CHAPTER 3

IMPLEMENTATION PLAN

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3.1 Implementation Plan

3.1.1 Implementation Concept

The Project will be implemented in accordance with the framework of Japan's grant aid system. Accordingly, the Project will only be implemented after approval of the Government of Japan of the implementation of the Project and the subsequent exchange of the Exchange of Notes (E/N) between the Government of Japan and the Government of Egypt. This E/N will become valid on the day when its ratification by the People's Assembly of Egypt is notified by the Government of Egypt to the Government of Japan. The basic issues and special points to note regarding the implementation of the Project are described next.

(1) Project Implementation Body

The Giza Governorate will have overall responsibility for the Project while Giza City (Giza municipal authority) will act as the project implementation body. As described earlier (see 2.4.1), Giza City plans to implement the Project by mobilising its administrative, civil engineering, architectural and public relations staff members to share the necessary work under the leadership of the Technical Advisor.

As the E/N signed by the two governments will only become valid after its ratification by the People's Assembly, the Giza Governorate and Giza City must approach the government organizations involved in the Project to facilitate the required ratification of the E/N by the People's Assembly so that smooth progress towards the Project's implementation can be made.

Moreover, as the project implementation body, Giza City will be required to select a person to be in charge of the Project and to establish the Project Promotion Committee in cooperation with the GOGCWS, which will be responsible for the operation and maintenance of the facilities constructed under the Project in the post-Project period, with a view to smoothly implementing the Project through close liaisoning and consultation with the Japanese Consultant as well as Contractor.

(2) Consultant

For the construction of facilities and procurement of equipment and materials to be conducted under the Project, a Japanese Consultant will conclude a design and supervision agreement with Giza City to conduct the detailed design and work supervision. The same Consultant will prepare the tender documents and will also conduct the prequalification and evaluation of bids on behalf of the project implementation body (Giza City).

(3) Contractor

The Japanese Contractor selected through open tender by the Egyptian side in accordance with the framework of Japan's grant aid system will conduct the construction of the facilities and procurement of the equipment, etc. planned under the Project. As the Contractor is expected to provide after-service, including the supply of spare parts and arrangement of repair work, etc., following the completion of the Project, it must carefully consider the post-Project liaison arrangements with the Giza municipal authority.

Given the use of locally procured construction materials and others and the planned construction work at roads with heavy traffic in densely populated areas, the Contractor must have a sound understanding of the local natural and socioeconomic conditions, construction market, labour situation and labour laws, etc.

(4) Necessity to Dispatch Japanese Engineers

For the successful completion of the planned construction work under the Project, it will be necessary to dispatch Japanese engineers who are thoroughly conversant with water reservoir construction work and large diameter water transmission main laying work. As it appears difficult to secure the services of such specialist engineers in Egypt, it will be necessary for the Japanese manufacturer(s) of the equipment to be used to dispatch engineers to Egypt in view of the proper construction of the planned facilities.

Apart from the above specialist engineers, it will not be difficult to locally secure engineers, technicians and site workers, etc. in Egypt.

3.1.2 Points to Note Regarding Construction Work

The following points must be noted in consideration of the facts that the planned construction work will be conducted in densely populated areas, along trunk roads and across drainage canals and that the Project will be implemented with grant aid provided by the Government of Japan.

(1) Local residents should be encouraged to understand the objectives and contents of the work in view of obtaining their cooperation and particular attention should be paid to preventing accidents involving local residents due to the work.

(2) Careful attention should be paid to the selection of the construction method(s) and construction machinery to minimise/prevent harm to local residents and their homes, etc., including noise, vibration and building damage.

(3) Careful attention should be paid to avoiding any damage to the existing bridges across the drainage canals.

(4) Given the existence of many underground structures (sewer lines, water supply lines and electric and telephone cables) along the planned routes, careful attention should be paid to preserving their functions and to avoiding any damage to these structures.

(5) Careful attention should be paid to ensuring the safe passage of pedestrians and road traffic through the work sections.

(6) Because of the use of heavy machinery for the water reservoir construction work which also involves work high above the ground, careful attention should be paid to preventing accidents involving engineers and workers.

3.1.3 Division of Construction Work

The division of the construction work between the Egyptian side and the Japanese side is shown in Table 3-1-1.

Table 3-1-1 Division of Construction Work Between Egyptian and Japanese Sides

Item	Japan	Egypt	Remarks
1. Laying of Water Transmission Main	○		
2. Construction of Water Distribution Station			
1) Site Acquisition and Preparation		○	
2) Construction of Access Road		○	
3) Installation of Power Receiving Facilities			
- Extension of Local 10.5 kV Power Distribution Line		○	
- Connecting Box to 10.5 kV Line		○	
- Integrating Watt-Hour Meter		○	
4) Construction of Water Reservoirs	○		
5) Construction of Water Distribution Pump System			
- Construction of Pump House (including foundations for No. 1 - No. 4 pumps)	○		
- Supply and Installation of No. 1 - No. 3 Pumps	○		
- Supply and Installation of No. 4 Pump		○	Planned for 2006
6) Construction of Paved Premise Roads	○		
7) Outdoor Lighting of Premises	○		
8) Perimeter Fencing and Gates		○	
9) Landscaping		○	
10) Construction of Drainage Channel from T.P. to Sewer Inlet		○	T.P.: terminal point (1.0 meter from outer boundary of perimeter fence)
3. Construction of Aqueduct	○		
4. Laying of Water Distribution Pipes			
1) Procurement of Water Distribution Pipes			
- ϕ 200 - 600 mm	○		
- ϕ 100 - 150 mm		○	
2) Laying of Above Pipes		○	

3.1.4 Work Supervision Plan

In accordance with the grant aid system of the Government of Japan and based on the purport of the basic design, the Consultant will organize a project team which will consistently work through the detailed design and work supervision stages of the Project for the smooth implementation of the Project. At the work supervision stage, the Consultant will dispatch the following on-site supervisors in accordance with the construction schedule for the purposes of schedule control, quality control and safety control.

Water reservoir construction work supervisor	:	one (full-time)
Piping work supervisor	:	one (full-time)
Mechanical work supervisor	:	one (spot)
Electrical work supervisor	:	one (spot)
Civil engineering work supervisor	:	one (spot)

In addition, Japanese experts will be involved in the factory inspection and pre-delivery inspection of the equipment to be manufactured in Japan or a third country to preclude any problems with such equipment following its delivery to Egypt.

(1) Basic Principles of Work Supervision

The Consultant will supervise the work progress to ensure the completion of the work envisaged under the Project within the predetermined time limit and will also supervise and guide the Contractor in order to safely and fully achieve the work quality stipulated in the agreement. The key points of this supervision are described below.

1) Schedule Control

The Consultant will compare the planned work schedule submitted by the Contractor at the time of signing the agreement with the actual progress on a weekly and monthly basis. If the Consultant believes that a delay is likely to occur, he will issue a warning to the Contractor, requesting the submission of improvement measures so that the work in question can be completed on schedule.

① Confirmation of the completed work

② Confirmation of the delivery of equipment and materials

③ Confirmation of the actual number of engineers, technicians and workers, etc. and their proportion vis-a-vis the originally planned manpower level

2) Quality Control

The Consultant will conduct the following actions to check whether or not the Contractor is achieving the quality standards of the facilities and equipment stipulated in the contract documents (technical specifications and detailed design drawings, etc.) If the Consultant believes that the required quality may be compromised, he will ask the Contractor to change, modify or alter the quality of the facilities or equipment to meet the originally agreed standard.

① Checking of the shop drawings and equipment specifications
② Checking of the equipment factory inspection results or attendance at the factory inspection
③ Checking of the equipment installation manuals, on-site trial operation, adjustment and inspection manuals and working drawings
④ Supervision of the site installation work of the equipment and attendance at the trial operation, adjustment and inspection
⑤ Checking of the working drawings for the facilities
⑥ Checking of the site work progress and its comparison with the working drawings for the facilities

3) Safety Control

The Consultant will consult and cooperation with the project manager of the Contractor with a view to supervising the construction work in order to avoid any accidents or disasters. The key points of the on-site safety control are listed below.

① Establishment of safety control rules and selection of a safety manager
② Prevention of disasters through regular inspection of the construction machinery and other equipment
③ Confirmation of the travel route(s) for work-related vehicles and construction machinery and the thorough enforcement of slow driving
④ Introduction of worker welfare measures and the strict enforcement of day offs.

(2) Project Implementation System

The project implementation system, incorporating all parties of the Project, is shown in Fig. 3-1-1.

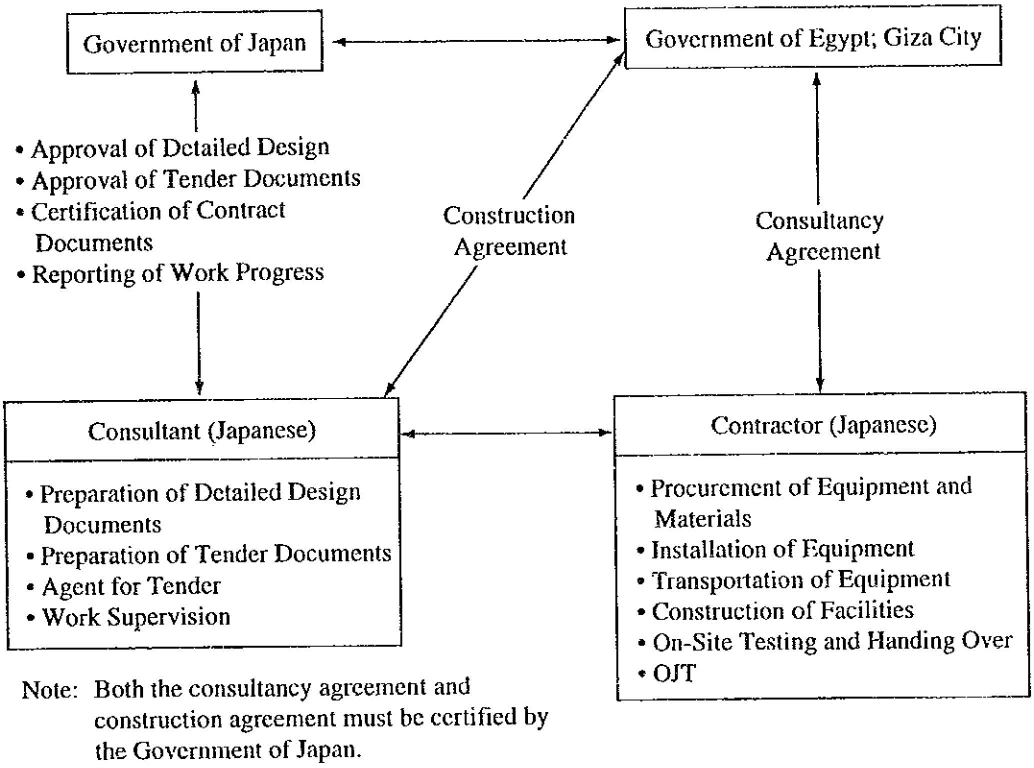


Fig. 3-1-1 Project Implementation System

(3) Work Supervisors

The Contractor will employ local engineers and technicians by means of either direct contract or subcontracting to a local construction company to complete the equipment procurement and construction work within the time limit set forth in the construction agreement. It will be necessary for the Contractor to dispatch engineers with overseas experience of work similar to the expected work under the Project to Egypt to ensure strict schedule control, quality control and safety control with the local engineers and technicians employed directly or by the subcontractor.

Given the scope of the Project, the Contractor will be required to dispatch the following work supervisors on either a full-time or spot basis.

- Site representative (full-time) (one)
  consultation and coordination with Project-related organizations; acquisition of the necessary approval, etc.
- Chief administrator(full-time) (one)
  labour control; procurement
- Senior supervisor (full-time) (one)
  guidance and control of the entire work
- Piping engineer (full-time) (one)
  guidance and control of the water transmission main construction work
- Water reservoir engineer (full-time) (one)
  guidance and control of the water reservoir construction work
- Building engineer (spot) (one)
  guidance and control of the pump house building work
- Mechanical and electrical engineer (spot) (one)
  guidance and control of the pump system installation work
- Assistant engineer (spot) (one)
  assistance for work supervision during the overlapping period of the first and second stages

3.1.5 Procurement Plan

(1) Procurement Sources of Equipment and Materials

The equipment and materials for the Project will be procured in Egypt where possible provided that they meet the set specifications, quality, delivery period and price, etc. Those which cannot be procured in Egypt will be procured in Japan or a third country.

1) General construction materials are readily available in Egypt, except mechanical and electrical equipment for the PC water reservoir and water distribution pump system.

2) Items which cannot be procured in Egypt include 1,200 mm diameter ductile cast iron pipes (straight pipes and specials) and valves, 800 mm or larger diameter valves and steel pipes for the aqueduct. Although 150 mm diameter ductile cast iron specials and valves, etc. can be procured in Egypt, the fact that there is only one manufacturer of these items with a limited production volume casts doubt on punctual delivery.

The division of the procurement of the main equipment and materials for the Project between the two sides is shown in Table 3-1-2 and this division takes the procurement principles described in 2.3.1-(4) and the above-mentioned points into consideration.

Table 3-1-2 Division of Procurement of Main Equipment and Materials

Equipment/Material	Egypt	Japan/Third Country	Remarks
Concrete Aggregates (Sand and Gravel)	○		
Cement	○		
Reinforcing Bars	○		
Forms	○		
Bricks and Concrete Blocks	○		
Ductile Cast Iron Pipes (Straight: upto ϕ 1,000 mm)	○		for water transmission main and branch lines
Ductile Cast Iron Pipes (Straight: ϕ 1,200 mm)		○	for water transmission main
Ductile Cast Iron Pipes (Specials) and Valves		○	for water transmission main and branch lines
Steel Pipes (Straight)		○	for aqueducts
Steel Pipes (Specials) and Valves		○	
Water Distribution Pump (Mechanical and Electrical)		○	
PC Steel Wire		○	for water reservoirs

(2) Transportation

For the transportation of construction equipment, etc. from Japan or a third country, the packaging must be strong enough to sufficiently withstand long maritime transportation, loading and unloading, land transportation to the Project Site from the port of landing and storage thereafter.

Port Alexandria appears to be the most appropriate port of landing as it is a free port where frequent calls are regularly made by ships from Japan, the US and Europe and where adequate landing facilities are provided.

Regular shipping services will be used for maritime transportation between Japan and/or a third country and Port Alexandria while trucks, the main means of freight transportation in Egypt, will be used for land transportation (some 200 km) between Port Alexandria and the Project Site. The so-called Desert Road will be best suited for land transportation because of its wide width, light traffic and good paved surface conditions.

3.1.6 Implementation Schedule

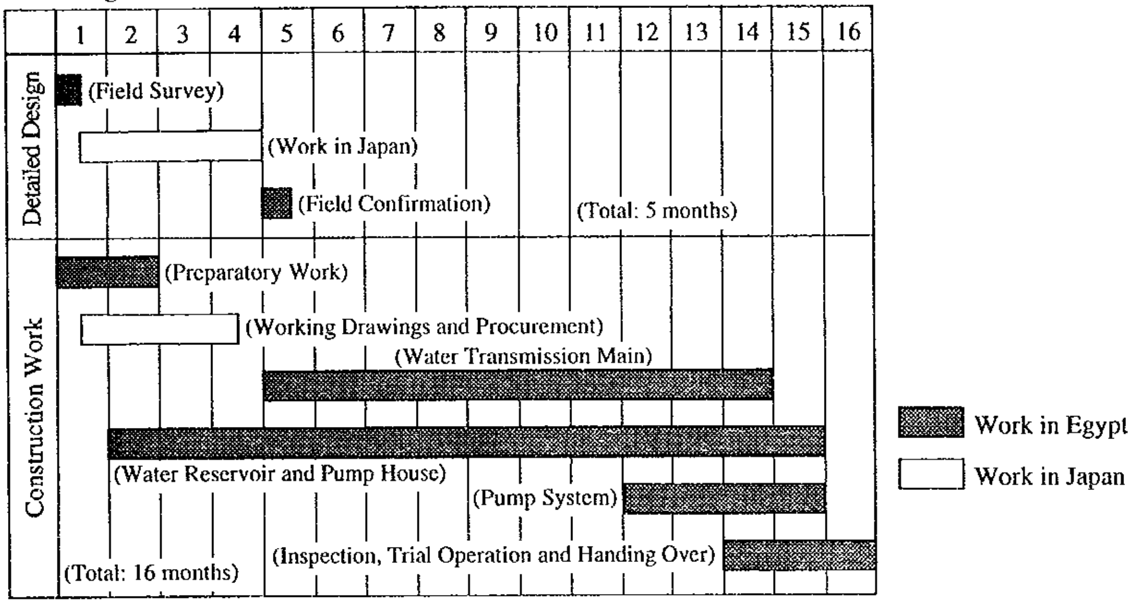
Following approval of the implementation of the Project by the Government of Japan, the E/N will be exchanged between the Government of Japan and the Government of Egypt to commence the construction process of the Project. This will largely be divided into three stages: ① detailed design and the preparation of tender documents, ② tender and the signing of the construction agreement and ③ construction of facilities and procurement of equipment and materials.

