally, the cost of the total system, which includes engineering design, construction and engineering supervision contracts, and well field development, is included as a net cost to the project.

8.55 Using the above data, the Economic Internal Rate of Return (IRR) for the project is 4.3 percent. Changes in capital costs do not greatly affect this return; a sensitivity analysis reveals that a 20 percent increase in construction costs lowers the expected IRR to 3.6 percent. The IRR, however, is more sensitive to changes in water sales (determined by changes in price and/or demand). No sensitivity analyses were performed on these measures since the tariff being proposed is based on the research of Haskins and Sells consultants and is recommended by them as the most reasonable price to recover costs and also provide water and sewerage services on an equitable, affordable basis.

8.56 The above analysis relies on revenues as a measure of gross quantifiable benefits from the project. However, what a consumer actually pays for a good or service and what it is worth in terms of utility provided are often not the same. Water and sewerage services will be provided under a schedule of prices designed to recoup the cost of production and to provide a necessary service to the community. Some consumers would be willing to pay a higher price for the identical service and therefore, this consumer saving should be interpreted as a project-related benefit. The total difference between what consumers pay and what they would be willing to pay is termed "consumer surplus". The value of this surplus should be added to incremental net income in order to fairly depict economic benefits. No attempt has been made to quantify the consumer surplus for this project, but general economic practices suggest that these benefits do exist and that the IRR would be substantially higher if these benefits are included.

8.57 Finally, there are important unquantifiable benefits that will result from the improved environment of Taiz and the improvement in individual health and vitality. Such indirect benefits include reductions in certain water-related diseases with a corresponding reduction in medical expenses, fewer work-days lost

through sickness, and increases in worker's productivity. Additionally, a more efficient home economy will be possible due to cleaner, more abundant, and more reliable water supplies. A potable water supply and sewerage system may reduce the probability of certain types of epidemics and contribute to a longer life expectancy of the inhabitants of Taiz. Economic externalities such as cleaner streets, elimination of unpleasant odors normally associated with untreated waste, and a general overall improvement in the immediate environment will be realized.

8.58 In summary, while the Internal Rate of Return is satisfactory for a project of this nature, quantification of consumers' surplus and health benefits would yield a much higher return. In the case of Taiz these unquantifiable benefits are very important and there is no real alternative to providing water and sewerage services. Most cities have determined that such systems are essential for a safe, healthy environment and that total benefits exceed total costs.

F. Environmental Assessment

8.59 The major impact of the project is beneficial since the proposed water supply and sewerage systems will improve the public health and well-being of Taiz residents as a result of making additional water available for drinking and personal cleanliness, reducing nitrate and coliform levels in the water supplied and by removing and treating liquid wastes. Negative impacts of a short-term nature during construction will be minimized by precautions to be taken by the contractor. Long-term negative impacts, resulting from withdrawal, for a higher use (potable water supply), of water presently used for irrigation and from land acquisition for lagoons will be mitigated by compensation from the government or making agricultural land available at alternative sites. Thus, the overall impact of the project will be beneficial and no significant adverse effects on the environment will occur. The Environmental Assessment of the project is presented in Annex J.

IX. Project Implementation

A. Implementation Plan

9.01 The consultant, with NWSA's approval, will start contractor pre-qualification procedures in October, 1977, using international construction contractors pre-qualification procedures. It is planned that pre-qualification advertisement will be done in the U.S.A. (Commerce Business Daily), Europe and in countries in the Near East. The responses from the advertisements should provide an indication of bidding interest from international contractors.

9.02 It is expected that the regulations regarding construction services will be based on Standard International Tendering format as contained in the International Rules for Construction Services and presently being used on the active IBRD funded projects in Yemen. In cases where constructing contracting regulations differ from AID regulations it is intended to waive, wherever possible, AID regulations for purposes of realizing timely implementation of the project and coordination with the other donors. This procedure is suggested since AID will provide only about $5 million of the total project's construction cost. This $5 million will be used to purchase U.S. equipment which will be incorporated into the project. This material will be purchased in the U.S.; it will be the responsibility of the contractor or the consulting engineer firm to purchase and arrange delivery to the site. Materials purchased will receive standard inspections and approvals prior to shipment to Yemen. Payment for materials, procurement services, inspection services and shipping insurance will be covered under a letter of credit arrangement made available to the contractor or the consulting engineering firm. Bidding documents will specifically outline these procedures for procurement and payment of the equipment.

9.03 Part of the AID grant for this project includes funds for engineering construction supervision to be carried out during the construction phase of the project. It is intended that these services will be provided by the existing consultant, Hazen and Sawyer, under the option provided in the present design contract between Hazen and Sawyer and NWSA. These servicies will include project inspection responsibilities during the construction period and on the job training of NWSA personnel as designated in the scope of services for the consultant. These services are estimated to cost $3.8 million and will be implemented by a contract between Hazen and Sawyer and NWSA conforming to AID Handbook 11, Regulations for Country Contracting.

9.04 Following is a suggested project schedule for the construction phase of the project.

1.	Prequalification of Contractors	Oct. 1977
2.	Design Completed	Nov. 1977
3.	Design Approved by NWSA and AID	Jan. 1978
4.	Prequalification of Contractors Completed	Jan. 1978
5.	IFB available to prequalified Contractors	March 1, 1978
6.	Site Visit for Contractors	April, 1978
7.	End of Bidding Period	May 15, 1978
8.	Bid Evaluation Completed	June 15, 1978
9.	Negotiate Engineering Supervision Contract	July, 1978
10.	Award of Construction Contract and Notice to Proceed	July 15, 1978
11.	Open Letter Credit and Contractor Mobilization Commences	Aug. 15, 1978
12.	Estimated Construction Completed	May, 1981

B. Evaluation Plan

9.05 The overall project evaluation will take place one year after completion of the project and will measure the progress of NWSA in operating and maintaining the water and sewerage system. Additionally, the evaluation team will ascertain if the proposed water/sewerage tariff is adequate to cover fixed and variable costs of the system and will also determine the number of low-income families who are benefitting from the system. The evaluation team should examine the quality of construction of the project and compare the actual cost of building the system with the estimated itemized costs presented by the design engineers in June 1977.

C. Conditions and Covenants

9.06 In addition to the standard conditions precedent to disbursement of funds the following conditions will be included in the grant agreement:

(1) NWSA will provide a complete set of plans and specifications, bid documents, cost estimates and construction schedule for carrying out the project.

(2) AID must review and approve the contracts for construction services and supervisory engineering services for the project.

(3) NWSA will submit to AID a reasonable water and sewerage tariff schedule for the project.

(4) The YARG and NWSA will ensure that other donors and/or YARG have committed sufficient funds to cover the difference between AID's grant and the total financing necessary to complete the project.