The components of the Project are the laying of the water transmission main, construction of water reservoirs and provision of water distribution pipes and others. As the Project Site is divided by canals, the Project will be implemented in two phases (1st phase for the No. 1 Water Distribution Basin and 2nd phase for the No. 2 Water Distribution Basin). Table 3-1-3 shows the work contents of each stage while Fig. 3-1-2 shows the work implementation schedule of the Project.

Table 3-1-3 Scope of Work Under the Project

Phase	Work to be Conducted
1st Phase	[Water Supply Improvement Plan for No. 1 Water Distribution Basin] (1) Laying of Water Transmission Main - ϕ 1,200 mm × 990 m - ϕ 800 mm × 430 m (2) Construction of No. 1 Water Distribution Station - capacity: 14,000 m^3 × 1 (3) Provision of Water Distribution Pipes for No. 1 Water Distribution Basin - ϕ 200 - 600 mm x approximately 11.7 km
2nd Phase	[Water Supply Improvement Plan for No. 2 Water Distribution Basin] (1) Laying of Water Transmission Main - ϕ 1,000 mm × 3,150 m - ϕ 800 mm × 840 m (2) Construction of No. 2 Water Distribution Station - capacity: 11,000 m^3 × 1 (3) Construction of Aqueducts - ϕ 800 mm × 30 m × 1 - ϕ 800 mm × 25 m × 1 (4) Provision of Water Distribution Pipes for No. 2 Water Distribution Basin - ϕ 200 - 600 mm x approximately 16.7 km

<First Stage: No. 1 Water Distribution Basin>



<Second Stage: No. 2 Water Distribution Basin>

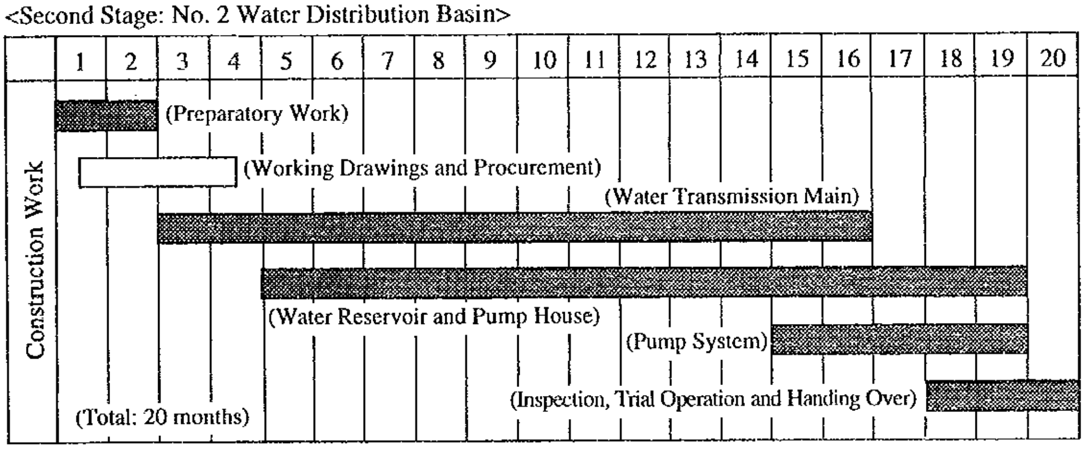


Fig. 3-1-2 Work Implementation Schedule of the Project

3.1.7 Work to be Undertaken by Egyptian Side

As part of the implementation process of the Project, the Egyptian side will be responsible for the following work.

(1) Acquisition and preparation of land required for the water distribution stations.

(2) Free provision of land to be used for a stock yard and temporary structures during the construction period.

(3) Provision of information and data required for the detailed design for the Project.

(4) Acquisition of permission for preliminary excavation to confirm the existence of underground structures at the detailed design stage.

(5) Facilitation of the acquisition of permits and approvals required for the implementation of the Project.

(6) Acquisition of permits regarding all types of work, including manhole investigation, entry into the canal zone and surveying work on roads, associated with the Project.

(7) Arrangements for witnessing and confirmation by the competent organizations for preliminary excavation and protective work for underground structures.

(8) Introduction of necessary measures and arrangements for traffic control and obtaining of the cooperation of local residents.

(9) Adoption of necessary measures and arrangements in the case of any ancient remains being found during the construction work.

(10) Provision of disposal sites for surplus soil and waste water during the construction period.

(11) Establishment of the Giza City Project Promotion Committee to facilitate the implementation of the Project.

(12)Promotion of the work to lay the water distribution pipes provided under the Project in accordance with the project implementation schedule.

(13)Implementation of auxiliary work, including landscaping, erection of fencing and gates and installation of outdoor lighting at each of the water distribution station.

(14)Construction of an access road to each of the water distribution station sites prior to the commencement of the construction work by the Japanese side.

(15)Construction/extension of power receiving facilities (extension of the local 10.5 kV power distribution line, installation of a 10.5 kV connection box and installation of an integrating watt-hour meter), water supply system, telephone line and drainage system to each of the water distribution station sites.

(16)Swift unloading, customs clearance and tax exemption of the equipment, etc. required for the Project at the Egyptian port of landing.

(17)Exemption of the equipment, etc. imported for the Project and Japanese nationals visiting Egypt for the implementation of the Project from customs duties and any other taxes and provision of the facilities required by such Japanese nationals to perform their assigned work in Egypt.

(18)Exemption of the equipment, etc. imported for the Project, Japanese corporations and Japanese nationals from enterprise tax.

(19)Appropriate use and maintenance of the facilities and equipment which are either constructed or installed by Japanese grant aid for the Project.

(20)Payment of all costs necessary for the implementation of the Project which are not included in the scope of the Japanese grant aid for the Project.

3.2 Operation and Maintenance Plan

(1) Basic Principles

The proper operation and maintenance of the facilities as well as the equipment and the preservation of a good environment for the facilities are essential for the effective use of the planned facilities and equipment under the Project over a long period of time and also for the stable and continued supply of clean water in response to general fluctuations of the water demand.

The Egyptian side is required to enforce adequate preventive maintenance and repair work aimed at improving the reliability, safety and efficiency of each facility or equipment in order to maintain the necessary performance and functions of the facilities and equipment to achieve a stable supply of clean water.

The basic maintenance concept for the planned facilities is shown in Fig. 3-2-1. The Egyptian side is required to employ the following measures to achieve proper maintenance.

① Securing of the necessary manpower and budgetary appropriation for the proper operation and maintenance of the facilities and equipment

② Securing of the necessary funding to pay all expenses regarding the operation and maintenance of the water distribution station for the effective use of the facilities

③ Securing of the necessary funding for the future renewal of the facilities and equipment

With continual reference to the operational and maintenance requirements referred to in Fig. 3-2-1, the Egyptian side should conduct the operation and maintenance of the facilities and equipment following the Project's completion using the operation and maintenance technologies and techniques transferred to the Egyptian side during the project period through the OJT organized by the Contractor and in accordance with the operation and maintenance manuals.

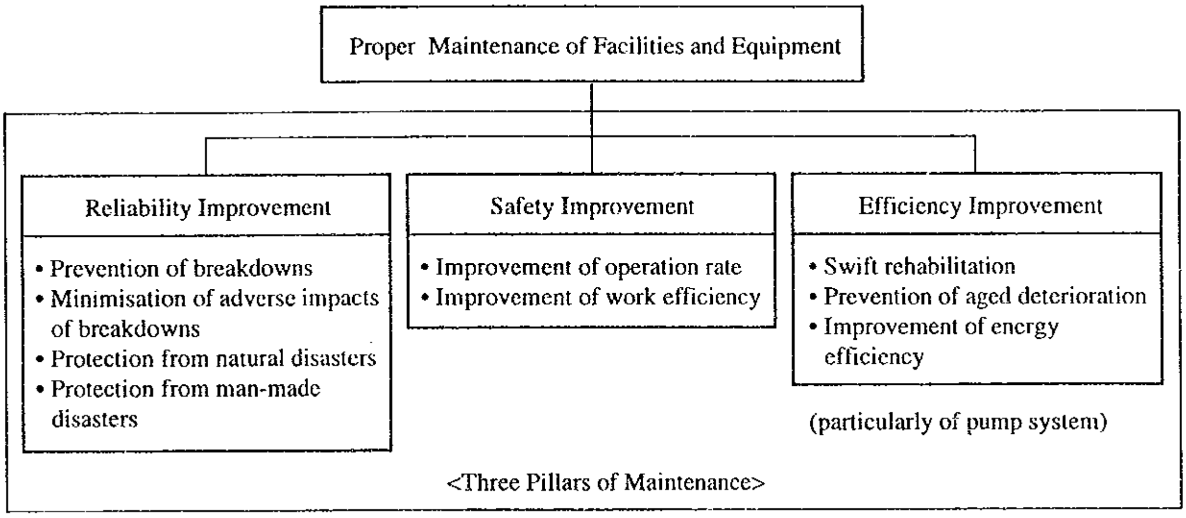


Fig. 3-2-1 Basic Concept of Operation and Maintenance System

(2) Regular Check Items

The standard check items regarding the pump system, water reservoir, water transmission main and water distribution pipes are shown in Tables 3-2-1 through 3-2-3. GOGCWS in Egypt should prepare an operation and maintenance plan for the facilities and equipment based on the maintenance manuals submitted by the manufacturers of the equipment/facilities and Table 3-2-1 and should uphold the plan as an essential part of the overall operation plan for the water supply facilities in Giza City.

Table 3-2-1 Standard Regular Check Items for Water Distribution Pump System

Equipment	Frequency	Check Item
Pump	Daily (in operation)	• Daily operation record ① Recording of water supply volume ② Visual check of various sections ③ Check of abnormal sound ④ Check of axial temperature rise ⑤ Check of water leakage ⑥ Recording of suction and discharge pressures
	Monthly	• Check of bearing oil deterioration • Check of bearing oil level • Measuring of bearing oil temperature
	Three Monthly	• Change of bearing oil • Measuring of shaft centre accuracy • Measuring of vibration and noise levels • Replenishment of bearing grease
	Six Monthly	• Change of bearing grease • Change of gland packing
	Annually	• Overhaul ① State of abrasion of rotating section ② State of gap at sliding section ③ State of internal corrosion ④ State of clogging by foreign matters ⑤ Repair of exfoliated paint • Check of accessories and auxiliary machine
Motor	Daily (in operation)	• Daily operation record ① Measuring of current value ② Visual check of various sections ③ Check of abnormal sound ④ Check of axial temperature rise
	Six Monthly	• Replenishment of bearing grease • Measuring of vibration and noise levels • Measuring of axial temperature
	Annually	• Check of bearing • Measuring of insulation resistance value

Table 3-2-2 Regular Check Items for Water Reservoir

Check Item	Check Interval	
	Monthly	Annually
① State of water leakage, if any		○
② Damage due to uneven subsidence, etc.		○

Table 3-2-3 Regular Check Items for Water Transmission Main and Water Distribution Network

Check Item	Check Interval	
	Monthly	Annually
① State of water leakage, if any	○	
② State of ground subsidence, if any		○
③ Conditions of valves, plugs and lids, etc.	○	
④ State of damage, if any - Damage by underground structure work, road work, building work and/or vehicle traffic - Damage by uneven subsidence, etc. - Damage by cleaning tools - Damage by aged deterioration	○	
⑤ Availability of emergency equipment/tools	○	
⑥ Functioning of fire plugs		○
⑦ Functioning of blow-off valve		○
⑧ State of manhole covers (damage, abrasion, gap between iron frame and road surface due to uneven height and state of soil deposit, etc.)	○	
⑨ State of interior of manholes (uneven subsidence, cracks on side walls, corrosion of metal steps and state of soil deposit, etc.)	○	
⑩ State of damage to aqueduct painting, if any		○

(3) Spare Parts Procurement Plan

The spare parts for the water distribution pump system are classified as standard accessories for regular replacement and emergency replacement parts required at the time of a breakdown, etc. It will be necessary for the Egyptian side to procure both types of spare parts in accordance with the regular check cycles shown in Table 3-2-1.

It is planned to provide two years supply of spare parts under the Project as listed in Table 3-2-4. Consequently, it will be necessary for the Egyptian side to secure the necessary funding for the standard accessories and emergency replacement parts within two years of the completion of the Project.

Table 3-2-4 Main Spare Parts and Maintenance Tools to be Procured Under the Project

I. Spare Parts (for each water distribution station)

No.	Item	Quantity	Remarks
1	Water distribution pump		
	- Gland packing set	8 sets × number of pumps	for 4 replacements
	- Shaft sleeve set	4 sets × number of pumps	for 2 replacements
	- O ring	4 sets × number of pumps	for 2 replacements
	- Linear ring	4 sets × number of pumps	for 2 replacements
	- Bearing metal set	4 sets × number of pumps	for 2 replacements
	- Ball bearing	4 sets × number of pumps	for 2 replacements
	- Casing gasket	2 sets × number of pumps	for 2 replacements
2	Gate valve (including motor-operated valve)		
	- Gland packing	1 set × number of valves	for 1 replacement
	- Gate valve	1 set × various sizes/models	emergency parts
3	Butterfly valve (including motor-operated valve)		
	- Seat	1 set × various sizes/models	emergency parts
	- Butterfly valve	1 set × various sizes/models	emergency parts
4	Motor-operated valve		
	- With actuator	1 set × various sizes/models	emergency parts
5	Pressure gauge		
	- Suction side	2 sets	emergency parts
	- Discharge side	2 sets	emergency parts
	- Gauge cock and pressure damper	4 sets	emergency parts
6	Pump control panel and power receiving and transformation panel		
	- Frequency conversion unit	1 set	emergency parts
	- Display lamp	100%	
	- Fuse	100%	
	- Circuit breaker	1 set × various sizes/models	emergency parts
	- Protective relay	1 set × various sizes/models	emergency parts
	- Display instruments	1 set × various sizes/models	emergency parts

II. Maintenance Tools (for each water distribution station)

No.	Item	Quantity	Remarks
1	Tool set for mechanical equipment (with tool box)	1 set	
2	Tool set for electrical equipment (with tool box)	1 set	
3	Multi-tester (AC 600 V; 12 A)	1 set	
4	Bar thermometer (mercury; 0 - 100℃)	10	
5	Insulation resistance tester (1,000 V)	1 set	
6	Pump centering tester		
	- Dial gauge (2 mm)	1 set	
	- Dial gauge (lever system)	1 set	
	- Magnet base	2 sets	
	- Shim (0.1, 0.2 and 0.5 mm)	1 reel each	
7	Revolution counter (optical; remote)	1 set	see Note
8	Vibration tester	1	see Note
9	Noise tester	1	see Note
10	Pressure gauge calibrator		
	- Weight balance type	1	see Note

Note: Due to the low use frequency, only one item is provided to serve two water distribution station.