For 279-0028 Water Supply Systems Management
YEMEN

6C(1) - COUNTRY CHECKLIST

Listed below are, first, statutory criteria applicable generally to FAA funds, and then criteria applicable to individual fund sources: Development Assistance and Security Supporting Assistance funds.

A. GENERAL CRITERIA FOR COUNTRY

1. FAA Sec. 116. Can it be demonstrated that contemplated assistance will directly benefit the needy? If not, has the Department of State determined that this government has engaged in consistent pattern of gross violations of internationally recognized human rights?	Yes. When the Taiz Water and Sewerage system is complete, NWSA will be able to provide more water and sewerage facilities for the needy. The increased efficiency of the system will make it possible to provide potable water to the poor on a more reliable basis. As potable water is provided, the incidence of water-borne disease among the poor in Taiz will decrease.
2. FAA Sec. 481. Has it been determined that the government of recipient country has failed to take adequate steps to prevent narcotics drugs and other controlled substances (as defined by the Comprehensive Drug Abuse Prevention and Control Act of 1970) produced or processed, in whole or in part, in such country, or transported through such country, from being sold illegally within the jurisdiction of such country to U.S. Government personnel or their dependents, or from entering the U.S. unlawfully?	No.
3. FAA Sec. 620(a). Does recipient country furnish assistance to Cuba or fail to take appropriate steps to prevent ships or aircraft under its flag from carrying cargoes to or from Cuba?	We are not aware of any YARG non-compliance with this section.

4.	FAA Sec. 620(b). If assistance is to a government, has the Secretary of State determined that it is not controlled by the international Communist movement?	The Secretary of State has determined that Yemen is not controlled by the international communist movement.
5.	FAA Sec. 620(c). If assistance government, is the government liable as debtor or unconditional guarantor on any debt to a U.S. citizen for goods or services furnished or ordered where (a) such citizen has exhausted available legal remedies and (b) debt is not denied or contested by such government?	Yemen is not known to be in violation of the requirements of this section. Claims arising from A.I.D.'s departure from Yemen in 1967 were settled with the YARG when A.I.D. re-established its Mission in 1973.
6.	FAA Sec. 620(e) (1). If assistance is to a government, has it (including government agencies or subdivisions) taken any action which has the effect of nationalizing, expropriating, or otherwise seizing ownership or control of property of U.S. citizens or entities beneficially owned by them without taking steps to discharge its obligations toward such citizens or entities?	Yemen is not known to be in violation of the requirements of this section.
7.	FAA Sec. 620(f); App. Sec. 108. Is recipient country a Communist country? Will assistance be provided to the Democratic Republic of Vietnam (North Vietnam), South Vietnam, Cambodia or Laos?	No.
8.	FAA Sec. 620(i). Is recipient country in any way involved in (a) subversion of, or military aggression against, the United States or any country receiving U.S. assistance, or (b) the planning of such subversion or aggression?	(a) No. (b) No.

9.	FAA Sec. 620(j). Has the country permitted, or failed to take adequate measures to prevent, the damage or destruction, by mob action, of U.S. property?	While a certain amount of damage occurred to U.S. property by mob action at the time of our severing diplomatic relations with Yemen in 1967, the USG's decision to resume diplomatic relations with YARG and re-establish an AID program there represents a decision on our part to look beyond the turbulent days of 1967 when Yemen was in a state of internal chaos. Furthermore, although specific action was not taken by either side with respect to the damage that occurred, the matter has been discussed at length by YARG and U.S. officials.
10.	FAA Sec. 620(l). If the country has failed to institute the investment guaranty program for the specific risks of expropriation, inconvertibility or confiscation, has the AID Administrator within the past year considered denying assistance to such government for this reason?	An investment quaranty agreement has been concluded with YARG covering specific risks of expropriation, inconvertibility and confiscation.
11.	FAA Sec. 620(o); Fishermen's Protective Act, Sec. 5. If country has seized, or imposed any penalty or sanction against, any U.S. fishing activities in international waters, a. has any deduction required by Fishermen's Protective Act been made? b. has complete denial of assistance been considered by AID Administrator?	Yemen has not done so.

16. FAA Sec. 620A. Has the country granted sanctuary from prosecution to any individual or group which has committed an act of international terrorism?	No.
17. FAA Sec. 666. Does the country object, on basis of race, religion, national origin or sex, to the presence of any officer or employee of the U.S. there to carry out economic development program under FAA?	A.I.D. has no knowledge of any such objection.
18. FAA Sec. 669. Has the country delivered or received nuclear reprocessing or enrichment equipment, materials or technology, without specified arrangements on safeguards, etc.?	No.
19. FAA Sec. 901. Has the country denied its citizens the right or opportunity to emigrate?	No.

B. FUNDING CRITERIA FOR COUNTRY

1. Development Assistance Country Criteria

a. FAA Sec. 102(c), (d). Have criteria been established, and taken into account, to assess commitment and progress of country in effectively involving the poor in development, on such indexes,as: (1) small-farm labor intensive agriculture, (2) reduced infant mortality, (3) population growth, (4) equality of income distribution, and (5) unemployment.	a. The YARG's initial Three-Year Plan (1974-1976) calls for programs that directly affect the role of poor people in the development process. Expenditures in the health sector account for 20% of the total expenditures while education and agriculture account for 20% and 15% respectively. This project will have an important impact on infant mortality. As the water and sewerage system in Taiz is upgraded and expanded and the incidence of waterborne disease is reduced, there will be an improvement in the general health (and indirectly economic) situation in that city.

b. FAA Sec. 201(b)(5), (7) & (8); Sec. 208; 211(a)(4), (7). Describe extent to which country is:

(1) Making appropriate efforts to increase food production and improve means for food storage and distribution.	(1) Increased food production is a high priority goal of the Government of Yemen. The YARG's first three-year plan places high priority on agriculture with an emphasis on the following: improvement of agricultural sector income; the growth of agricultural diversification in order to enhance national nutritional levels; and the improvement of Yemen's foreign exchange position (especially the reduction of food imports). USAID and other donor assistance projects to Yemen's agriculture sector support one or more of these objectives and there are a large number of such projects either completed or on-going.
(2) Creating a favorable climate for foreign and domestic private enterprise and investment.	(2) The YARG's official policy is to welcome foreign private investment and enterprise and to encourage domestic private enterprise and investment. There currently exists in Yemen liberal legislation favoring private, including foreign private, investment.
(3) Increasing the public's role in the development process.	(3) The YARG is continually seeking to increase public participation in development. For example, 65 local development boards have been established to promote nation building in a self-help context. Activities include road building, schools, hospitals, agriculture, water development, etc. Financial support is provided to the Boards by allocating to them one-half of the Muslim tax, one-fourth of municipal income, road customs and goods, and donations from welfare and charitable organizations.