(4) Examination of Operation and Maintenance Cost

It is assumed that the water distribution pump system to be installed at each water distribution station will be operated throughout the peak water demand hours (i.e. approximately 10 hours/day). Based on this operation mode, the operation and maintenance cost of the pump system at each water distribution station planned under the Project is estimated to be 730,000 LE in 2000 after the completion of the Project and 950,000 LE in 2010, the target year of the Project. See Appendix 7 for further details.

(5) Financial Feasibility of the Project

GOGCWS is experiencing a chronic operation deficit, exacerbated by accumulated debts originating from domestic and foreign loans. In view of this state, the financial feasibility of the Project is examined below from the viewpoint of the finances of GOGCWS after the Project's completion.

1) Ratio Analysis

Based on water supply operation data, the various ratios regarding the facilities and water supply operation of the GOGCWS in 1995 are given in Table 3-2-5. The key points of this table are described below.

① While the operation rate is as high as almost 100% due to the lack of a surplus water supply capacity, the water charge collection rate of 52% is similar to that of other developing countries (where the relevant ratio ranges from 40% to 60%).

② As the unit income of water supply is lower than the unit cost of water supply, the operational deficit increases in proportion to the volume of water sold.

③ As both the service population and volume of water supply per staff member are small, whether or not the current number of staff is appropriate must be examined.

④ The ratio between the current income and expenditure is well below 100% as the income structure is such that the amount of current loss increases with expansion of the water supply service.

Table 3-2-5 Ratio Analysis of Water Supply Operation of GOGCWS

Item	Ratio	Calculation Formula
Water Charge Collection Ratio	52%	$\frac{795,260,000m^3 \text{(Annual Water Supply Paid)}}{1,537,867,000m^3 \text{(Annual Gross Water Supply)}} \times 100$
Load Ratio	81%	$\frac{4,200,000m^3 \text{(Average Daily Water Supply)}}{5,200,000m^3 \text{(Maximum Daily Water Supply)}} \times 100$
Facility Utilisation Ratio	99%	$\frac{4,200,000m^3 \text{(Average Daily Water Supply)}}{4,246,000m^3 \text{(Daily Water Supply Capacity)}} \times 100$
Maximum Operation Ratio	122%	$\frac{5,200,000m^3 \text{(Maximum Daily Water Supply)}}{4,246,000m^3 \text{(Daily Water Supply Capacity)}} \times 100$
Unit Income of Water Supply	0.298 LE/m^3	$\frac{236,851,000LE \text{ (Water Supply Income)}}{795,260,000m^3 \text{(Annual Water Supply Paid)}}$
Unit Cost of Water Supply	0.546 LE/m^3	$\frac{434,287,000LE \text{ (Operation Cost)}}{795,260,000m^3 \text{(Annual Water Supply Paid)}}$
Service Population per Staff	1,148	$\frac{15,000,000 \text{ (Total Service Population)}}{13,064 \text{ (Total Number of Staff)}}$
Water Supply Volume per Staff	60,874 m^3	$\frac{795,260,000 \text{ (Annual Water Supply Paid)}}{13,064 \text{ (Total Number of Staff)}}$
The ratio between the current income and expenditure	81.6%	$\frac{305,641+178,457 \text{(Operating Revenue+Non-operating Revenue)}}{373,526+219,753 \text{(Operating Expenses+Non-operating Expenses)}}$

2) Financial Balance After Completion of the Project

The feasibility of the Project is examined here based on two cases of the financial balance of the GOGCWS, i.e. after the planned completion of the Project, with and without the implementation of the Project. The following assumptions are made for this examination.

① The ratio of the water supply paid for the Project Site is 80%.

② The annual increase rate of the water distribution volume is 3.5% based on the past performance.

③ Taking the targets set by the GOGCWS into consideration, the water charge collection ratio for the existing water supply facilities is 35% in 2000 and 63% in 2010.

④ The operation income excludes other operating income.

⑤ The operation income increases in proportion to the volume of water supply paid.

⑥ The operation cost increases in proportion to the water supply volume.

The estimated financial balance of the GOGCWS following the completion of the Project (2000 and 2010) based on the above assumptions is shown in Table 3-2-6. As the table indicates, the financial balance of the GOGCWS after the completion of the Project (for 2000 and 2010), shown as the ratio of the operation loss to the operation income, will decline by 0.5 - 0.9% excluding the depreciation cost or by 0.7 - 1.2% including the depreciation cost with the implementation of the Project. This suggests that the operation and maintenance of the new facilities by the GOGCWS following the completion of the Project is feasible although the overall financial balance of the GOGCWS will stay in the red in terms of both the operation balance and current balance.

The GOGCWS should, therefore, implement the following measures by 2000 to improve its financial state in order to make proper operation and maintenance of the new facilities viable after the completion of the Project.

① Revision of water charges to raise sufficient water supply income to meet the operation cost.

② Preparation and implementation of measures and an implementation programme to improve the water charge collection rate.

③ Improvement of maintenance technologies and skills.

Table 3-2-6 Estimated Financial Balance of GOGCWS After Completion of the Project

Water Supply Volume and Water Supply Paid After Completion of the Project (2000 and 2010) (Unit: 1,000 m^3)

	1995	2000			2010			Change After the Project (Average)
	(Present)	Without Project	Project Only	With Project	Without Project	Without Project	Project Only	
Water Supply Volume	1,537,867	1,797,703	28,800	1,826,503	2,533,394	43,070	2,576,464	1.7% increase
Water Charge Collection Rate	51.7%	55.0%	80.0%	55.4%	63.0%	80.0%	63.3%	0.35% increase
Water Supply Paid	795,260	988,737	23,040	1,011,777	1,596,038	34,456	1,630,494	2.3% increase

Operation Balance After Completion of the Project (2000 and 2010) (Unit: 1,000 LE)

	1995	2000			2010			Remarks
	(Present)	Without Project	Project Only	With Project	Without Project	Project Only	With Project	
(A) Operation Revenue	202,957	252,334	5,880	258,214	407,322	8,794	416,116	
(B) Operation Cost	373,526	436,636	6,996	443,632	615,325	10,461	625,786	
B1: Operation and Maintenance Cost	280,767	327,477	5,247	332,724	461,494	7,846	469,340	
B2: Depreciation Cost	92,759	109,159	1,749	110,908	153,831	2,615	156,446	
(C1) Operation Profit (A – B1)		-75,143	633	-74,510	-54,172	948	-53,224	
Ratio to (A) (C1/A × 100)		-29.8%	10.8%	-28.9%	-13.3%	10.8%	-12.8%	excluding depreciation cost
(C) Operation Profit (A – B)		-184,302	-1,116	-185,418	-208,003	-1,667	-209,670	
Ratio to (B) (C/A × 100)		-73.0%	-19.0%	-71.8%	-51.1%	-19.0%	-50.4%	excluding depreciation cost

CHAPTER 4

PROJECT EVALUATION AND RECOMMENDATIONS

CHAPTER 4 PROJECT EVALUATION AND RECOMMENDATIONS

4.1 Evaluation of Project Suitability and Project Effects

The Southern Pyramids Area, i.e. the Project Site, is a newly formed residential area located in the southwestern part of Giza City near Pyramids Street, a major trunk road. As the completion of the Greater Cairo Circular Road running south of the Project Site is now in sight in several years time, substantially shortening the travelling time to Cairo, the area's population has been rapidly increasing in recent years.

The Project Site has a land area of 8.2 km^2 and a current population of some 290,000 (1994) which is estimated to increase to some 560,000 in the target year (2010).

Although some parts of the Project Site have a water distribution system, the service ratio is still as low as some 25%. The present water distribution system does not constitute a stable system whereby water is distributed from a Waterworks to the distribution network via the water transmission main as well as water reservoir. Instead, water is directly distributed to the network via the water distribution trunk line. Because of (i) its distance from a Waterworks, (ii) its location at the far end of Giza City's water distribution network and (iii) the lack of such water distribution facilities as a water transmission main, water reservoir and water distribution trunk line, the Project Site suffers from an extremely low water supply volume as well as water supply pressure. Consequently, the areas served by the existing service network only receive 50 litres/person/day, which is far below the target supply volume of 210 litres/person/day of the GOGCWS for the Project Site, or little supply during the day.

In the case of areas without the service network which account for 75% of all, people obtain water from public water plugs, wells and travelling water tankers. All of these sources face specific problems. The water plugs impose the hard work of fetching water on women and children, the wells cause concern in regard to hygiene due to water contamination and the travelling water tankers are a financial burden on the household because of the high water price. The above-described situation suggests that those people living at the Project Site have a poor living environment and poor public hygiene.

In order to improve the situation, the GOGCWS prepared the General Water Supply System Development Plan for the Imbaba and Pyramid Areas designed to ensure a stable supply for the Southern Pyramids Area (the subject area of the present Project), Northern Pyramids Area and Imbaba Area. The present Project is the highest priority project under this Plan and intends the construction of a water transmission main and water reservoirs and the procurement of the water distribution pipes required for the development of the water distribution network to establish a water distribution system capable of providing a stable water supply for the people living at the Project Site.

With regard to the development of the water distribution network, the Japanese side will procure and provide the main water distribution pipes while the Giza municipal authority will procure the branch water distribution pipes to feed water from the water distribution main to the service pipe to each household, etc. and will conduct the laying work for all of the water distribution pipes. No problems are anticipated in regard to the ability of the Egyptian side to complete the necessary work as demonstrated by the previous projects.

Following the completion of the Project, the responsibility to operate and maintain the new facilities will be transferred to the GOGCWS from Giza City, which is the project implementation agency. The GOGCWS has been in the red for the last few years due to the sluggish performance of its operation income, in turn resulting from the low water charge level and also the practice of keeping as many employees as possible, both of which reflect the character of the GOGCWS as a state enterprise and the low water charge collection rate, and has been forced to rely on a subsidy provided by the central government and both domestic and foreign loans to make ends meet.

The financial balance of the GOGCWS following the completion of the Project will slightly improve as the ratio of the operation loss to the operation revenue will decline by 0.5 - 0.9%, excluding the depreciation cost, or by 0.7 - 1.2%, including the depreciation cost, with the implementation of the Project. This suggests that the operation and maintenance of the new facilities by the GOGCWS after the completion of the Project will be feasible although the overall financial balance of the GOGCWS will stay in the red in terms of both the operation balance and current balance.

The GOGCWS should, therefore, make efforts to implement a number of financial improvement measures currently in preparation, including the introduction of more appropriate water charges, rationalisation of the organization and improvement of the maintenance technologies, by 2000 in order to improve the financial state of its water supply operation and to make the self-financing of the operation and maintenance of the new facilities feasible after the Project's completion.

The implementation of the Project will result in a maximum daily water supply volume of 210 litres/person for the estimated 370,000 people living at the Project Site immediately after its completion (2000) and for 560,000 people in the Project's target year (2010), improving both the environment and standard of living as well as ensuring public hygiene.

The Project will also constitute a continued step forward after the previous projects to the substantial expansion and improvement of the water supply facilities which comprise important social infrastructure in Giza City. Moreover, the Project will help to promote the development programme of Giza City, have a profound effect on the steady socioeconomic development of the Greater Cairo Region.

From an environmental point of view, the issues to be examined in relation to the implementation of the Project consist of vibration at the time of the sheet pile driving and removal work, both dust and subsidence relating to the earth work for the laying of the new water transmission main and distribution pipes and piling work noise during the construction period and noise due to the operation of the new facilities after their completion. However, it is believed that the planned measures to reduce vibration and noise, etc. in connection with the earth work and piling work, etc. will minimise the adverse impacts of this work on local residents.

Given the points discussed above relating to the Project, the Project is judged to be feasible with grant aid provided by the Government of Japan provided that the Government of Egypt successfully fulfills its obligations to be described later. In view of its expected significant achievements, the Project is deemed to be highly suitable for Japanese grant aid.

Current Conditions and Problems	Remedial Measures Under the Project	Positive Effects and Improvement Under the Project
1. Low Level of Water Supply System Development • The delayed water supply system development in rapidly urbanised residential areas for ordinary workers has resulted in a poor living environment. • Some 75% of the Project Site has no water distribution network while areas which are supplied receive only a very low level of supply of 50 litres/person/day. • Those residents of areas without the water distribution network rely on public water plugs, wells and travelling water tankers for the supply of vital water. • Water supply through the public water plugs is a heavy burden on women who fetch the water, supply through wells caused concern in regard to hygiene due to the use of contaminated groundwater and supply from travelling water tankers constitutes a heavy burden on household finance because of the high price	Construction of New Water Distribution Network • In principle, a new water distribution network with a design supply of 210 litres/person/day will be constructed and connected to each household.	• Direct improvement of the living environment and convenience will be achieve for the 370,000 residents in the year 2000 after the Project's completion and the 560,000 residents in the design target year of 2010 to ensure a better standard of sanitation. • Women and children will be freed from the hard work of fetching water. • The abolition of the use of contaminated groundwater from wells will eradicate the concern in regard to health. • The non-dependence on expensive water from travelling water tankers will improve the standard of living.

Current Conditions and Problems	Remedial Measures Under the Project	Positive Effects and Improvement Under the Project
2. Absence of Water Transmission Main	Construction of Water Transmission Main	
• While the water distribution network is available for some 25% of the Project Area, the long distance of the network from the South Giza Waterworks, the main supply source, means an insufficient supply volume and supply pressure, resulting in unstable water supply.	• The water transmission main will be extended to near the consumption area without branching out. • The water distribution network will be constructed around the water distribution station.	• The shortened length of the water distribution lines will ensure a uniform level of water flow and water pressure to the end. • The future link between the southern and northern trunk routes will enable the highly efficient operation of the water supply service in Giza City.
3. Shortage of Water Reservoirs	Construction of Water Reservoirs	
• There are only two small water reservoirs around the Project Site and the waterworks are forced to conduct overload operation during peak hours, causing a deterioration of the water quality and insufficient water pressure as well as flow at the ends of the network.	• A volume of water equivalent to five hours supply of the maximum daily supply volume will be stored. • Water storage operation at the new water reservoirs during off-peak hours will minimise the water transmission volume during peak hours.	• The nominal water reservoir capacity on the west bank of the Nile will increase by 25,000 m^3 and the sufficiency rate will improve to 45%. • The supply of drinking water at the time of an emergency will become possible. • The prospect of a stable water supply will also be improved in areas where there are no water storage facilities around the Project Site.

4.2 Recommendations

Some issues demand further improvement or development in the coming years to ensure the firm implementation of the Project and the sustainable operation and maintenance of the new facilities after the completion of the Project.

(1) Continuation of Phased Improvement

The Project is the first stage of the General Improvement Plan for the Water Supply System in the Embaba and Pyramids Areas. The extension of the water distribution network and construction of a new water transmission main in the Embaba and Northern Pyramids Areas in the future will certainly enhance the positive effects of the Project. Consequently, the Giza municipal authority is required to secure the necessary funding for the ultimate completion of the Plan in the future.

(2) Provision of Necessary Funds by Egyptian Side

It will be necessary for the Giza municipal authority to secure the required funds to finance the work for which it is responsible, ranging from the acquisition of the water reservoir sites to the laying of the water distribution pipes, for the smooth implementation and in order to meet the targets of the Project.

(3) Improvement of Management

The water supply operation of the GOGCWS is currently recording an annual deficit, including business difficulties. The management improvement programme prepared with US assistance suggests the following improvement measures.

① Revision of the water charge to a level capable of financing the operation and maintenance cost of the water supply facilities to ensure the autonomous development of the service in financial terms.

② Improvement of the water charge collection rate.

③ Efficient use of facilities and an improved chargeable water supply ratio through improvement of the staff maintenance skills.

④ Appropriate assignment of manpower and reduction of the personnel cost through a thorough review of the water supply facilities and required manpower level.

The GOGCWS should implement these improvement measures without fail to establish a sound financial situation as soon as possible in view of appropriate operation and maintenance work after the Project's completion.

As described earlier, the prospective balance after the completion of the Project will improve, provided that the following requirements are met, compared to the case where the Project is not implemented.

① Strict care is taken in regard to the exact planning and implementation of the construction work with improved construction skills to contain the leakage ratio at less than 10% given the fact that all of the water distribution and transmission pipes will be newly laid.