(4)(a) Allocating available budgetary resources to development.	(4)(a) The majority of Yemen's budgetary resources, including foreign assistance contributions, are presently committed to social and economic development.
(b) Diverting such resources for unnecessary military expenditure and intervention in affairs of other free and independent nations.	(4)(b) Yemen's military expenditures are limited to internal security and defense. These expenses account for approximately 46% of current budget expenditures, with a further 11% for so-called extra budgetary expenses (loyalty payments and relief payments arising out of the civil war of the 1960's). These percentages are somewhat misleading, however, as an index of the attention given to development, because the budget represents mostly current administrative costs. Development programs, which are for the most part foreign financed, are not included. There are no meaningful summaries, as yet, of total government expenditures which can be used as a measure of the impact of development.
(5) Making economic, social, and political reforms such as tax collection improvements and changes in land tenure arrangements, and making progress toward respect for the rule of law, freedom of expression and of the press, and recognizing the importance of individual freedom, initiative, and private enterprise.	(5) Since the establishment of the present Republican Government in 1970 there have been efforts directed by the government at making economic, social and political reforms, including the passage of liberal legislation favoring private investment.
(6) Otherwise responding to the vital economic, political, and social concerns of its people, and demonstrating a clear determination to take effective self-help measures.	(6) The YARG is devoting a part of its national budget to the vital development needs of the country's people. In recent years, the YARG has undertaken an expensive development program with the assistance of numerous foreign donors including the United States. See also item 2.A.(3) above.

c. FAA Sec. 201(b), 211(a). Is the country among the 20 countries in which development assistance loans may be made in this fiscal year, or among the 40 in which development assistance grants (other than for self-help projects) may be made? — Yes.

d. FAA Sec. 115. Will country be furnished, in same fiscal year, either security supporting assistance, or Middle East peace funds? If so, is assistance for population programs, humanitarian aid through international organizations, or regional programs? — No.

2. Security Supporting Assistance Country Criteria — N/A

a. FAA Sec. 502B. Has the country engaged in a consistent pattern of gross violations of internation ally recognized human rights? Is program in accordance with policy of this Section?

b. FAA Sec. 531. Is the Assistance to be furnished to a friendly country, organization, or body eligible to receive assistance?

c. FAA Sec. 609. If commodities are to be granted so that sale proceeds will accrue to the recipient country, have Special Account (counterpart) arrangements been made?

6C(2) - PROJECT CHECKLIST

Listed below are, first, statutory criteria applicable generally to projects with FAA funds, and then project criteria applicable to individual fund sources: Development Assistance (with a sub-category for criteria applicable only to loans); and Security Supporting Assistance funds.

CROSS REFERENCES: IS COUNTRY CHECKLIST UP TO DATE? IDENTIFY. HAS STANDARD ITEM CHECKLIST BEEN REVIEWED FOR THIS PROJECT?

A. GENERAL CRITERIA FOR PROJECT.

1.	App. Unnumbered; FAA Sec. 653(b) (a) Describe how Committees on Appropriations of Senate and House have been or will be notified concerning the project; (b) is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than $1 million over that figure plus 10%)?	(a) Project description and cost data for a loan to YAR were presented in the FY 77 Congressional Presentation. (b) All necessary additional notification has been made, including the change of project from a loan to a grant.
2.	FAA Sec. 611(a)(1). Prior to obligation in excess of $100,000 will there be (a) engineering, financial, and other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?	Yes.
3.	FAA Sec. 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?	No additional legislative action is required.

4.	FAA Sec. 611(b); App. Sec. 101. If for water or water-related land resource construction, has project met the standards and criteria as per Memorandum of the President dated Sept. 5, 1973 (replaces Memorandum of May 15 1962; see Fed. Register, Vol 38, No. 174, Part III, Sept. 10, 1973)?	Yes. A full statement of compliance appears in the Project Paper, p.24.
5.	FAA Sec. 611(e). If project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed $1 million, has Mission Director certified the country's capability effectively to maintain and utilize the project?	Yes.
6.	FAA Sec. 209, 619. Is project susceptible of execution as part of regional or multilateral project? If so why is project not so executed? Information and conclusion whether assistance will encourage regional development programs. If assistance is for newly independent country, is it furnished through multilateral organizations or plans to the maximum extent appropriate?	Project is part of multilateral efforts to develop the NWSA and Yemen's water systems. A.I.D. and other donors are all contributing to this project in a complementary fashion.
7.	FAA Sec. 601(a); (and Sec. 201(f) for development loans). Information and conclusions whether project will encourage efforts of the country to (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions.	The construction component of this project will be procured on a competitive basis and a substantial amount of the equipment and materials necessary will be purchased in the U.S. To this extent, the project will foster private initiative and competition, the flow of international trade, and will discourage monopolistic practices. Indirectly, the project may improve the technical efficiency of industry, agriculture and commerce and strengthen free labor unions.

8.	FAA Sec. 601(b). Information and conclusion on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).	The engineering and construction services components of this project will utilize private U.S. firms; private U.S. flag carriers will be involving U.S. financed goods.
9.	FAA Sec. 612(b); Sec. 636(h). Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized to meet the cost of contractual and other services.	The YARG is contributing to the local currency costs by providing land and other resources.
10.	FAA Sec. 612(d). Does the U.S. own excess foreign currency and, if so, what arrangements have been made for its release?	The U.S. does not own excess currency of Yemen which could be used for this project.

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria

a.	FAA Sec. 102(c); Sec. 111; Sec. 281a. Extent to which activity will (a) effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive production, spreading investment out from cities to small towns and rural areas; and (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions?	a. By providing the Taiz water and sewerage system, the poor in the target area will spend less time and money in securing adequate water for household activities and the indirect benefit of improved health conditions will create an environment more conducive to the poor's participation in the economy.

b. FAA Sec. 103, 103A, 104, 105, 106, 107. Is assistance being made available: (include only applicable paragraph -- e.g., a, b, etc. -- which corresponds to source of funds used. If more than one fund s source is used for project, include relevant paragraph for each fund source.)

(1) (103) for agriculture, rural development or nutrition; if so, extent to which activity is specifically designed to increase productivity and income of rural poor; (103A) if for agricultural research, is full account taken of needs of small farmers;

(1) No.

(2) (104) for population planning or health; if so, extent to which activity extends low-cost, integrated delivery systems to provide health and family planning services, especially to rural areas and poor;

(2) Yes. The project will affect and improve the health of the urban poor by providing potable water and sewerage systems. The Taiz system will directly affect the poor in that city by providing adequate water and sewerage facilities.