② The water charge system and obligation to pay the water charge is widely publicised vis-a-vis local residents prior to the commencement of the pipe laying work with a view to improving the water charge collection rate to not less than 80%.

(4) Service Connection to Each Household

If the water distribution pipe laying work and house connection work to be conducted by the Giza municipal authority are delayed, the planned functions under the Project will not be duly performed after the Project's completion. Based on experience accumulated through previous projects, it is essential that the Giza municipal authority establish the Water Distribution Extension Promotion Committee to prepare appropriate work schedule, detailed design, manpower, procurement and work placement plans together with adequate budgetary appropriation to ensure the punctual implementation and completion of all work at the time of the completion of the Project.

(5) Response to New Technologies

The GOGCWS's maintenance staff at the exiting water distribution pumping stations have an adequate level to operate and maintain the pumping system but need to undergo upgrading training in relation to the technologies introduced under the Project, the effective use of the residual head of the water transmission main, the efficient use of the water reservoir capacity and adjustment of the water distribution pressure using the speed control pump. The GOGCWS should accordingly promptly appoint operation and maintenance personnel to be responsible for the management of the new water distribution system to be established under the Project and these operation and maintenance personnel should participate in the OJT and operation guidance sessions to be organized as part of the Project.

(6) Improvement of Technical Capability

As it is planned to conduct a technical training programme based on project-type technical cooperation provided by Japan in parallel with the OJT to be organized during the construction period of the Project as well as after the commissioning of the new facilities constructed under the Project, it will be possible for the OJT to be integrated with the training programme envisaged by the project-type technical cooperation. It is, therefore, essential for the Egyptian side to understand the significance of this OJT and training programme and to use them to improve the operation and maintenance skills of the GOGCWS staff. The prospective technical training may include the following subjects. The proposed technical training may include the following subjects.

- Water distribution/transmission network computation techniques
- Division of the service area into blocks and leakage probing techniques
- Distribution pipe design and laying technologies
- Service pipe installation technology
- Pump speed control technology
- Pump installation and maintenance technologies

APPENDIX 1

MEMBER LIST OF THE SURVEY TEAM

1. Basic Design Study

Name	Assignment	Current Position / Company
Haruo IWAHORI	Leader	Development Specialist, Institute for International Cooperation, JICA
Yuichi SUGANO	Coordinator	First Project Study Division, Grant Aid Project Study Department, JICA
Noboru SAEKI	Chief Consultant / Maintenance & Operation Planner	Yachiyo Engineering Co., LTD.
Masahiro TAKEUCHI	Water Supply Planner / Pipeline Designer	Yachiyo Engineering Co., LTD.
Masatsugu KOMIYA	Mechanical and Electrical Facilities Planner	Yachiyo Engineering Co., LTD.
Toshio TAKESHIMA	Civil Engineer	Yachiyo Engineering Co., LTD.
Katsumi FUJII	Procurement Planner / Cost Estimation	Yachiyo Engineering Co., LTD.

2. Draft Basic Design Explanation

Name	Assignment	Current Position / Company
Haruo IWAHORI	Leader	Development Specialist, Institute for International Cooperation, JICA
Noboru SAEKI	Chief Consultant / Maintenance & Operation Planner	Yachiyo Engineering Co., LTD.
Masahiro TAKEUCHI	Water Supply Planner / Pipeline Designer	Yachiyo Engineering Co., LTD.

APPENDIX 2

SURVEY SCHEDULE

1. Basic Design Study Team

Day No.	Date	Weather	Stay	Travelling	Activities
1	Jan. 11 Sat.	Fine	Paris	Leave Tokyo 12:15 (JL 405) Arrive Paris 16:55	Government members [Iwabori (Team Leader) and Sugano] and consultant staff members (Saeki, Takeuchi, Komiya and Fujii) leave Japan (Tokyo)
2	Jan. 12 Sun.	Fine	Cairo	Leave Paris 13:50 (AF 8004) Arrive Cairo 19:20	All members arrive in Cairo
3	Jan. 13 Mon.	Fine	Cairo		- Courtesy visit to and meeting at JICA Office - Courtesy visit to MOEIC to explain IC/R - Courtesy visit to Giza City and discussions on study schedule
4	Jan. 14 Tues.	Fine	Cairo		- Courtesy visit to GOGCWS and discussions on technical issues
5	Jan. 15 Wed.	Fine	Cairo		- Discussions with GOGCWS on technical issues - Discussions with Giza City (on the questionnaire, etc.) - Survey on project site - Preparations for local subcontracting
6	Jan. 16 Thur.	Fine	Cairo		- Discussions with Giza City - Survey on project site - Survey on facilities construction under previous project - Preparations for local subcontracting
7	Jan. 17 Fri.	Fine	Cairo		Survey on project site
8	Jan. 18 Sat.	Fine	Cairo		- Discussions with Giza City on Minutes - Survey on project-related facilities - Data gathering - Survey on project site (on water supply situation, including existing water supply facilities)
9	Jan. 19 Sun.	Fine	Cairo		- Survey on project site - Survey on project-related facilities - Courtesy visit to Mayor of Giza City - Survey related to procurement - Preparations for local subcontracting
10	Jan. 20 Mon.	Fine	Cairo		- Courtesy visit to Governor of Giza Governorate - Signing of Minutes of Discussions - Reporting to Japanese Embassy - Discussions with GOGCWS on questionnaire - Preparations for local subcontracting
11	Jan. 21 Tues.	Fine	Cairo		- Survey on project site - Survey on project-related facilities (distribution reservoir, etc.) - Survey related to procurement - Data gathering - Preparations for local subcontracting

12	Jan. 22	Wed.	Fine	Cairo	Leave Cairo 08:46 (BA 154) Arrive London 12:00	- Government members leave Egypt (overnight in London) < Consultant Staff Members > - Survey on project site (proposed distribution reservoir site, etc.) - Survey on project-related facilities - Survey related to procurement
13	Jan. 23	Thur.	Fine	Cairo	Leave London 19:00 (JL 402)	- Government members on the move (overnight onboard aircraft) < Consultant Staff Members > - Survey on project site - Survey on project-related facilities - Survey related to procurement - Data gathering - Natural conditions survey (geological survey)
14	Jan. 24	Fri.	Fine	Cairo	Arrive Tokyo 15:40	- Government members arrive in Tokyo < Consultant Staff Members > - New member, Takeshima, arrived in Cairo (AF 8004) - Day off for other members in Egypt
15	Jan. 25	Sat.	Fine	Cairo		- Survey on project site - Survey on operation and maintenance system - Discussions with GOGCWS on technical issues (conditions of existing distribution lines, etc.) - Discussions with Gaza City (on land acquisition at proposed distribution reservoir site) - Survey related to procurement - Data gathering - Natural conditions survey
16	Jan. 26	Sun.	Fine	Cairo		- Survey on project site - Survey on operation and maintenance system - Preparation of field report (FLD/R) (on general water distribution system) - Survey related to procurement - Data gathering - Natural conditions survey
17	Jan 27	Mon.	Fine	Cairo		- Survey on project site - Survey on operation and maintenance system - Preparation of field report (FLD/R) (on general water distribution system) - Survey related to procurement - Data gathering - Natural conditions survey
18	Jan. 28	Tues.	Fine	Cairo		- Survey on project site - Survey on operation and maintenance system - Discussions with Cairo Electricity Board - Survey related to procurement - Data gathering - Natural conditions survey

19	Jan. 29	Wed.	Fine	Cairo		- Survey on project site - Survey on operation and maintenance system - Survey related to procurement - Data gathering - Natural conditions survey - Preparation of FLD/R (on electrical equipment) - Explanation of and discussions on FLD/R with GOGCWS
20	Jan. 30	Thur.	Fine	Cairo		- Interim reporting to Giza City - Survey related to procurement - Data gathering - Natural conditions survey - Preparation of FLD/R (on electrical equipment) - Explanation of and discussions of FLD/R with GOGCWS
21	Jan. 31	Fri.	Fine	Cairo		Day off
22	Feb. 1	Sat.	Fine	Cairo	Leave Cairo 08:45 (BA 154) Arrive London 12:00	- Komiya and Fuji leave Egypt (overnight in London - Saeki, Takeuchi and Takeshima continue their work in Egypt - Preparation of FLD/R (on structure of distribution reservoir, etc.) - Survey related to procurement - Natural conditions survey
23	Feb. 2	Sun.	Fine	Cairo	Leave London 19:00 (JL 402)	- Komiya and Fuji on the move (overnight onboard aircraft) < Other Consultant Staff Members) - Discussions with GOGCWS (on local procurement of piping, etc.) - Preparation of FLD/R - Data analysis - Natural conditions survey
24	Feb. 3	Mon.	Fine/ Cloudy	Cairo	Arrive Tokyo 15:40	- Komiya and Fuji arrive in Tokyo < Other Consultant Staff Members > - Preparation of FLD/R - Data analysis - Natural conditions survey
25	Feb. 4	Tues.	Cloudy with some rain	Cairo		- Explanation of and discussions on FLD/R with GOGCWS - Data analysis - Discussions with Drainage and Canal Directorate of Cairo Governorate
26	Feb. 5	Wed.	Fine	Cairo		- Explanation of and discussions on FLD/R with Giza City and GOGCWS - Data analysis - Natural conditions survey
27	Feb. 6	Thur.	Fine	Cairo		- Data analysis - Analysis of natural conditions survey results
28	Feb. 7	Fri.	Fine	Cairo		Day off
29	Feb. 8	Sat.	Fine	Cairo		- Data analysis - Analysis of natural conditions survey results

30	Feb. 9	Sun.	Fine	Cairo		- Data analysis - Analysis of natural conditions survey results
31	Feb. 10	Mon.	Cloudy with some rain	Cairo		- Data analysis - Analysis of natural conditions survey results - Preparation of summary of survey results
32	Feb. 11	Tue.	Fine	Cairo		- Data analysis - Analysis of natural conditions survey results - Preparation of summary of survey results
33	Feb. 12	Wed.	Fine	Cairo		Reporting of survey results to Japanese Embassy, JICA Office and Giza City and departure from Egypt on following day
34	Feb. 13	Thur.	Fine	London	Leave Cairo 08:45 (BA 154) Arrive London 12:00	Saeki, Takeuchi and Takeshima leave Egypt
35	Feb. 14	Fri.	-	-	Leave London 19:00 (JL 402)	Consultant party of three on the move (overnight onboard aircraft)
36	Feb. 15	Sat.	-	-	Arrive Tokyo 15:40	Consultant party of three arrives in Tokyo

2. Draft Basic Design Explanation Team

Day No.	Date		Weather	Stay	Travelling	Activities
1	May 12	Mon.	Fine	Paris	Leave Tokyo 12:00 (AF 275) Arrive Paris 17:20	Team members leave Japan (Tokyo)
2	May 13	Tue.	Fine	Cairo	Leave Paris 13:45 (AF 8004) Arrive Cairo 19:15	Team members arrive in Cairo
3	May 14	Wed.	Fine	Cairo		- Courtesy visit to and meeting at JICA Office - Courtesy visit to Japanese Embassy - Courtesy visit to MOEIC - Courtesy visit and submission of Draft Basic Design (D.BD) to Giza City
4	May 15	Thur.	Fine	Cairo		- Explanation of contents of D.BD to Giza City - Confirmation of items to be undertaken by Giza City
5	May 16	Fri.	Fine	Cairo		- Team discussion - Preparation of draft Minutes of Discussions (M/D)
6	May 17	Sat.	Fine	Cairo		Courtesy visit to GOGCWS, explanation of D.BD and discussions on technical issues
7	May 18	Sun.	Fine	Cairo		- Discussions on technical issues with GOGCWS - Survey on project sites
8	May 19	Mon.	Fine	Cairo		Submission and explanation of draft M/D to Giza City followed by discussions
9	May 20	Tue.	Fine	Cairo		- Signing of M/D - Reporting to JICA and Japanese Embassy
10	May 21	Wed.	Fine	Paris	Leave Cairo 08:00 (AF 8003) Arrive Paris 11:40	Team members leave Egypt
11	May 22	Thur.	-	-	Leave Paris 13:30 (AF 276)	Team members on the move (overnight onboard aircraft)
12	May 23	Fri.	-	-	Arrive Tokyo 08:15	Team members arrive in Tokyo

APPENDIX 3

LIST OF PARTY CONCERNED IN THE RECIPIENT COUNTRY

List of party concerned in the recipient country

Name and Agency	Position
MINISTRY OF ECONOMY & INTERNATIONAL COOPERATION (MOEIC)	
MR. AHMED RAGAI	FIRST UNDERSECRETARY
MS. SANAA HAGAZI	HEAD OF ASIA DEPARTMENT
MR. HASSAN G. LASHEEN	JAPAN DEPARTMENT DIRECTOR
MR. EHAB MOHAMED	ECONOMIC RESEARCHER
GIZA GOVERNORATE	
DR. ABDEL REHEEM SHEHATA	GOVERNOR
MR. AHMED EFFAT	SECRETARY GENERAL
GIZA CITY	
MR. SAYED SALEH	MAYOR
MR. HAMDY EL TAWEL	SECRETARY GENERAL
DR. NABIL MAKHLOUF	TECHNICAL ADVISER
MR. NASR ABDALLAH AMBER	MANAGER OF INFRASTRUCTURE AND BRIDGE DEPARTMENT
MR. IBRAHIM ABD EL WEHAB	MANAGER OF FINANCIAL DEPARTMENT
GENERAL ORGANIZATION FOR GREATER CAIRO WATER SUPPLY (GOGCWS)	
MR. ADEL EL TOWEIRY	CHAIRMAN
MR. FARAH. K. FARAH	GENERAL DIRECTOR OF PROJECT DEPARTMENT
MS. NAGWA ZAGHLAUL	FIRST ENGINEER OF SOUTH GIZA WATER TREATMENT PLANT
MR. AWAD AHMED	MECHANICAL ENGINEER OF SOUTH GIZA WATER TREATMENT PLANT
MR. MOHAMED SHAWKY	ELECTRIC ENGINEER OF SOUTH GIZA WATER TREATMENT PLANT

Name and Agency	Position
MR. ABDEL AZIZ GAD	MANAGER OF PYRAMIDS WATER NETWORK CENTER
MRS. SALWA ABD EL MENAM	DEPUTY MANAGER OF NETWORK RENEWAL AND WATER SUPPLY SERVICES DEPARTMENT
THE CENTRAL DEPARTMENT OF DRAINAGE FOR GIZA GOVERNORATE	
MR. WAGIH ROSHDY	GENERAL MANAGER
MR. GEORGE MECHARAKY	MANAGER OF DRAINAGE WORKS
CAIRO DISTRIBUTION COMPANY (SOUTH GIZA NETWORKS)	
MR. MOHAMED ABU EL FADEL	GENERAL MANAGER
MR. REFAAT KENAWY	MANAGER OF MEDIUM VOLTAGE DEPARTMENT

APPENDIX 4

MINUTES OF DISCUSSIONS

MINUTES OF DISCUSSIONS

BASIC DESIGN STUDY
ON
THE PROJECT FOR IMPROVEMENT OF WATER SUPPLY SYSTEM
AT THE SOUTHERN PYRAMIDS AREA
IN GIZA CITY
IN
THE ARAB REPUBLIC OF EGYPT

In response to a request from the Government of the Arab Republic of Egypt, the Government of Japan decided to conduct a basic design study on the Project for Improvement of Water Supply System at the Southern Pyramids Area in Giza City (hereinafter referred to as "the Project") and entrusted the study to Japan International Cooperation Agency (JICA).

JICA has sent to Egypt a study team, which is headed by Mr. Haruo Iwahori, Development Specialist, Institute for International Cooperation, JICA, and is scheduled to stay in the country from January 12 to February 13, 1997.

The team held discussions with the officials concerned of the Government of Egypt and conducted a field survey at the study area.

In the course of the discussions and field survey, both parties have confirmed the main items described on the attached sheets. The team will proceed to further works and prepare the Basic Design Study report.