(3) (105) for education, public administration, or human resources development; if so, extent to which activity strengthens nonformal education, makes formal education more relevant, especially for rural families and urban poor, or strengthens management capability of institutions enabling the poor to participate in development;

(3) No.

(4) (106) for technical assistance, engery, research, reconstruction, and selected development problems; if so, extent activity is:

(4) No.

(a) technical cooperation and development, especially with U.S. private and voluntary, or regional and international development, organizations;	N/A
(b) to help alleviate energy problem;	No.
(c) research into, and evaluation of, economic development processes and techniques;	No.
(d) reconstruction after natural or manmade disaster;	No.
(e) for special development problem, and to enable proper utilization of earlier U.S. infrastructure, etc., assistance;	No.
(f) for programs of urban development, especially small labor-intensive enterprises, marketing systems, and financial or other institutions to help urban poor participate in economic and social development.	No.
(5) (107) by grants for coordinated private effort to develop and disseminate intermediate technologies appropriate for developing countries.	
c. FAA Sec. 110(a); Sec. 208(e). Is the recipient country willing to contribute funds to the project, and in what manner has or will it provide assurances that it will provide at least 25% of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or has the latter cost-sharing requirement been waived for a "relatively least-developed" country)?	c. The cost sharing requirement is inapplicable since this is a multi-nationally funded project. Yemen is, however, contributing approximately $1 million of the total costs.

d. FAA Sec. 110(b). Will grant capital assistance be disbursed for project over more than 3 years? If so, has justification satisfactory to Congress been made, and efforts for other financing?	No.
e. FAA Sec. 207; Sec. 113. Extent to which assistance reflects appropriate emphasis on; (1) encouraging development of democratic, economic, political, and social institutions; (2) self-help in meeting the country's food needs; (3) improving availability of trained worker-power in the country; (4) programs designed to meet the country's health needs; (5) other important areas of economic, political, and social development, including industry; free labor unions, cooperatives, and Voluntary Agencies; transportation and communication; planning and public administration; urban development, and modernization of existing laws; or (6) integrating women into the recipient country's national economy.	The project will have an indirect impact on strengthening the institution building process by expanding and redefining the goals of the National Water and Sewerage Authority (NWSA). The project will redound to the urban poor in Taiz as health conditions improve through the provision of potable water and a sewerage system. The anticipated health benefits should accrue to women in Taiz and allow more emphasis on education and career pursuits.
f. FAA Sec. 281(b). Describe extent to which program recognizes the particular needs, desires, and capabilities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civic education and training in skills required for effective participation in governmental and political processes essential to self-government.	See a. above.

g. FAA Sec. 201(b)(2)-(4) and -(8); Sec. 201(e); Sec. 211(a)(1)-(3) and -(8). Does the activity give reasonable promise of contributing to the development: of economic resources, or to the increase of productive capacities and self-sustaining economic growth; or of educational or other institutions directed toward social progress" Is it related to and consistent with other development activities, and will it contribute to realizable long-range objectives? And does project paper provide information and conclusion on an activity's economic and technical soundness?	The project will increase economic resources by providing the target group with potable water and a sewerage system. The anticipated improved health of the affected population will lead to higher productivity through a reduction in waterborne diseases. The project is fully consistent with YARG's objective of improving and expanding water supplies and strengthening the capacities of NWSA.
h. FAA Sec. 201(b)(6); Sec. 211(a)(5), (6). Information and conclusion on possible effects of the assistance on U.S. economy, with special reference to areas of substantial labor surplus, and extent to which U.S. commodities and assistance are furnished in a manner consistent with improving or safeguarding the U.S. balance-of-payments position.	A moderate amount of the equipment materials and services financed by this project will have its source and origin in the U.S. Any effect on the U.S. balance of payments will be minimal.
2. Development Assistance Project Criteria (Loans only)	
a. FAA Sec. 201(b)(1). Information and conclusion on availability of financing from other free-world sources, including private sources within U.S.	N/A
b. FAA Sec. 201(b)(2); 201(d). Information and conclusion on (1) capacity of the country to repay the the loan, including reason-	

ableness of repayment prospects, and (2) reasonableness and legality (under laws of country and U.S.) of lending and relending terms of the loan.	
c. FAA Sec. 201(e). If loan is not made pursuant to a multilateral plan, and the amount of the loan exceeds $100,000, has country submitted to AID an application for such funds together with assurances to indicate that funds will be used in an economically and technically sound manner?	
d. FAA Sec. 201(f). Does project paper describe how project will promote the country's economic development taking into account the country's human and material resources requirements and relationship between ultimate objectives of the project and overall economic development?	
e. FAA Sec. 202(a). Total amount of money under loan which is going directly to private enterprise, is going to intermediate credit institutions or other borrowers for use by private enterprise, is being used to finance imports from private sources, or is otherwise being used to finance procurements from private sources?	N/A
f. FAA Sec. 620(d). If assistance is for any productive enterprise which will compete in the U.S. with U.S. enterprise, is there an agreement by the recipient country to prevent export to the U.S. of more than 20% of the enterprise's annual production during the life of the loan?	Project is not for a productive enterprise which will compete in the U.S. with U.S. enterprise.

3. Project Criteria Solely for Security Supporting Assistance

FAA Sec. 531. How will this assistance support promote economic or political stability? N/A

4. Additional Criteria for Alliance for Progress

(Note: Alliance for Progress projects should add the following two items to a project checklist.)

a. FAA Sec. 251(b)(1), -(8). Does assistance take into account principles of the Act of Bogota and the Charter of Punta del Este; and to what extent will the activity contribute to the economic or political integration of Latin America? N/A

b. FAA Sec. 251(b)(8); 251(h). For loans, has there been taken into account the effort made by recipient nation to repatriate capital invested in other countries by their own citizens? Is loan consistent with the findings and recommendations of the Inter-American Committee for the Alliance for Progress (now "CEPCIES," the Permanent Executive Committee of OAS) in its annual review of national development activities?