Giza, January 20, 1997

岩堀春雄

Mr. Haruo Iwahori
Leader
Basic Design Study Team
JICA

Sayed Saleh

Mr. Sayed Saleh
Mayor of Giza City
Giza Governorate
The Arab Republic of Egypt

Mr. Ahmed Ragai
First Undersecretary
Ministry of Economic and International Cooperation
The Arab Republic of Egypt

ATTACHMENT

1. Title of the Project

The official title of the Project is **Improvement of Water Supply System at the Southern Pyramids Area in Giza City**.

2. Objective

The objective of the Project is to improve the living standard and sanitation condition of the residents in the Project site, where the people have been suffering from a chronic water shortage, by upgrading the water supply system to meet the water supply demand in the target year of 2010.

3. Project Site

The Project site is the Southern Pyramids Area of Pyramids District in Giza City, Giza Governorate, the location of which is shown in Annex-I.

4. Responsible and Executing Organization

- Responsible and Coordinating Organization for the Project:
  Giza Governorate
- Executing Organization of the Project:
  Giza City

The organization of Giza Governorate and Giza City is shown in Annex-II.

5. Items requested by the Egyptian side

After discussions with the Basic Design Study Team, the following items were finally requested by the Egyptian side.

(1) Construction of water transmission main
  - Diameter : 1,000mm, Length : approx. 4.2km
  - Diameter : 800mm, Length : approx. 2.1km

(2) Construction of ground water reservoir with distribution pump system
  - Capacity : approx. 14,000m^3, 1 unit
  - Capacity : approx. 11,000m^3, 1 unit

(3) Construction of aqueduct

(4) Provision of piping materials
  - Diameter : 600mm～100mm
  - Length : approx. 96km

S. S. A

However, final items to be constructed and procured under Japan's Grant Aid will be decided after further studies in Japan, taking account of :

- existing conditions of the water supply system
- justification of the Project in the future plan for the water supply system
- water supply demand forecast
- operation and maintenance capability of the operating authority
- economic and administrative viability of the Project

6. Japan's Grant Aid System

(1) The Government of Egypt has understood the system of Japan's Grant Aid explained by the Team, as described in Annex-III.

(2) The Government of Egypt will take necessary measures, as described in Annex-IV, for smooth implementation of the Project, on condition that the Grant Aid by the Government of Japan is extended to the Project.

7. Schedule of the Study

(1) The consultant will proceed to further studies in Egypt until February 13, 1997.

(2) Based on the Minutes of Discussions and technical examination of the field survey results, JICA will prepare a draft basic design study report and dispatch a mission to Egypt in order to explain its contents to the Egyptian side around the middle of May,1997.

(3) In case that the contents of the draft report are accepted in principal by the Government of Egypt, JICA will complete the final report and send it to the Government of Egypt by the end of July 1997.

8. Required Undertaking from Giza Governorate in case Japan's Grant is executed:

(1) to secure the land for water supply system and other related facilities.

(2) to provide temporary land for a construction liaison office, warehouse, stockyard, etc., during the construction period.

(3) to provide necessary data and information for detailed design. These data and information are not eligible to be delivered to the third parties or brought to their notice unless there is a written consent by Giza Governorate.

(4) to give permission required for test pitting to check underground services at the time of detailed design, if necessary.

(5) to take necessary actions to expedite permissions and approvals necessary for execution of the Project by Giza Governorate.

(6) to give permission required for all the works related to the Project, e.g., opening of

manholes, entering into canal lot, surveying on the road, etc.

(7) to witness and confirm by the authorities concerned when test pitting, and protection and relocation of services are carried out.

(8) to take necessary measures for inhabitant's cooperation and traffic control.

(9) to take necessary measures for historical remains which may be encountered during the construction period, if any.

(10) to provide disposal places of the waste water containing silt, clay, etc., discharged during the construction period.

(11) to form a committee in Giza City to expedite the Project.

(12) to expedite the above mentioned execution of the water supply branch lines in order to keep the planned construction schedule of the Project.

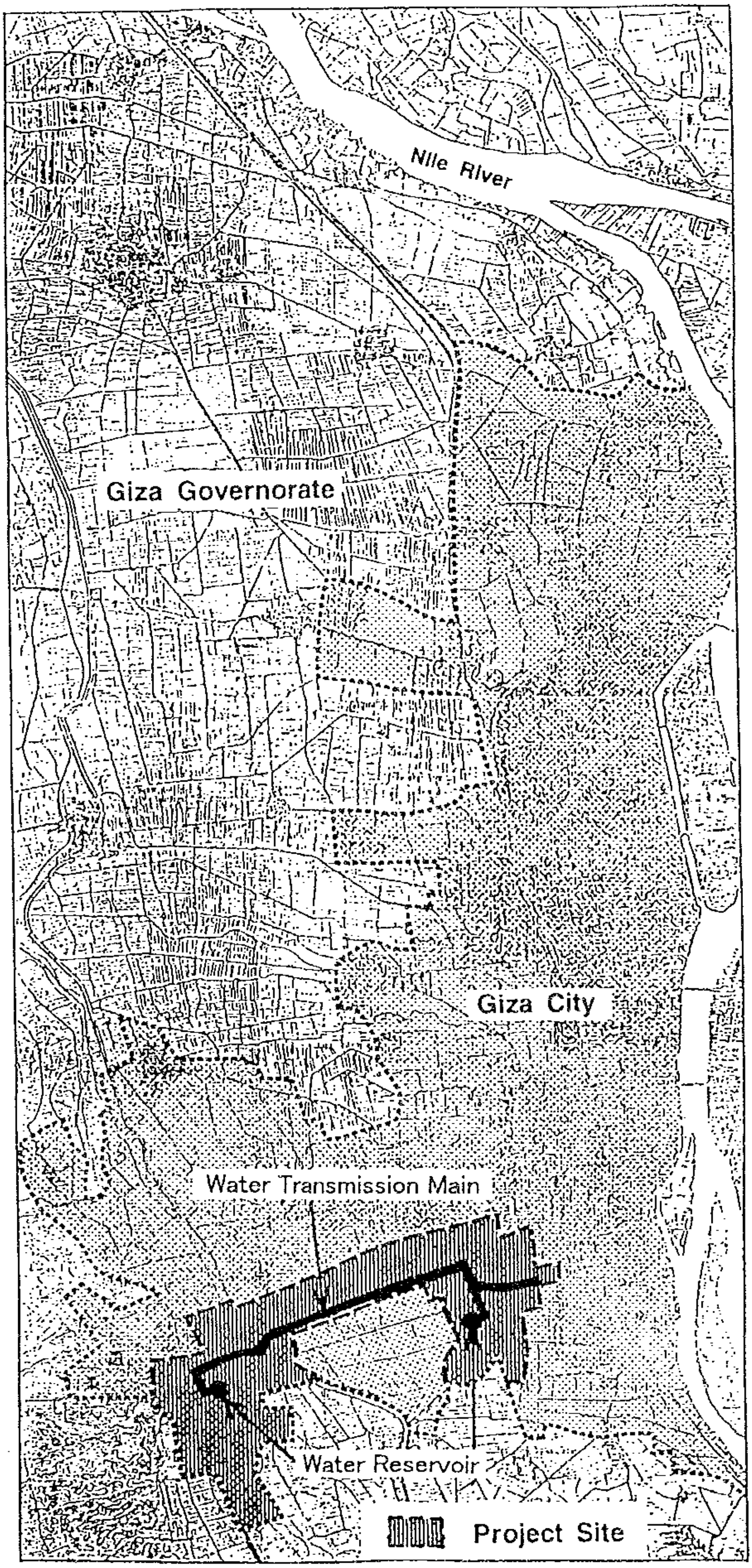
(13) to prepare the budget securing and allocation schedule for the works to be done by Giza Governorate during the construction period of the Project and submit it to the Japanese side by the time when the mission for draft report explanation is dispatched.

9. Other relevant issue

(1) The Team explained to the Egyptian side the importance of executing the renewal of the existing water supply facilities based upon the renewal schedule for the continuous proper operation of the facilities and the Egyptian side has understood it.

(2) The Egyptian side requested for elevated reservoir according to the available pressure in the network. The Japanese side compared the initial construction cost and O/M cost of the elevated reservoir system and the ground reservoir system. As a result, the Japanese side suggested that the latter system is more economical and technically sound. Finally both sides agreed to adopt the ground reservoir system.

Annex-I Project Site



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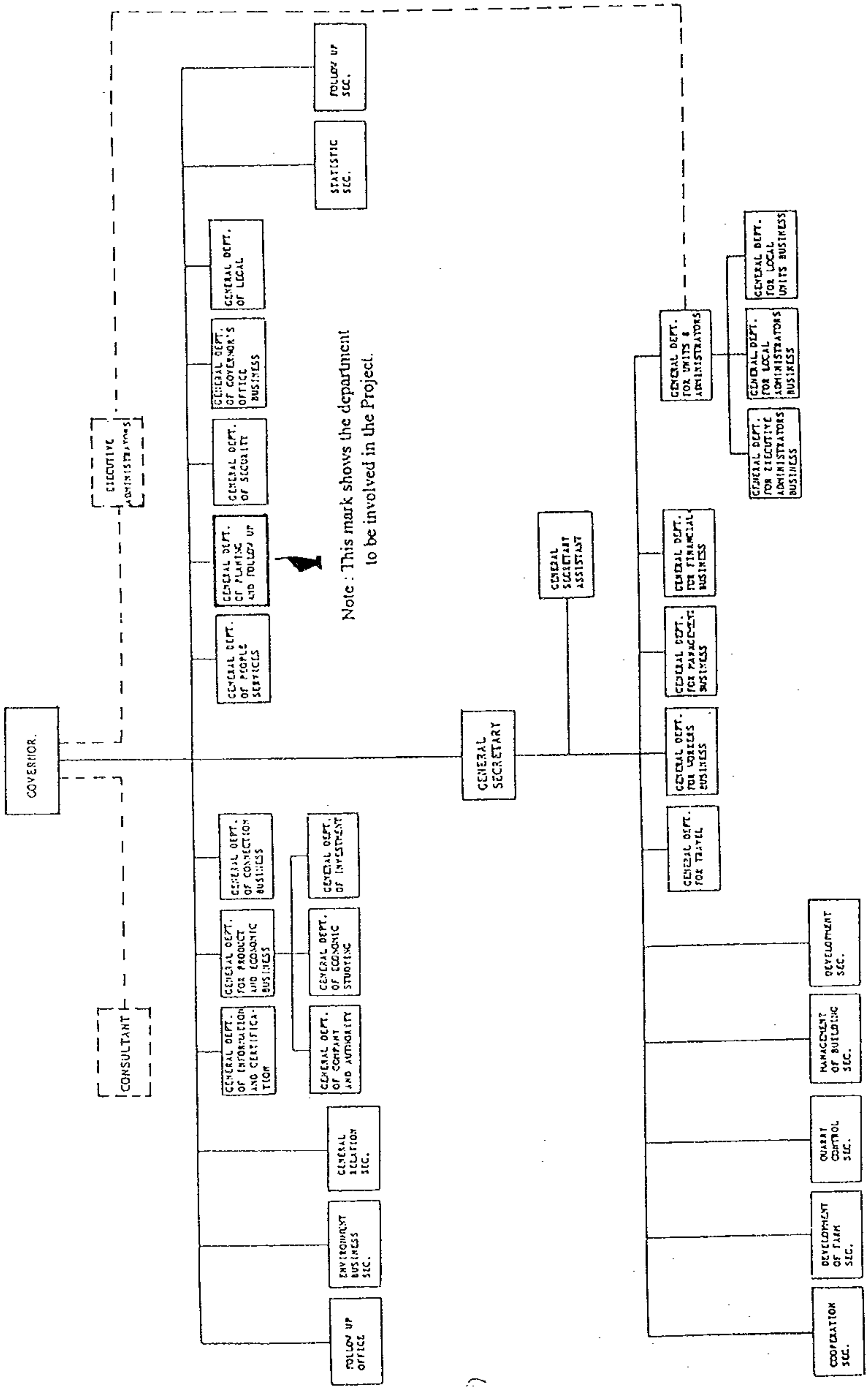
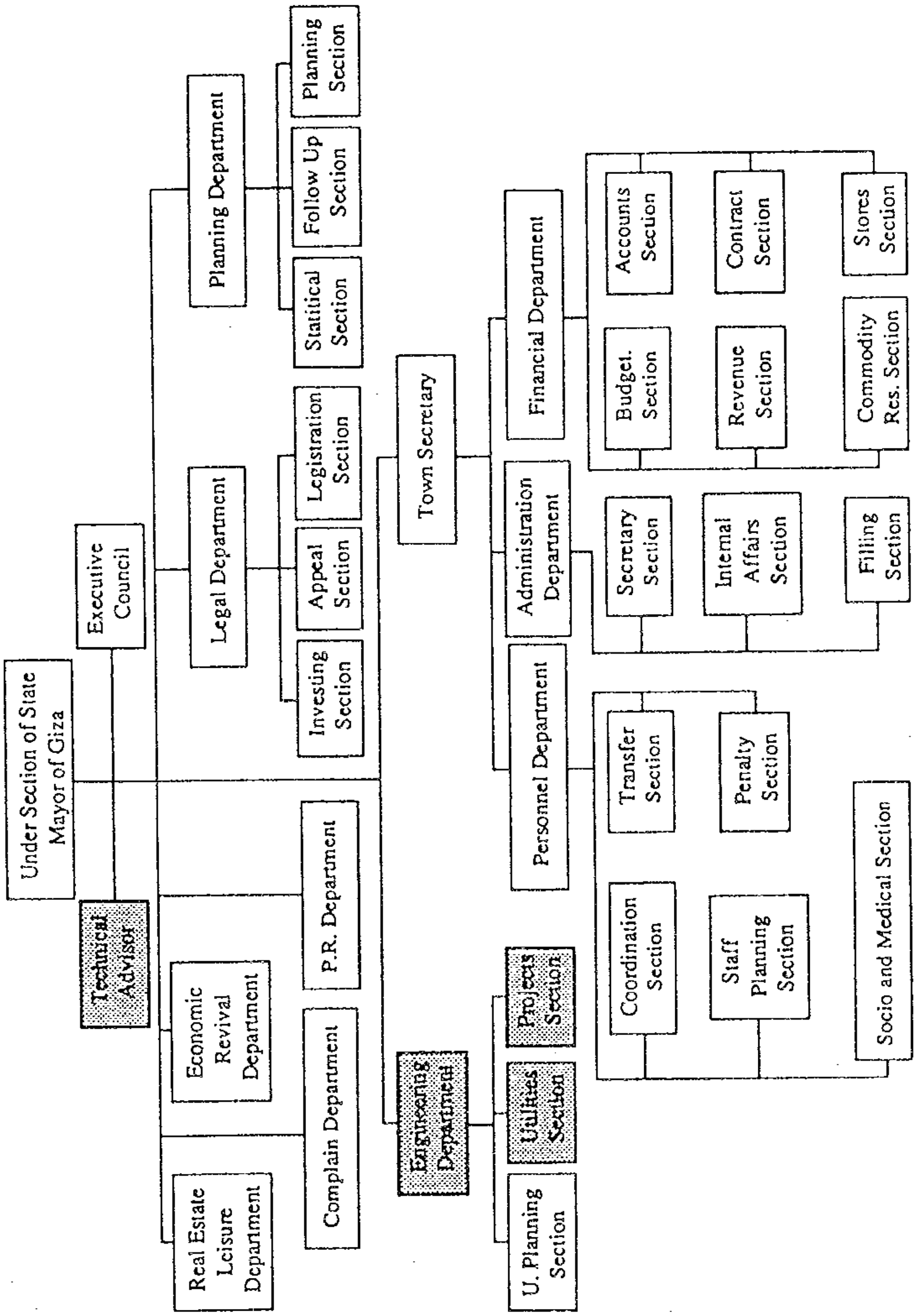
Annex-II (1/2) Organization of Giza Governorate



Annex-II (2/2) Organization of Giza City



Note : Shadowed parts show the section and department to be involved in the Project.