ANNEX B

AID 1020-28 (1-77)

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project
From FY 77 to FY 80
Total U.S. Funding FY 77
Date Prepared August 7, 1977

Project Title & Number Taiz Water and Sewerage Project 279-0039

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal The broader objective to which this project contributes Improve personal health and environmental sanitary conditions in Taiz, Yemen by renovating and expanding the Kennedy Municipal Water and Sewerage System.	Measures of Goal Achievement Decrease the incidence of water-related diseases.	YARG medical records	Assumptions for achieving goal targets That satisfactory personal and household hygiene practices are utilized
Project Purpose To construct a financially viable water and sewerage system that supplies adequate service to consumers.	Conditions that will indicate purpose has been achieved End of project status. Completed and operational water and sewerage system producing approximately 11.5 million cubic meters of water annually.	NWSA financial and operational records	Assumptions for achieving purpose That the proposed water and sewerage system is adequately managed and maintained
Outputs (1) Wells, water transmission and distribution pipes, pumping stations and sewage treatment facilities. (2) Trained staff for the operation of facilities.	Magnitude of Outputs (1) 21 production wells (2) approximately 11 miles of water transmission mains (3) 90 percent of Taiz's population connected to water system and 70 percent of population connected to sewerage facility by 1990 (4) Minimum of ten staff members received training	Taiz Water and Sewerage Project operating successfully and consumers receiving adequate service	Assumptions for achieving outputs NWSA continues to operate and manage the Taiz Water and Sewerage System
Inputs (1) AID and other donor financial assistance (2) Contracts for construction of project and engineering supervision contract (3) Qualified personnel to be trained to manage and operate facilities.	Implementation Target (Type and Quantity) (1) $10 million AID grant (2) Implementation plan presented in project paper.	(1) AID grant authorization (2) grant agreement signed (3) other donors financial input (4) NWSA and YARG budgets	Assumptions for providing inputs That the NWSA and YARG are committed to developing the project and the YARG provides financial contribution and obtains other donor financing.

ANNEX C

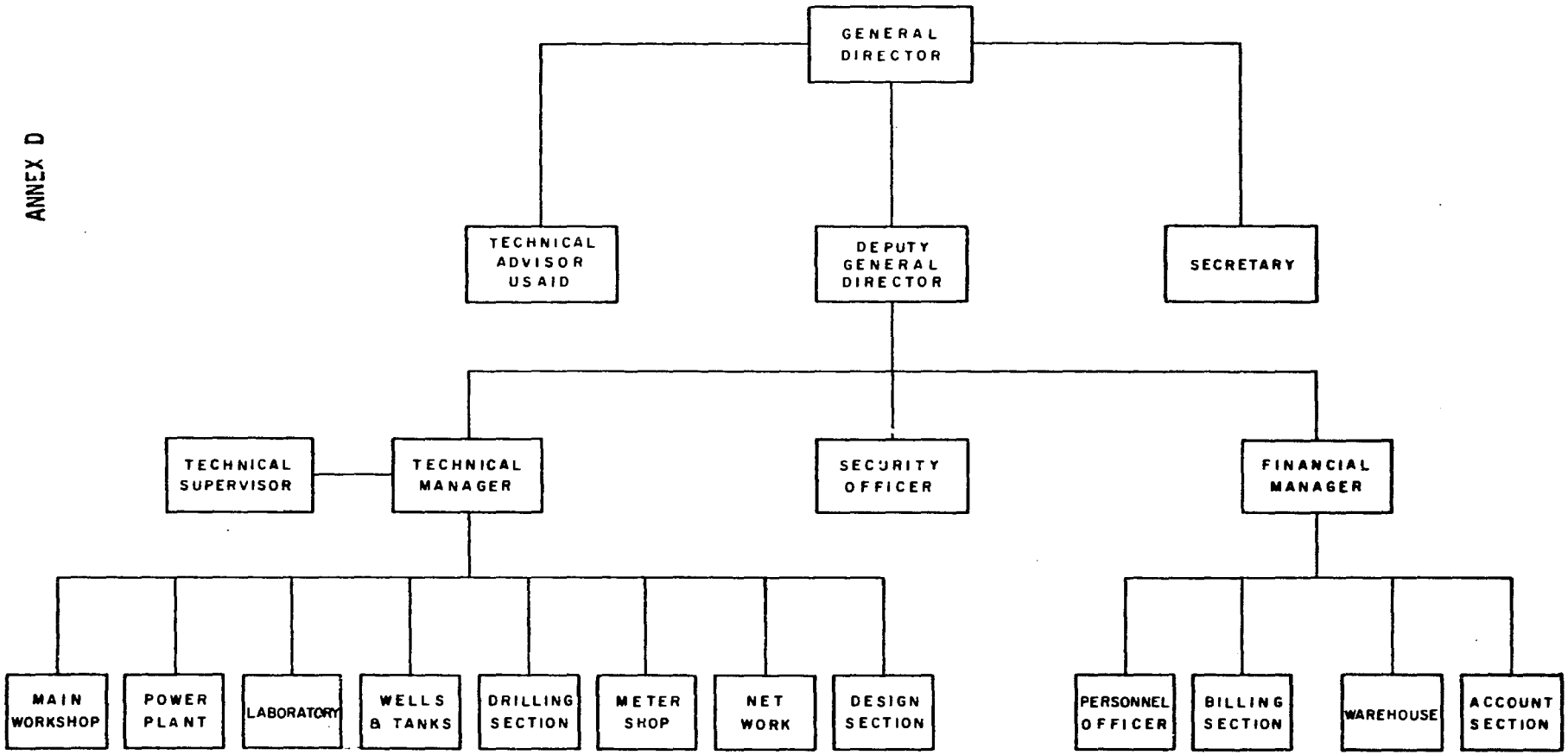
Yemen - Taiz Water and Sewerage Project
Certification Pursuant to Section 611 (e) of
the Foreign Assistance Act of 1961, as Amended

I, Aldelmo Ruiz, the principal officer of the Agency for International Development in Yemen, having taken into account, among other things, the maintenance and utilization of projects in Yemen previously financed or assisted by the United States, do hereby certify that in my judgement the Yemen Arab Republic Government has both the financial capability and the human resource capability to effectively maintain and utilize the capital assistance project to be carried out under this grant.

Aldelmo Ruiz, Director
USAID/Yemen

Date

ANNEX D



PRESENT ORGANIZATION CHART*

KENNEDY MEMORIAL WATER SYSTEM

* OBTAINED FROM THE KMWS

ANNEX E

Proposed Training Program for Taiz Water and Sewerage System Staff

POSITION	PREVIOUS EDUCATION	PROPOSED COURSE LENGTH (MONTHS)	COURSE
Administrative/Financial Manager	Bachelor of Science	24	Business Administration (Masters)
Public Relations	High School	6	Business Administration
Personnel Manager	High School	12	Business Administration
Chief Accountant	Bachelor of Science	12	Advanced Accounting
Purchasing Agent	High School	12	Business Instruction
Technical Manager	Bachelor of Science	12	Post Graduate Management
Chief in Sector	Technical High School	9	Technical Training
Draftsmen (4)	Technical High School	4x6	Technical Instruction
Water Distribution Supervisor	Technical High School		Technical Instruction
Chief Pump Operator	Technical High School	12	Technical Instruction
Meter Mechanics (2)	Technical High School	2x	Technical Instruction
Electrical Engineer	Bachelor of Science	24	Electrical Engineering (Master Science)
Electrical Technician (3)	Technical High School	3x12	Technical Instruction
Biologist, Chemist	Bachelor of Science	HC24	Chemistry and Bacteriology (Master of Science)

ANNEX F

Taiz Water and Sewerage System
Balance Sheet 1972-1974 (Actual) 1975 (Projected)

(In $)

	1972	1973	1974	1975
Assets				
Fixed Assets	427891	518702	574722	574722
Less: Depreciation	23334	55320	94419	145222
NET FIXED ASSETS	404557	463382	480303	429500
Stocks	954977	938766	878273	894827
Accounts Receivable	242287	293394	258906	259710
Provision for Bad Debts	(154460)	(153471)	(152422)	(127099)
Cash and Equivalent	10483	40959	12181	9500
CURRENT ASSETS	1053287	1119648	996938	1036938
TOTAL ASSETS	1457844	1583030	1477241	1466438
Equity and Liabilities				
Government Equity	1277778	1381577	1410958	1419296
Retained Surplus (Deficit)	(52929)	(41063)	(227515)	(286656)
TOTAL EQUITY	1224849	1340514	1183443	1132640
Long Term Debt	-	-	-	-
Current Liabilities	232995	242516	293798	333798
TOTAL LIABILITIES	232995	242516	293798	333798
TOTAL EQUITY AND LIABILITIES	1457844	1583030	1477241	1466438

ANNEX G

Taiz Water and Sewerage System
Pro Forma Balance Sheet 1981-1985 and 1990

(In $)

	1981	1982	1983	1984	1985	1986	1990
Assets							
Fixed Assets	66574222	66574222	66574222	66574222	66574222	66574222	66574222
Less: Depreciation	2099237	3799237	5499237	7199237	8849237	10499237	17099237
Net Fixed Assets	64474985	62774985	61074985	59374985	57724985	56074985	49474985
Stocks	990000	1010000	1030000	1050000	1070000	1090000	2010000
Accounts Receivable	1768142	2093243	2496248	2785653	3005180	3398227	5260960
Provision for Bad Debts	(866389)	(1025689)	(1223162)	(1364970)	(1472538)	(1665131)	(2577871)
Cash and Equivalent	3166117	3055816	1120401	2757643	1726636	1029371	5255910
Current Assets	5057870	5133370	3423487	5228326	4329278	3852467	9948999
TOTAL ASSETS	69532855	67908355	64498472	64603311	62054263	59927452	59423984
Equity and Liabilities							
Government Equity	30454128	30763103	30763103	33763103	33763103	33763103	33763103
Retained Surplus (Deficit)	(5275773)	(7284748)	(8623164)	(9436959)	(9815306)	(9450508)	410131
Total Equity	25178355	23478355	22139939	24326144	23947797	24312595	34173234
Current Liabilities	1354500	1430000	1506000	1658000	1810000	1734000	2038000
Long-Term Debt	43000000	43000000	40852533	38619167	36296466	33880857	23212750
Total Liabilities	44354500	44430000	42358533	40277167	38106466	35614857	25250750
TOTAL EQUITY & LIABILITIES	69532855	67908355	64498472	64603311	62054263	59927452	59423984

ANNEX H

Taiz Water and Sewerage System
Pro Forma Source and Use of Funds Statement 1978-1986, 1990

(In $)

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1990
Source of Funds										
Revenue	741262	878396	1040898	3608453	4271925	5094384	5685006	6133020	6935157	10736654
Government Equity	4264905	11739597	9084437	3820547	308975	-	3000000	-	-	-
Depreciation	-	-	-	-	-	743168	886205	1271653	1650000	1650000
Loan Disbursements	7400000	20000000	14000000	-	-	-	-	-	-	-
SUBTOTAL	12406167	32617993	24125335	7429000	4580900	5837552	9571211	7404673	8585157	12386654
Net Decrease in Working Capital	-	-	-	-	-	1042715	-	-	-	-
TOTAL	12406167	32617993	24125335	7429000	4580900	6880267	9571211	7404673	8585157	12386654
Use of Funds										
Operating Expenditures	889167	1508993	2351335	4429000	4580900	4732800	4798801	4861367	4920359	5117547
Debt Repayment	-	-	-	-	-	2147467	2233366	2322701	2415609	2825921
Capital Expenditures	11517000	31109000	21774000	-	-	-	-	-	-	-
SUBTOTAL	12406167	32617993	24125335	4429000	4580900	6880267	7032167	7184068	7335968	7943468
Net Increase in Working Capital	-	-	-	3000000	-	-	2539044	220605	1249189	4443186
TOTAL	12406167	32617993	24125335	7429000	4580900	6880267	9571211	7404673	8585157	12386654

ANNEX 11

Taiz Water and Sewerage System
Income Statements 1975 (Actual) 1976-1990 (Proforma)

(In $)

(Data in U.S. $)	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Revenues																
Operating Revenue	453264	478501	571753	682100	813318	969312	3529708	4185305	4999102	5580196	6017729	6808337	7589849	8421958	9375089	10550977
Other Revenue	76757[1]	48895	53784	59162	65078	71586	78745	86620	95282	104810	115291	126820	139502	153452	168797	185677
Total Revenue	530021	527396	625537	741262	878396	1040898	3608453	4271925	5094384	5685006	6133020	6935157	7729351	8645410	9543886	10736654
Expenses																
Operations and Maintenance Expense	538359	602962	675317	756355	847118	948772	2709000	2860900	3012800	3164700	3316600	3468500	3620400	3772300	3924200	4076000
Income Before Depreciation and Interest	(8338)	(75566)	(49780)	(15093)	31278	92126	899453	1411025	2081584	2520306	2816420	3466657	4108951	4873110	5619686	6660654
LESS: Depreciation	50803	50803	50803	50803	50803	50803	1700000	1700000	1700000	1700000	1650000	1650000	1650000	1650000	1650000	1650000
Net Income (Loss) Before Interest	(59141)	(126639)	(100583)	(65896)	(19525)	41323	(800547)	(288975)	381584	820306	1166420	1816657	2458951	3223110	3969686	5010654
LESS: Interest	-	-	-	132812	661875	1402563	1720000	1720000	1720000	1634101	1544767	1451859	1355234	1254745	1150236	1041547
Net Income (Loss)	(59141)	(126639)	(100583)	(198708)	(681400)	(1361240)	(2520547)	(2008975)	(1338416)	(813795)	(378347)	364798	1103717	1968365	2819450	3969107
Rate Base[2]	-	-	-	-	-	-	-	-	61924000	60224000	58549000	56899000	55249000	53599000	51949000	50299000
Return to Net Fixed Assets	--	--	--	--	--	--	--	--	.6%	1.4%	2.0%	3.2%	4.4%	6.0%	7.6%	10.0%

1/ Includes $25,323 in extraordinary income

2/ Rate Base = Average Net Fixed Assets

I. PROJECT DESCRIPTION

A. Project Area

The Yemen Arab Republic (YAR), situated in the southwestern region of the Arabian Peninsula, is bounded on the north and east by Saudi Arabia, on the south by the People's Democratic Republic of Yemen, and on the west by the Red Sea.