Annex-III Japan's Grant Aid Scheme

Japan's Grant Aid Scheme

1. Grant Aid Procedures

(1) Japan's Grant Aid Program is executed through the following procedures.

Application	(Request made by a recipient country)
Study	(Basic Design Study conducted by JICA)
Appraisal & Approval	(Appraisal by the Government of Japan and Approval by Cabinet)
Determination of Implementation	(The Notes exchanged between the Governments of Japan and the recipient country)

(2) Firstly, the application or request for a Grant Aid project submitted by a recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether or not it is eligible for Grant Aid. If the request is deemed appropriate, the Government of Japan assigns JICA (Japan International Cooperation Agency) to conduct a study on the request.
Secondly, JICA conducts the study (Basic Design Study), using (a) Japanese consulting firm(s).
Thirdly, the Government of Japan appraises the project to see whether or not it is suitable for Japan's Grant Aid Program, based on the Basic Design Study report prepared by JICA, and the results are then submitted to the Cabinet for approval.
Fourthly, the project, once approved by the Cabinet, becomes official with the Exchange of Notes signed by the Governments of Japan and the recipient country.
Finally, for the implementation of the project, JICA assists the recipient country in such matters as preparing tenders, contracts and so on.

2. Basic Design Study

(1) Contents of the Study
The aim of the Basic Design Study (hereinafter referred to as "the Study"), conducted by JICA on a requested project (hereinafter referred to as "the Project") is to provide a basic document necessary for the appraisal of the Project by the Japanese Government. The contents of the Study are as follows:

a) Confirmation of the background, objectives, and benefits of the requested project and also institutional capacity of agencies concerned of the recipient country necessary for the Project's implementation.
b) Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, social and economic point of view.
c) Confirmation of items agreed on by both parties concerning the basic concept of the Project.
d) Preparation of a basic design of the Project
e) Estimation of costs of the Project

The contents of the original request are not necessarily approved in their initial form as the contents of the Grant Aid project. The Basic Design of the Project is confirmed considering the guidelines of Japan's Grant Aid Scheme.
The Government of Japan requests the Government of the recipient country to take whatever measures are necessary to ensure its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country

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through the Minutes of Discussions.

(2) Selection of Consultants
For smooth implementation of the Study, JICA uses (a) registered consultant firm(s). JICA selects (a) firms(s) based on proposals submitted by interested firms. The firm(s) selected carry(ies) out a Basic Design Study and write(s) a report, based upon terms of reference set by JICA.
The consulting firm(s) used for the Study is(are) recommended by JICA to the recipient country to also work on the Project's implementation after the Exchange of Notes, in order to maintain technical consistency and also to avoid any undue delay in implementation should the selection process be repeated.

3. Japan's Grant Aid Scheme

(1) What is Grant Aid?
The Grant Aid Program provides a recipient country with non-reimbursable funds to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. Grant Aid is not supplied through the donation of materials as such.

(2) Exchange of Notes (E/N)
Japan's Grant Aid is extended in accordance with the Notes exchanged by the two Governments concerned, in which the objectives of the Project, period of execution, conditions and amount of the Grant Aid, etc., are confirmed.

(3) "The period of the Grant Aid" means the one fiscal year which the Cabinet approves the Project for. Within the fiscal year, all procedures such as exchanging of the Notes, concluding contracts with (a) consultant firm(s) and (a) contractor(s) and final payment to them must be completed.
However in case of delays in delivery, installation or construction due to unforeseen factors such as weather, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

(4) Under the Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased.
When the two Governments deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country.
However the prime contractors, namely, consulting, contracting and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

(5) Necessity of "Verification"
The Government of recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. This "Verification" is deemed necessary to secure accountability to Japanese taxpayers.

(6) Undertakings required of the Government of the Recipient Country
In the implementation of the Grant Aid project, the recipient country is required to undertake such necessary measures as the following:
1) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the construction.
2) To provide facilities for the distribution of electricity, water supply and drainage and other

incidental facilities in and around the sites.

3) To secure buildings prior to the procurement in case the installation of the equipment.
4) To ensure all the expenses and prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid.
5) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts.
6) To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the Verified Contracts, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.

(7) "Proper Use"

The recipient country is required to maintain and use the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

(8) "Re-export"

The products purchased under the Grant Aid should not be re-exported from the recipient country.

(9) Banking Arrangements (B/A)

1) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in an authorized foreign exchange bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.
2) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an authorization to pay issued by the Government of the recipient country or its designated authority.

Annex-IV Necessary measures to be taken by the Government of the Arab Republic of Egypt on condition that Japan's Grant Aid is extended.

1. to undertake incidental outdoor works such as gardening, fencing, gates and exterior lighting in and around the site.

2. to construct the access road to the site prior to the commencement of the construction.

3. to provide facilities for distribution of electricity, water supply, telephone, drainage and other incidental facilities to the Project site.

4. to ensure prompt unloading and customs clearance of the goods for the Project at the port of disembarkation in the Arab Republic of Egypt.

5. to exempt Japanese nationals from custom duties, internal taxes and other fiscal levies which may be imposed in the Arab Republic of Egypt with respect to the supply of the products and services under the verified Contracts. And to take necessary measures for such tax exemption.

6. to accord Japanese nationals whose services may be required in connection with the supply of products and services under the verified contract(s) such facilities as may be necessary for their entry into the Arab Republic of Egypt and stay therein for the performance of their work.

7. to use and maintain properly and effectively all the facilities constructed, and equipment and materials purchased under the Japan's Grant Aid.

8. to bear all the expenses other than those to be borne by the Grant Aid necessary for the execution of the Project.

MINUTES OF DISCUSSIONS

BASIC DESIGN STUDY
ON
THE PROJECT
FOR
IMPROVEMENT OF WATER SUPPLY SYSTEM
AT THE SOUTHERN PYRAMIDS AREA IN GIZA CITY
IN
THE ARAB REPUBLIC OF EGYPT
(CONSULTATION ON DRAFT REPORT)

In January 1997, the Japan International Cooperation Agency (JICA) dispatched a Basic Design Study Team on the Project for Improvement of Water Supply System at the Southern Pyramids Area in Giza City (hereinafter referred to as "the Project") to the Arab Republic of Egypt, and through discussions, field survey, and technical examination of the results in Japan, has prepared the draft report of the Study.

In order to explain and to consult the Egyptian side on components of the draft report, JICA sent to Egypt a study team, which is headed by Mr. Haruo Iwahori, Development Specialist, Institute for International Cooperation, JICA, and is scheduled to stay in the country from May 13 to 21, 1997.

As a result of discussions, both parties confirmed the main items described on the attached sheets.

Giza, May 20, 1997

岩堀 春雄

Mr. Haruo Iwahori
Leader
Basic Design Study Team
JICA

Sayed Saleh

Mr. Sayed Saleh
Mayor of Giza City
Giza Governorate
The Arab Republic of Egypt

Ahmed Ragai

Mr. Ahmed Ragai
First Undersecretary
Ministry of Economic and International Cooperation
The Arab Republic of Egypt

Sayed

ATTACHMENT

1. Components of the Draft Report

The Government of Egypt has agreed and accepted in principle the components of the Draft Report proposed by the Team.

2. Japan's Grant Aid System

(1) The Government of Egypt has understood the system of Japan's Grant Aid explained by the Team, as described in Annex-I.

(2) The Government of Egypt will take necessary measures, as described in Annex-II, for smooth implementation of the Project, on condition that the Grant Aid assistance by the Government of Japan is extended to the Project.

3. Further schedule

The Team will make the final report in accordance with the confirmed items, and send it to the Government of Egypt by the end of July, 1997

4. Required Undertakings from Giza Governorate in case Japan's Grant is executed

(1) to secure the land for two (2) water distribution stations for the Project and to execute the necessary earth work by the commencement of the construction work.

(2) to provide temporary land for a construction liaison office, warehouse, stockyard, etc., during the construction period.

(3) to provide necessary data and information for detailed design. These data and information are not eligible to be delivered to the third parties or brought to their notice unless there is a written consent by Giza Governorate.

(4) to give permission required for test pitting to check underground services at the time of detailed design, if necessary.

(5) to take necessary actions to expedite permissions and approvals necessary for execution of the Project by Giza Governorate.

(6) to give permission required for all the works related to the Project, e.g., opening of manholes, entering into canal lot, surveying on the road, etc.

(7) to witness and confirm by the authorities concerned when test pitting, and protection and relocation of services are carried out.

(8) to take necessary measures for inhabitant's cooperation and traffic control.

(9) to take necessary measures for historical remains which may be encountered during the

construction period, if any.

(10) to provide disposal places of the waste water containing silt, clay, etc., discharged during the construction period.

(11) to form a committee in Giza City to expedite the Project.

(12) to expedite the execution of the water supply branch lines for the Project in order to keep the planned construction schedule of the Project.

4. Other relevant issues

(1) The Team requested the Egyptian side to follow the recommendations described in the draft report for the achievement of the objectives of the Project.

(2) The Team explained to the Egyptian side that as it is planned to conduct Japanese technical cooperation programme for General Organization for Greater Cairo Water Supply (GOGCWS) named as "The Water Supply Technology Training Improvement Project" during the construction period of the Project as well as after the commissioning of the new facilities constructed under the Project, it will be possible for the Project to be integrated with the training programme envisaged by the technical cooperation.

The Team requested the Egyptian side to understand the significance of the training programme and use them to improve the water supply technology of the GOGCWS personnel.

(3) The Team explained to the Egyptian side the importance of executing the renewal of the existing water supply facilities based upon the renewal schedule for the continuous proper operation of the facilities.

The Egyptian side has understood the above explanations and requests by the Team.

Annex-I Japan's Grant Aid Scheme

Japan's·Grant Aid Scheme

1. Grant Aid Procedures

(1) Japan's Grant Aid Program is executed through the following procedures.

Application	(Request made by a recipient country)
Study	(Basic Design Study conducted by JICA)
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Secondly, JICA conducts the study (Basic Design Study), using (a) Japanese consulting firm(s).
Thirdly, the Government of Japan appraises the project to see whether or not it is suitable for Japan's Grant Aid Program, based on the Basic Design Study report prepared by JICA, and the results are then submitted to the Cabinet for approval.
Fourthly, the project, once approved by the Cabinet, becomes official with the Exchange of Notes signed by the Governments of Japan and the recipient country.
Finally, for the implementation of the project, JICA assists the recipient country in such matters as preparing tenders, contracts and so on.

2. Basic Design Study

(1) Contents of the Study
The aim of the Basic Design Study (hereinafter referred to as "the Study"), conducted by JICA on a requested project (hereinafter referred to as "the Project") is to provide a basic document necessary for the appraisal of the Project by the Japanese Government. The contents of the Study are as follows:

a) Confirmation of the background, objectives, and benefits of the requested project and also institutional capacity of agencies concerned of the recipient country necessary for the Project's implementation.
b) Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, social and economic point of view.
c) Confirmation of items agreed on by both parties concerning the basic concept of the Project.
d) Preparation of a basic design of the Project
e) Estimation of costs of the Project

The contents of the original request are not necessarily approved in their initial form as the contents of the Grant Aid project. The Basic Design of the Project is confirmed considering the guidelines of Japan's Grant Aid Scheme.
The Government of Japan requests the Government of the recipient country to take whatever measures are necessary to ensure its self-reliance in the implementation of the Project. Such

measures must be guaranteed even though they may fall outside of the jurisdiction of the organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

(2) Selection of Consultants
For smooth implementation of the Study, JICA uses (a) registered consultant firm(s). JICA selects (a) firms(s) based on proposals submitted by interested firms. The firm(s) selected carry(ies) out a Basic Design Study and write(s) a report, based upon terms of reference set by JICA.
The consulting firm(s) used for the Study is(are) recommended by JICA to the recipient country to also work on the Project's implementation after the Exchange of Notes, in order to maintain technical consistency and also to avoid any undue delay in implementation should the selection process be repeated.

3. Japan's Grant Aid Scheme

(1) What is Grant Aid?
The Grant Aid Program provides a recipient country with non-reimbursable funds to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. Grant Aid is not supplied through the donation of materials as such.

(2) Exchange of Notes (E/N)
Japan's Grant Aid is extended in accordance with the Notes exchanged by the two Governments concerned, in which the objectives of the Project, period of execution, conditions and amount of the Grant Aid, etc., are confirmed.

(3) "The period of the Grant Aid" means the one fiscal year which the Cabinet approves the Project for. Within the fiscal year, all procedures such as exchanging of the Notes, concluding contracts with (a) consultant firm(s) and (a) contractor(s) and final payment to them must be completed.
However in case of delays in delivery, installation or construction due to unforeseen factors such as weather, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

(4) Under the Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased.
When the two Governments deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country.
However the prime contractors, namely, consulting, contracting and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

(5) Necessity of "Verification"
The Government of recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. This "Verification" is deemed necessary to secure accountability to Japanese taxpayers.

(6) Undertakings required of the Government of the Recipient Country
In the implementation of the Grant Aid project, the recipient country is required to undertake

such necessary measures as the following:

1) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the construction.
2) To provide facilities for the distribution of electricity, water supply and drainage and other incidental facilities in and around the sites.
3) To secure buildings prior to the procurement in case the installation of the equipment.
4) To ensure all the expenses and prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid.
5) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts.
6) To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the Verified Contracts, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.

(7) "Proper Use"
The recipient country is required to maintain and use the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

(8) "Re-export"
The products purchased under the Grant Aid should not be re-exported from the recipient country.

(9) Banking Arrangements (B/A)

1) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in an authorized foreign exchange bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.
2) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an authorization to pay issued by the Government of the recipient country or its designated authority.

Annex-II Necessary measures to be taken by the Government of the Arab Republic of Egypt on condition that Japan's Grant Aid is extended.

1. to undertake incidental outdoor works such as gardening, fencing, gates and exterior lighting in and around the site.

2. to construct the access road to the site prior to the commencement of the construction.

3. to provide facilities for distribution of electricity, water supply, telephone, drainage and other incidental facilities to the Project site.

4. to ensure prompt unloading and customs clearance of the goods for the Project at the port of disembarkation in the Arab Republic of Egypt.

5. to exempt Japanese nationals from custom duties, internal taxes and other fiscal levies which may be imposed in the Arab Republic of Egypt with respect to the supply of the products and services under the verified Contracts. And to take necessary measures for such tax exemption.

6. to accord Japanese nationals whose services may be required in connection with the supply of products and services under the verified contract(s) such facilities as may be necessary for their entry into the Arab Republic of Egypt and stay therein for the performance of their work.

7. to use and maintain properly and effectively all the facilities constructed, and equipment and materials purchased under the Japan's Grant Aid.

8. to bear all the expenses other than those to be borne by the Grant Aid necessary for the execution of the Project.

APPENDIX 5

COST ESTIMATION BORNE BY THE RECIPIENT COUNTRY

Cost Estimation Borne by the Recipient Country

No.	Item	Unit	Rate (US$)	Phase-1		Phase-2		Total Cost		Remarks
				Q'ty	Price(US$)	Q'ty	Price(US$)	Q'ty	Price(US$)	
1	Construction of Distribution Pipes									
1-1	Supply of Dist. Pipes (dia. 100, 150)	Lot		1	2,959,207	1	1,892,649	1	4,851,856	L=118,960m
1-2	Installation of Dist. Pipes (dia. 100, 150)	m	21	68,100	1,430,100	50,860	1,068,060	118,960	2,498,160	
1-3	Installation of Dist. Pipes (dia. 200～600)	m	21	11,700	245,700	16,710	350,910	28,410	596,610	
	Sub Total			79,800	4,635,007	67,570	3,311,619	147,370	7,946,626	
2	House Connection Work	m	14.45	79,800	1,153,110	67,570	976,387	147,370	2,129,497	
		(as per dist. pipe length)								
3	Fence and Gate for Water Dist. Station									
3-1	Fence (H=2.0m, brick)	m2	18	588	10,584	572	10,296	1	20,880	Phase-1 : 85x62m Phase-2 : 83x60m
3-2	Gate (steel made)	t	2200	0.2	440	0.2	440	0.4	880	
	Sub Total				11,024		10,736		21,760	
	Total				5,799,141		4,298,742		10,097,883	

APPENDIX 6

ECONOMIC COMPARISON BETWEEN ELEVATED WATER TANK SYSTEM AND GROUND WATER RESERVOIR WITH DISTRIBUTION PUMP SYSTEM

APPENDIX 6

Economic Comparison Between Elevated Water Tank System and Ground Water Reservoir with Distribution Pump System

At the early stage of the Basic Design Study for the Project, the Egyptian side requested the introduction of an elevated water tank system for water reservoirs to efficiently use the fairly high level of residual head of the existing water transmission facilities to the Project Site as part of the planned water distribution facilities under the Project. In response, the Basic Design Study Team conducted a case study to compare the economic performance of Case A whereby a ground water reservoir with a distribution pump is constructed with the partial use of the residual head through direct connection with some distribution pipes and Case B whereby an elevated water tank is constructed without the use of the distribution pump planned in Case A.