Taiz is the capital of the Province of Taiz which occupies the extreme southern portion of the YAR. It is the second largest city in Yemen with a present population of about 104,000. Elevations within the city vary about 300 meters, but average approximately 1300 meters. The city is drained by two major wadis.

Taiz lies along the foot of Jabel Sabir, the jagged peaks of which rise to 2,900 meters immediately south of the city. A broad vista of moderate to rugged hills and narrow valleys extends northward for several tens of kilometers from the city.

The region has a warm and slightly humid climate with annual rainfall of about 540 mm. Except for periods of dust stroms, which last for a week or more, the climate can be classified as almost ideal. These winds occur mostly in the early summer.

B. Project Activities

The project activities inovlve improvement of the Taiz water supply and sewage disposal systems. The major activities to be undertaken are:

1. development of new wells to provide quality water (TDS = 600 - 1000 mg/l), removed from the influence of sewage contamination,

2. construction of a transmission main and control structure to tie all new water sources into the city water yard, and provide a continuous water supply in quantities and at pressures suitable to eliminate interruption in service,

3. expansion of the water distribution system, and improvement of its operation and maintenance,

4. construction of sanitary sewers including house connections, and

5. construction of a central sewage treatment works with utilization of the treated effluent for irrigation.

The purpose of the project is thus to enhance sanitary conditions in Taiz for some 281,700 persons, the projected 1990 population of the city. Improvements in public health are also anticipated through reduction in the incidence of water-borne diseases and infant mortality.

II. IMPACTS OF THE PROJECT ON THE ENVIRONMENT

The environmental impacts of the proposed project can be divided into two major classifications: primary and secondary impacts. Areas of immediate interest focus on the vast benefits to the public health and welfare anticipated as a result of project implementation. The adverse short-term impacts that construction activities will have on the local environment are discussed below. Major potential areas of long-range concern include effects on local ground water tables, growth-inducing impacts, as well as adequately identifying possible cross-impacts upon the socio-cultural-economic aspects of the Taiz community.

A. Primary Impacts

The primary environmental impacts of the proposed project are associated initially with the construction phases, and subsequently, with the anticipated improvement in the availability and quality of potable water within the Taiz Study Area. The project involves expansion and modification of the present water system. The construction period will consist of the development of new well areas, the installation of pumping units, chlorination facilities, and a distribution system, including reservoirs. The proposed sewerage improvements include a major expansion of the present sewage collection system and transport by gravity interceptor to the treatment plant.

1. Construction Activities

Construction of the water transmission and distribution system routes will cause short-term disturbances to the local environment. Local residents will experience temporary disturbances associated with construction activities, such as increased noise levels, dust, particulate matter, and exhaust fumes, and traffic congestion. Construction of the water system will require clearing and excavation along the proposed routes, possibly disturbing local vegetation and wildlife. Efforts will be made to avoid routing the transmission line through hard rock, but some blasting may be required. In other areas, portions of the pipeline will be exposed to avoid such hard rock outcroppings. However, since most of the transmission lines will be installed below ground level, the effect of the construction on the local ecology is expected to be only short-term

Any damage done to the intricate terracing system in the highlands will be repaired; however, a certain amount of wind erosion can be anticipated. During the first growing season after construction work is completed, local plant species will return to the site. Although some cultivated fields will be disturbed, productivity losses are expected to be only seasonal

Construction effects for sanitary sewers are anticipated to be similar to those associated with construction of the water distribution improvements, and similar measures will be taken by the contractor as necessary. Somewhat more care would be needed where trenches are deeper than for water mains, and are likely to be open longer, to avoid probelms caused by severe rainstorms. No long-term or irreversible effects are anticipated.

2. Water Quality and Supply

The proposed water system expansion and modifications will greatly improve water quality in the Taiz Study Area as a result of reduced nitrate and coliform levels. Water analyses performed on samples from test holes at the sites of the proposed wells show NO_3 levels below 20 mg/l (present water supply: 170 mg/l) and total solids falling between 500 and 1,000 mg/l (present water supply TDS: 2,100 - 2,600 mg/l). Water quality will meet the recommended WHO International Standards for Drinking Water (1971). Thus, no degradation of water quality will result from project implementation.

The improvements to the present water system will minimize the water lost through leakage and will, for the first time, meter production. Although all service connections are metered, an estimated 30 percent of the water is unaccounted-for presently. The proposed project will help conserve water by improving the transmission and distribution system. In addition, all existing cesspools that have been constructed near water pipelines will be eliminated or relocated, as necessary.

Approximately 40 percent of the homes in Taiz presently have water flush toilets, and only 25 percent of the total population is connected to sewer lines which transport raw sewage into Wadi Taiz for disposal in the midst of the city. The proposed wastewater facilities will serve 65 percent of the population by the year 1985, and 70 percent of the total estimated population by the year 1995. The populace that cannot be feasibly sewered should be connected to septic tanks. Residents in low-income homes will be encouraged to install low-cost water seal privys which could be connected to the sewer.

H. Secondary Impacts

1. The Growth-Inducing Impacts on the Proposed Action

Taiz does not have a city land-use plan or any zoning regulations. Although light industry is emerging in the area west of the city, along the highway to the old airport, it is assumed residential and commercial growth will continue to be responsible for most future development.

Water will be provided to an area 160 percent larger than the present service area. Consequently, it is expected that the expansion of the water distribution system will stimulate growth within the Taiz locality. Reisdents of outlying regions that suffer from water shortages will be attracted to Taiz once the proposed project is constructed. The proposed project will have an accelerating effect on regional population growth, and thus, a 9 percent annual growth rate has been assumed constant throughout the project study period. In 1980, the projected Taiz Study Area population will be 119,000 and in 1990, 281,700.

As more people influx to Taiz, provisions will be made for additional government services, such as schools, hospitals, roads, and housing. New buildings within the service area will be properly connected to the water and waste water system. The capacity of the treatment facilities and disposal site are considered adequate to meet flows during the planned period, and could be easily expanded. Ultimate plant capacity is anticipated to be 200 lps.