These two cases have contrasting features. While Case A requires a relatively small amount of initial investment but incurs a high operation and maintenance cost after the commencement of operation, Case B requires a fairly large amount of initial investment but incurs a low operation and maintenance cost due to the absence of any electricity cost for the operation of the distribution pump. It was decided that the economic comparison of these two cases would be conducted in terms of their present value, taking the capital opportunity cost rate (which is commonly used in Egypt to assess development projects) into consideration and using estimated data on the initial investment cost and operation and maintenance cost of each case upto the year 2010. The construction cost and operation and maintenance cost of the water distribution network beyond the water reservoir and the profit as well as benefits of the Project were excluded from the comparison in order to obtain clearer comparison results given that these costs and profit, etc. are identical.

The analysis results show a large difference between the two cases in terms of the present value (shown as a negative value because only the costs but not the benefits are calculated) at the bottom of each table, indicating that the economic effect of the elevated water tank system is minimal.

The calculation conditions for this comparative analysis are given below.

1. Water Demand

   The water supply increase for the subject area (No. 1 Water Distribution Zone) is estimated based on the assumption that the population increase rate upto the Project's target year of 2010 will be constant.

2. Initial Construction Cost

(1) Water Reservoir Construction Cost

The rough construction cost is estimated for a prestressed concrete, cylinder-shaped water tank (capacity: 14,000 m^3) which will be constructed on top of a reinforced concrete foundation supported by piles (or a 40 m high platform for Case B).

(2) Pump System Construction Cost

To start with, the construction cost of a pump system required to meet the water demand upto 2005 is estimated for Case A. The construction cost of an additional pump system to meet the water demand upto 2010 is estimated for the year 2005. The construction cost of a pump system is not estimated for Case B on the assumption that a residual head will be secured upto 2010.

3. Operation and Maintenance Cost

(1) Maintenance Cost of Civil Engineering Structures and Buildings

The annual maintenance cost is set at a constant proportion (0.25%) of the construction cost of the water reservoir and pump facilities for Case A.

(2) Operation and Maintenance Cost of Pump System

The calculation formula used for estimation of the operation and maintenance cost in the analysis of the operation balance is also used to estimate the operation and maintenance cost of the pump system. The costing items are the electricity charge for pumping operation, taking the annual increase of the water demand into consideration, and the personnel cost, spare parts cost and maintenance cost, all of which are given as constant figures to be calculated based on the equipment cost. As this estimation exercise was conducted at the early stage of the Study, the actual figures slightly differ from those of the operation balance analysis which was conducted at a later stage when the contents of the Project were more detailed.

4. Discount Rate

The discount rate used to establish the present value is 12%/year which represents the capital opportunity cost rate commonly used in Egypt for development projects.

Economic Comparison on the Alternatives of Water Reservoir
at No.1 distribution Area: Konayessa and Talbia (remaining head: 40 meter)

Unit: Thousand USD at the exchange rate of 1 USD = 110 Japanese Yen

		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	NPV
Plan A (14,000 m3 ground tank + booster pump system)															
Construction Cost of	Reservoir/building	4,255													
	Pump system	2,055							455						
O/M cost for Reservoir/Building			11	11	11	11	11	11	11	11	11	11	11	11	
O/M cost for Pump system		0	166	171	175	179	184	189	209	216	222	229	236	243	
Total		6,309	177	181	186	190	195	200	675	226	233	240	247	254	-7,770

Notes Discount rate of 12 % for the calculation of net present value was derived from the Capital Oportunity Cost Rate adapted in Egypt.
Initial installation of pump system is for the demand in 2005 and additional installation for the demand of 2010 is done in 2005
O/M cost includes electric cost and other operation and maintenance cost for pump operation and its electric cost is considered installation of energy saving type pump/motor corresponding the required flow rate.

		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	NPV
Plan B (14,000 m3 elevated tank)															
Construction Cost of	Reservoir	11,364													
	Pump system	0													
O/M cost for Reservoir		0	28	28	28	28	28	28	28	28	28	28	28	28	
Total		11,364	28	28	28	28	28	28	28	28	28	28	28	28	-11,540

Notes Discount rate of 12 % for the calculation of net present value was derived from the Capital Oportunity Cost Rate adapted in Egypt.
There is no pump system considered in this plan because enough lifting pressure to the elevated reservoir is secured by the existing transfer pump system.
Maintenance cost for the reservoir facilities is considered.

APPENDIX 7

ECONOMIC COMPARISON OF DIFFERENT FLOW CONTROL SYSTEMS AND ANALYSIS OF OPERATION BALANCE

APPENDIX 7

Economic Comparison of Different Flow Control Systems and Analysis of Operation Balance

A. Economic Comparison of Pump Operation Control Systems

Here, the pumping system cost and operation and maintenance cost are calculated for each year upto the Project's target year of 2010 for three different types of pumping operation control (Case A: pump speed control system, Case B: no flow control, Case C: control through a number of pumps). All of the costs are discounted to current prices for 1998, the planned year of the completion of the construction of the new facilities under the Project. The main conditions for the analysis are as follows.

- Planned year of completion of the construction of the pumping system
  Three pumps (Project) : 1998
  One pump (future plan) : 2005

- Operation and maintenance cost: The costing items for each operation control system are electricity, personnel, spare parts and consumables (see 2. below).

- Discount factor to establish current prices: 12%

The analysis results indicate that Case A (pump speed control system) will be the most economical system.

B. Analysis of Operation Balance

Here, the operation and maintenance cost and water charge revenue are separately calculated for the No. 1 Water Distribution Works and No. 2 Water Distribution Works in reference to the three different pump operation control systems. The main conditions for the analysis and the calculation method are described below.

1. Conditions for Analysis

1.4 Design Daily Maximum Water Consumption (Qd)

This is calculated by multiplying the design population (Item 1-2) by the daily maximum water supply volume per person (Item 1.3).

1.6 Maximum Hourly Flow Rate (Qh-max)

This is calculated by multiplying the mean hourly flow rate by a time factor of 1.3.

2. Calculation of Required Capacity of Distribution Pump System

2.2-(f) Motor Capacity

The required motor capacity is calculated in the following manner in accordance with the relevant JIS standard.

$$P\ (KW) = 0.163 \cdot \gamma \cdot Q \cdot H/\eta \cdot C$$

Where,
- P : motor output (KW)
- γ : weight per unit volume of liquid (1 kg/litre)
- Q : discharge rate per pump (m^3/second . pump)
- H : total head of pump
- η : pump efficiency (0.82)
- C : margin (0.15)
- 0.163 : factor

2.3 Pumping Capacity to be Installed

The required pumping capacity in the Project's target year of 2005 is selected as the capacity of the pump system to be installed under the Project.

3. Pump Operation Mode and Power Consumption

3.4 Daily Power Consumption

The daily power consumption of the pumping motor for 10 hours operation (10:00 - 20:00) during the peak water demand period is calculated.

3.5 Annual Power Consumption

The annual power consumption is calculated based on the daily power consumption.

4. Operation and Maintenance (O & M) Cost

4.2 Estimated O & M Cost

(a) Power cost : calculated by multiplying the annual power consumption by the average electricity charge

(b) Personnel cost : annual average wages of O & M staff at the pump station are calculated

(c) Spare parts cost : 3% of the equipment cost is accounted for as the spare parts cost for each year

5. Water Charge Revenue

The water charge revenue is calculated based on an assumed water charge collection rate of 80%.

Economic Comparison on the Pump Operation System

(Unit:US$)

Year			1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total of PV (at 1998)
Case A (Speed Control)	No.1 Distribution Area	Equip Cost for Pump (Item4.1-b)	2,055,000							455,000						
		O&M Cost for Pump (Item 4.2-d)	-	207,977	211,659	215,504	219,517	223,707	228,081	244,752	251,299	256,627	262,087	267,922	274,331	
		Total	2,055,000	207,977	211,659	215,504	219,517	223,707	228,081	699,752.37	251,299	256,627	262,087	267,922	274,331	
		PV (at 1998) (Total x Discount Rate)	2,055,000	185,694	168,734	153,391	139,507	126,937	115,553	316,532	101,496	92,542	84,385	77,021	70,414	3,687,207
	No.2 Distribution Area	Equip Cost for Pump (Item4.1-b)	1,630,000							380,000						
		O&M Cost for Pump (Item 4.2-d)	-	176,421	179,276	182,256	185,368	188,616	192,007	205,120	210,408	214,547	218,789	223,322	228,331	
		Total	1,630,000	176,421	179,276	182,256	185,368	188,616	192,007	585,120	210,408	214,547	218,789	223,322	228,331	
		PV (at 1998) (Total x Discount Rate)	1,630,000	157,519	142,918	129,726	117,804	107,026	97,277	264,678	84,980	77,368	70,444	64,200	58,607	3,002,547
	Grand Total		-	-	-	-	-	-	-	-	-	-	-	-	-	**6,689,754**
Case B (No Control)	No.1 Distribution Area	Equip Cost for Pump (Item4.1-b)	1,980,000							420,000						
		O&M Cost for Pump (Item 4.2-d)	-	239,549	239,549	239,549	239,549	239,549	239,549	252,149	310,903	310,903	310,903	310,903	310,903	
		Total	1,980,000	239,549	239,549	239,549	239,549	239,549	239,549	672,149	310,903	310,903	310,903	310,903	310,903	
		PV (at 1998) (Total x Discount Rate)	1,980,000	213,883	190,967	170,506	152,238	135,926	121,363	304,046	125,569	112,115	100,102	89,377	79,801	3,775,892
	No.2 Distribution Area	Equip Cost for Pump (Item4.1-b)	1,570,000							350,000						
		O&M Cost for Pump (Item 4.2-d)	-	200,809	200,809	200,809	200,809	200,809	200,809	211,309	256,844	256,844	256,844	256,844	256,844	
		Total	1,570,000	200,809	200,809	200,809	200,809	200,809	200,809	561,309	256,844	256,844	256,844	256,844	256,844	
		PV (at 1998) (Total x Discount Rate)	1,570,000	179,294	160,084	142,932	127,618	113,945	101,736	253,908	103,735	92,620	82,697	73,836	65,925	3,068,330
	Grand Total		-	-	-	-	-	-	-	-	-	-	-	-	-	**6,844,222**
Case C (Number of Pumps)	No.1 Distribution Area	Equip Cost for Pump (Item4.1-b)	2,310,000							350,000						
		O&M Cost for Pump (Item 4.2-d)	-	249,449	249,449	249,449	249,449	249,449	249,449	259,949	289,326	289,326	289,326	289,326	289,326	
		Total	2,310,000	249,449	249,449	249,449	249,449	249,449	249,449	609,949	289,326	289,326	289,326	289,326	289,326	
		PV (at 1998) (Total x Discount Rate)	2,310,000	222,722	198,859	177,553	158,529	141,544	126,378	275,910	116,854	104,334	93,155	83,174	74,263	4,083,275
	No.2 Distribution Area	Equip Cost for Pump (Item4.1-b)	1,800,000							260,000						
		O&M Cost for Pump (Item 4.2-d)	-	207,709	207,709	207,709	207,709	207,709	207,709	215,509	238,277	238,277	238,277	238,277	238,277	
		Total	1,800,000	207,709	207,709	207,709	207,709	207,709	207,709	475,509	238,277	238,277	238,277	238,277	238,277	
		PV (at 1998) (Total x Discount Rate)	1,800,000	185,455	165,585	147,843	132,003	117,860	105,232	215,096	96,236	85,925	76,719	68,499	61,160	3,257,611
	Grand Total		-	-	-	-	-	-	-	-	-	-	-	-	-	**7,340,886**
Discount Rate			1	0.89	0.80	0.71	0.64	0.57	0.51	0.45	0.40	0.36	0.32	0.29	0.26	

Remarks: Discount Rate = $\frac{1}{(1+r)^n}$ where: r :Discount factor (12%), n : No. of years

PV: Present Value

The Basic Design Study on the Project for Improvement of Water Supply System at the Southern Pyramids Area in Giza City
Study on Operation and Maintenance (O&M) Costs

Case A (Flow rate control system: Pump Speed Control)

	(Unit)	1998 (FY1997)	1999	2000	2001	2002	2003	2004	2005 (FY2004)	2006	2007	2008	2009	2010
1. Study Conditions of the Project														
1.1 Site Area														
No.1 Area (Konayessa/Talbia)	km2	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
No.2 Area (Sphinx)	km2	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Total	km2	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
1.2 Population in the Project Area														
Annual Increasing Ratio		1.044	1.044	1.044	1.044	1.044	1.044	1.044	1.044	1.047	1.047	1.046	1.047	1.047
No.1 Area (Konayessa/Talbia)	person	185,832	194,009	202,545	211,457	220,761	230,475	240,615	251,000	262,797	275,148	287,805	301,332	315,495
No.2 Area (Sphinx)	person	144,072	150,411	157,029	163,939	171,152	178,683	186,545	195,000	204,165	213,761	223,594	234,103	245,105
Total	person	329,904	344,420	359,574	375,396	391,913	409,157	427,160	446,000	466,962	488,909	511,399	535,435	560,600
1.3 Design Water Consumption														
Design Maximum Water Consumption per Person-Day	m3/day	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
1.4 Design Water Consumption of Daily Maximum (Qd)														
No.1 Area (Konayessa/Talbia)	M3/day	39,025	40,742	42,534	44,406	46,360	48,400	50,529	52,000	55,187	57,781	60,439	63,280	66,400
No.2 Area (Sphinx)	M3/day	30,255	31,586	32,976	34,427	35,942	37,523	39,174	40,300	42,875	44,890	46,955	49,162	51,600
Total	M3/day	69,280	72,328	75,511	78,833	82,302	85,923	89,704	92,300	98,062	102,671	107,394	112,441	118,000
(% of the Volume at Year 2010)	%	58.7	61.3	64.0	66.8	69.7	72.8	76.0	78.2	83.1	87.0	91.0	95.3	100.0
1.5 Average Hourly Flow Rate (Qh-ave: Qd/24)														
No.1 Area (Konayessa/Talbia)	M3/h	1,626	1,698	1,772	1,850	1,932	2,017	2,105	2,167	2,299	2,408	2,518	2,637	2,767
No.2 Area (Sphinx)	M3/h	1,261	1,316	1,374	1,434	1,498	1,563	1,632	1,679	1,786	1,870	1,956	2,048	2,150
1.6 Maximum Hourly Flow Rate(Qh-max : Qh-ave x Coeffcient houly maximum:1.3)														
No.1 Area (Konayessa/Talbia)	M3/h	2,114	2,207	2,304	2,405	2,511	2,622	2,737	2,817	2,989	3,130	3,274	3,428	3,597
No.2 Area (Sphinx)	M3/h	1,639	1,711	1,786	1,865	1,947	2,033	2,122	2,183	2,322	2,432	2,543	2,663	2,795
1.7 Required Water Reservoir Capacity (5hr capacity of one day consumption)														
No.1 Area (Konayessa/Talbia)	M3	8,130	8,488	8,861	9,251	9,658	10,083	10,527	10,833	11,497	12,038	12,591	13,183	13,833
No.2 Area (Sphinx)	M3	6,303	6,580	6,870	7,172	7,488	7,817	8,161	8,396	8,932	9,352	9,782	10,242	10,750