2. Socio-Cultural-Economic Impacts

The standard of living within the Taiz Study Area will improve once water becomes widely available. People will begin to demand indoor water and sanitray facilities, and average per capita domestic consumption is expected to increase from 45 liters per capita per day in 1975, to 80 lpcd in 1980, and 120 lpcd by the year 1990. Commercial business and light industry is being encouraged to develop in Taiz in order to expand the local economy. It is projected that hotel and commercial/light industrial water requirements will jump from 75 cu m/day and 120 cu m/day, respectively, to 380 cu m/day and 825 cu m/day by 1995.

Thus, a program to encourage restrictive water usage will be implemented at the beginning of service to avoid acute water shortages. All connections would be metered and a service charge applied for a meter size over 9.5 mm. In addition, water charges would be levied proportional to water usage and group classification. These restrictive measures are necessary to assure water will be available for all sectors of the Taiz society in years to come.

III UNAVOIDABLE IMPACTS

A. Groundwater. The proposed groundwater development at Al Haima and Mikbaba for withdrawals to supply potable water for Taiz would be at the expense of current irrigation. Although preparation of a more exact water balance will have to wait for a better data base, preliminary estimates indicate that the present capability to support 2 or 3 crops per year, including vegetable crops, would be reduced to one crop per year, probably sorghum. Although neither the reduction in available food nor the impact on the overall economy are judged to be adverse, the economic impact on farmers in the ares affected would be serious. The proposed remedy is to arrange monetary compensation to the farmers for the reduction in crop values. Although difficult, these measures are considered essential to make this water source available first for a higher use - a potable supply - and then for agricultural use, albeit in a different area. The impact on the farmers is judged long-term, but not an irreversible or irretrievable commitment of resources.

B. Commitment of Land Area. Studies conducted for the Project Design Report have not developed a recommended site for the construction of waster stabilization lagoons, but have narrowed the possibilities to two feasible alternatives:

1. The Hougala site, located 1 km east of the Hougala well field, an area which would require lining of ponds to prevent contamination of groundwater.

2. The Brayhi site, located some 8 kms north of Taiz, an area which includes unproductive land.

Neither of the above sites has any known historical, archaeological or cultural values that would be destroyed by the use of these lands. Both would require some resident and economic dislocations, for which compensation will be arranged by YAR. Thus, commitment of land resources will be of no significant impact in the project.

IV ALTERNATIVES

The key environmental considerations involved for project elements are summarized in this section. Following a brief discussion of alternative project goals.

A. Alternative Project. Little serious consideration was given to alternative goals, per se, which would not enhance public health. Failure to implement the project proposed would eliminate the possibilityof achieving any beneficial effects.

B. Alternative methods to achieve project purpose.

1. Water Resource Development. The scarcity of water resources in the Taiz area precludes viable alternatives

to the proposed sources. All known water resources in the general area eventually will have to be developed to serve the growing potable water needs of Taiz. The project design represents the combination of available sources determined to most economically meet the estimated demands of Taiz to 1990, with the minimum environmental impact. Other available sources will be needed, to meet demands for years beyond 1990. It is recommended that these sources be placed under the control of NWSA to ensure their orderly development and to protect them for future use. Alternatives to these groundwater sources investigated include natural springs and surface impoundment of strom water.

Natural springs located throughout Jabel Sabir have served as a source of water for Taiz for many years. The springs have been fully developed through a system of cisterns and pipes; hence, no excess capacity exists.

Several sites for possible impoundments to store storm water that drains from Jabel Sabir were examined. Due to the narrow and steep wadis (valleys) draining the mountain, large and costly dams would be required to obtain a reasonable amount of storage, and even then the yield would be relatively small. Further, water losses from evaporation and seepage into the ground would occur. For these reasons impoundments were rejected.

2. Water Transmission. Several routes were examined for the transmission main from Al Haima to Taiz. Generally, each of the alternate routes examined would be more costly or be in rugged terrain which would have made access more difficult; for these reasons, they were rejected.

3. Water Distribution. The topography of the city requires that the distribution system be broken into narrow pressure zones, thereby limiting alternatives. The basic alternate considered was a scheme whereby the water would be pumped to storage tanks above the city and then would flow down into two or three lower pressure zones through pressure break structures. This scheme was rejected as being wasteful of energy. The proposed system would pump water to storage tanks located in the individual zones instead of to tanks located in pressure zones above the zone to be served.

4. Wastewater Collection. Combined sewers are not recommended because they would be excessively large and costly and would have several operational problems such as sediment clogging and surcharging. Except for a few instances, the

present storm system consisting of natural drainage channels is adequate. The proposed sewer service area includes all areas where population density or soil conditions would not permit proper operation of septic systems. Outside the sewer service area, septic tanks are recommended.

Alternate routing of the sewers is generally not possible in Taiz. Due to the building density, very few clear areas where sewers can be installed are available. Alternate routes for the main interceptor to the treatment plant are not feasible. Approxiamtely 80 percent of the city drains directly to Wadi Ussifera in which the interceptor is located. Any alternate routing would require costly pumping and none is proposed for the recommended project.

5. Wastewater Treatment. Several alternative treatment methods and associated site locations were considered, including the following:*

1. Minimal treatment in anaerobic lagoons.
2. Trickling filtration.
3. Oxidation ponds.

Minimal treatment was rejected chiefly because its effluent would not be as suitable for irrigation as that from a secondary-type process of the other two alternatives.

Trickling filtration was estimated to have a lower construction cost, require less land, and minimize evaporative losses. However, waste stabilization lagoons are proposed because they are simpler and cheaper to operate, and they are presently utilized in NWSA's two other facilities in Sana'a and Hodeida. Since waste stabilization lagoons require less mechanical equipment and lower technical operating skills than trickling filters, fewer operating probelms will be encountered since obtaining mechanical replacement parts and finding qualified operating personnel are significant problems in Yemen.

6. Wastewater Disposal. Alternative effluent disposal schemes considered include recharge to the Hougala well field, discharge to the wadi downstream, and return on the effluent to Al Haima to replace the water withdrawn by the proposed well field.

Recharge to Hougala was rejected chiefly because recycling of the water would result in excessive buildup of dissolved solids and other substances. Discharge to the wadi downstream was rejected because it would result in a loss to NWSA of potential revenue from selling irrigation water. Return of effluent to Al Haima was rejected for reasons of high cost.

*Treatment methods involving mechanical or diffused air were not considered in detail for reasons of their higher power requirements.

The sewage treatment works will be a series of multi-celled waste stabilization lagoons to ensure high bacterial removal in the effluent. Surface irrigation with the effluent will be employed on crops which will be consumed only after processing.