No.1 Distribution Area (Konayessa and Talbia)

2. Capacity of Distribution Pump Station

2.1 No. of Pump to be installed														
(a) No. of Units (operation)	unit	2	2	2	2	2	2	2	2	3	3	3	3	3
(b) No. of Units (stand-by)	unit	1	1	1	1	1	1	1	1	1	1	1	1	1
2.2 Calculation of Requried Pump Capacity														
(a) Specific gravity of pump liquid (γ)		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
(b) Requried Flow Rate of each Pump (Q-pump) (Q-pump=Qh-max /60/No. of Units)	M3/min/unit	17.6	18.4	19.2	20.0	20.9	21.8	22.8	23.5	16.6	17.4	18.2	19.0	20.0
(c) Total Head (H)	m	50	50	50	50	50	50	50	50	50	50	50	50	50
(d) Pump efficiency (η)		0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
(e) Excess (C)		1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
(f) Required motor out put (P) ($P = 0.163 \times \gamma \times Q\text{-pump} \times H/\eta \times C$)	kW/unit	201	210	219	229	239	250	261	268	190	199	208	218	228
2.3 Spec. of Pump to be installed (Capacity in 2005 shall be adopted.)														
(a) Pump Flow Rate (Q-spec)	M3/min/unit	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5
(b) Motor output (P-spec)	kW/unit	268	268	268	268	268	268	268	268	268	268	268	268	268

3. Pump Operation Mode and Power Consumption

3.1 Hourly Flow Rate during Pump Operation (Peak Time)													
10:00~11:00	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
11:00~12:00	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
12:00~13:00	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28
13:00~14:00	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28
14:00~15:00	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
15:00~16:00	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
16:00~17:00	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13
17:00~18:00	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13
18:00~19:00	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
19:00~20:00	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30
20:00~21:00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21:00~22:00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Average	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18

Item	Unit													
3.2 Average Flow Rate during Peak Time [(3.1)-ave x Qh-ave/60]														
Average Flow Rate	M3/min	32.0	33.4	34.9	36.4	38.0	39.7	41.5	42.7	45.3	47.4	49.6	51.9	54.5
3.3 Ratio of Average Flow Rate agaist Total Pump Flow Rate [(3.2)/(Q-spec x No. of Pump ope)]		0.68	0.71	0.74	0.78	0.81	0.85	0.88	0.91	0.64	0.67	0.70	0.74	0.77
3.4 Required Power Consumption during peak load (P-spec x No. of Pump Ope. x(3.3) x 10hrs/day) Notes: 1) Without Excess of Pump Motor 2) Speed control system of pump shall be adopted.	kWh/day	3,660	3,821	3,989	4,165	4,348	4,540	4,739	4,877	5,176	5,420	5,669	5,935	6,228
3.5 Annual Power Consumption [(3.4) x 365days/year]	kWh/year	1,336,001	1,394,785	1,456,155	1,520,226	1,587,116	1,656,949	1,729,855	,780,206	1,889,325	1,978,123	2,069,117	2,166,365	2,273,186
4. O&M Costs														
4.1 Electric Tariff and Equipment Costs														
(a) Electric Tariff	US$/kWh	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
(b) Equipment Cost (Total)	Mil.US$	2.055							2.510					
-3pumps		2.055							2.055					
-1pump (Future)		0.000							0.455					
(c) Exchange rate	¥/$	110	110	110	110	110	110	110	110	110	110	110	110	110
4.2 Estimated O&M Costs														
(a) Electric Charge [(3.5) x(4.1-a)]	US$/year		83,687	87,369	91,214	95,227	99,417	103,791	106,812	113,359	118,687	124,147	129,982	136,391
(b) Personnel Costs (8.)	US$/year		62,640	62,640	62,640	62,640	62,640	62,640	62,640	62,640	62,640	62,640	62,640	62,640
(c) Spare Parts Costs [(4.1-b) x 3%/year]	US$/year		61,650	61,650	61,650	61,650	61,650	61,650	75,300	75,300	75,300	75,300	75,300	75,300
(d) Total	US$/year		207,977	211,659	215,504	219,517	223,707	228,081	244,752	251,299	256,627	262,087	267,922	274,331
5. Income of Water Charge														
(a) Average Water Tariff	US$/M3		0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
(b) Leakage Ratio			0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
(c) Actual Water Supply Volume in a day [(1.4) x Leakage Ratio]	M3/day		32,593	34,028	35,525	37,088	38,720	40,423	41,600	44,150	46,225	48,351	50,624	53,120
(d) Annual Income of Water Supply	US$/year		475,864	496,802	518,662	541,483	565,308	590,182	607,360	644,588	674,884	705,929	739,107	775,552
6. Cost Balance (Income -O&M cost) [(4.2-d) - (5.-d)]	US$/year		267,887	285,143	303,158	321,966	341,601	362,100	362,608	393,289	418,257	443,842	471,186	501,221

No.2 Distribution Area (Sphinx)

2. Capacity of Distribution Pump Station

2.1 No. of Pump to be installed														
(a) No. of Units (operation)	unit	2	2	2	2	2	2	2	2	3	3	3	3	3
(b) No. of Units (stand-by)	unit	1	1	1	1	1	1	1	1	1	1	1	1	1
2.2 Calculation of Requried Pump Capacity														
(a) Specific gravity of pump liquid (γ)		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
(b) Requried Flow Rate of each Pump (Q-pump) (Q-pump=Qh-max /60/No. of Units)	M3/min/unit	13.1	14.3	14.9	15.5	16.2	16.9	17.7	18.2	12.9	13.5	14.1	14.8	15.5
(c) Total Head (H)	m	50	50	50	50	50	50	50	50	50	50	50	50	50
(d) Pump efficiency (η)		0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
(e) Excess (C)		1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
(f) Required motor out put (P) (P = 0.163 x γ x Q-pump x H/ η x C)	kW/unit	156	163	170	178	185	194	202	208	147	154	162	169	177
2.3 Spec. of Pump to be installed (Capacity in 2005 shall be adopted.)														
(a) Pump Flow Rate (Q-spec)	M3/min/unit	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2
(b) Motor output (P-spec)	kW/unit	208	208	208	208	208	208	208	208	208	208	208	208	208

3. Pump Operation Mode and Power Consumption

3.1 Hourly Flow Rate during Pump Operation (Peak Time)														
10:00～11:00		1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
11:00～12:00		1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
12:00～13:00		1.28	1.28	1.28	1.28	1.28	1.28	1.26	1.28	1.28	1.28	1.28	1.28	1.28
13:00～14:00		1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28
14:00～15:00		1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
15:00～16:00		1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
16:00～17:00		1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13
17:00～18:00		1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13
18:00～19:00		1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
19:00～20:00		1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30
20:00～21:00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21:00～22:00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Average		1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18
3.2 Average Flow Rate during Peak Time [(3.1-ave) x Qh-ave/60]														
Average Flow Rate	M3/min	24.8	25.9	27.1	28.3	29.5	30.8	32.1	33.1	35.2	36.8	38.5	40.3	42.3

3.3 Ratio of Average Flow Rate agaist Total Pump Flow Rate [(3.2)/(Q-spec x No. of Pump ope)]		0.68	0.71	0.74	0.78	0.81	0.85	0.88	0.91	0.64	0.67	0.71	0.74	0.78
3.4 Required Power Consumption during peak load (P-spec x No. of Pump Ope. x(3.3) x 10hrs/day) Notes: 1) Without Excess of Pump Motor 2) Speed control system of pump shall be adopted.	kWh/day	2,838	2,963	3,093	3,229	3,371	3,519	3,674	3,780	4,021	4,210	4,404	4,611	4,840
3.5 Annual Power Consumption [(3.4) x 365days/year]	kWh/year	1,035,776	1,081,350	1,128,930	1,178,602	1,230,461	1,284,601	1,341,124	,379,660	1,467,802	1,536,789	1,607,481	1,683,033	1,766,512
4. O&M Costs														
4.1 Electric Tariff and Equipment Costs														
(a) Electric Tariff	US$/kWh	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
(b) Equipment Cost (Total)	Mil.US$	1.63							1.99					
-3pumps		1.63							1.61					
-1pump (Future)		0.00							0.38					
(c) Exchange rate	¥/$	110	110	110	110	110	110	110	110	110	110	110	110	110
4.2 Estimated O&M Costs														
(a) Electric Charge [(3.5) x (4.1-a)]	US$/year		64,881	67,736	70,716	73,828	77,076	80,467	82,780	88,068	92,207	96,449	100,982	105,991
(b) Personnel Costs (8.)	US$/year		62,640	62,640	62,640	62,640	62,640	62,640	62,640	62,640	62,640	62,640	62,640	62,640
(c) Spare Parts Costs [(4.1-b) x 3%/year]	US$/year		48,900	48,900	48,900	48,900	48,900	48,900	59,700	59,700	59,700	59,700	59,700	59,700
(d) Total	US$/year		176,421	179,276	182,256	185,368	188,616	192,007	205,120	210,408	214,547	218,789	223,322	228,331
5. Income of Water Charge														
(a) Average Water Tariff	US$/M3		0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
(b) Leakage Ratio			0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
(c) Actual Water Supply Volume in a day [(1.4) x Leakage Ratio]	M3/day		25,269	26,381	27,542	28,754	30,019	31,339	32,240	34,300	35,912	37,564	39,329	41,280
(d) Annual Income of Water Supply	US$/year		368,929	385,161	402,108	419,801	438,272	457,556	470,704	500,776	524,312	548,431	574,207	602,688
6. Cost Balance (Income - O&M cost) [(4.2-d) - (5.-d)]	US$/year		192,508	205,886	219,852	234,434	249,656	265,549	265,584	290,368	309,765	329,642	350,885	374,357

7. Total Cost Balance(No.1 Area + No.2 Area)	US$/year	460,395	491,029	523,010	556,399	591,257	627,649	628,192	683,657	728,022	773,484	822,071	875,578

8. Data for Personnel Costs	Total No. persons (person/day)	Salary (US$/day)	Shift	Total (per day) (US$/day)	Total (per month) (US$/month)	Total (per year) (US$/year)
(a) Chief Engineer	1	21	1	21	630	7,560
(b) Mechanical Operator	1	7.5	3	22.5	675	8,100
(c) Electrical Operator	1	7.5	3	22.5	675	8,100
(d) Worker	6	5.5	3	99	2970	35,640
(e) Guard Man	1	3	3	9	270	3,240
(f) Total					5,220	62,640

The Basic Design Study on the Project for Improvement of Water Supply System at the Southern Pyramids Area in Giza City
Study on Operation and Maintenance (O&M) Costs

Case B (Flow rate control system: No Control)

	(Unit)	1998 (FY1997)	1999	2000	2001	2002	2003	2004	2005 (FY2004)	2006	2007	2008	2009	2010
1. Study Conditions of the Project														
1.1 Site Area														
No.1 Area (Konayessa/Talbia)	km2	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
No.2 Area (Sphinx)	km2	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Total	km2	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
1.2 Population in the Project Area														
Annual Increasing Ratio		1.044	1.044	1.044	1.044	1.044	1.044	1.044	1.044	1.047	1.047	1.046	1.047	1.047
No.1 Area (Konayessa/Talbia)	person	185,832	194,009	202,545	211,457	220,761	230,475	240,615	251,000	262,797	275,148	287,805	301,332	315,495
No.2 Area (Sphinx)	person	144,072	150,411	157,029	163,939	171,152	178,683	186,545	195,000	204,165	213,761	223,594	234,103	245,105
Total	person	329,904	344,420	359,574	375,396	391,913	409,157	427,160	446,000	466,962	488,909	511,399	535,435	560,600
1.3 Design Water Consumption														
Design Maximum Water Consumption per Person-Day	m3/day	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
1.4 Design Water Consumption of Daily Maximum (Qd)														
No.1 Area (Konayessa/Talbia)	M3/day	39,025	40,742	42,534	44,406	46,360	48,400	50,529	52,000	55,187	57,781	60,439	63,280	66,400
No.2 Area (Sphinx)	M3/day	30,255	31,586	32,976	34,427	35,942	37,523	39,174	40,300	42,875	44,890	46,955	49,162	51,600
Total	M3/day	69,280	72,328	75,511	78,833	82,302	85,923	89,704	92,300	98,062	102,671	107,394	112,441	118,000
(% of the Volume at Year 2010)	%	58.7	61.3	64.0	66.8	69.7	72.8	76.0	78.2	83.1	87.0	91.0	95.3	100.0
1.5 Average Hourly Flow Rate (Qh-ave: Qd/24)														
No.1 Area (Konayessa/Talbia)	M3/h	1,626	1,698	1,772	1,850	1,932	2,017	2,105	2,167	2,299	2,408	2,518	2,637	2,767
No.2 Area (Sphinx)	M3/h	1,261	1,316	1,374	1,434	1,498	1,563	1,632	1,679	1,786	1,870	1,956	2,048	2,150
1.6 Maximum Hourly Flow Rate(Qh-max : Qh-ave x Coeffcient houly maximum:1.3)														
No.1 Area (Konayessa/Talbia)	M3/h	2,114	2,207	2,304	2,405	2,511	2,622	2,737	2,817	2,989	3,130	3,274	3,428	3,597
No.2 Area (Sphinx)	M3/h	1,639	1,711	1,786	1,865	1,947	2,033	2,122	2,183	2,322	2,432	2,543	2,663	2,795
1.7 Required Water Reservoir Capacity (5hr capacity of one day consumption)														
No.1 Area (Konayessa/Talbia)	M3	8,130	8,488	8,861	9,251	9,658	10,083	10,527	10,833	11,497	12,038	12,591	13,183	13,833
No.2 Area (Sphinx)	M3	6,303	6,580	6,870	7,172	7,488	7,817	8,161	8,396	8,932	9,352	9,782	10,242	10,750

No.1 Distribution Area (Konayessa and Talbia)

2. Capacity of Distribution Pump Station

2.1 No. of Pump to be installed														
(a) No. of Units (operation)	unit	2	2	2	2	2	2	2	2	3	3	3	3	3
(b) No. of Units (stand-by)	unit	1	1	1	1	1	1	1	1	1	1	1	1	1
2.2 Calculation of Requried Pump Capacity														
(a) Specific gravity of pump liquid (γ)		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
(b) Requried Flow Rate of each Pump (Q-pump) (Q-pump=Qh-max /60/No. of Units)	M3/min/unit	17.6	18.4	19.2	20.0	20.9	21.8	22.8	23.5	16.6	17.4	18.2	19.0	20.0
(c) Total Head (H)	m	50	50	50	50	50	50	50	50	50	50	50	50	50
(d) Pump efficiency (η)		0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
(e) Excess (C)		1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
(f) Required motor out put (P) (P = 0.163 x γ x Q-pump x H/ η x C)	kW/unit	201	210	219	229	239	250	261	268	190	199	208	218	228
2.3 Spec. of Pump to be installed (Capacity in 2005 shall be adopted.)														
(a) Pump Flow Rate (Q-spec)	M3/min/unit	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5
(b) Motor output (P-spec)	kW/unit	268	268	268	268	268	268	268	268	268	268	268	268	268

3. Pump Operation Mode and Power Consumption

3.1 Hourly Flow Rate during Pump Operation (Peak Time)													
10:00~11:00	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
11:00~12:00	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
12:00~13:00	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28
13:00~14:00	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28
14:00~15:00	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
15:00~16:00	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
16:00~17:00	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13
17:00~18:00	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13
18:00~19:00	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
19:00~20:00	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30
20:00~21:00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21:00~22:00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Average	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18

Item	Unit													
3.2 Average Flow Rate during Peak Time [(3.1)-ave x Qh-ave/60]														
Average Flow Rate	M3/min	32.0	33.4	34.9	36.4	38.0	39.7	41.5	42.7	45.3	47.4	49.6	51.9	54.5
3.3 Ratio of Average Flow Rate agaist Total Pump Flow Rate [(3.2)/(Q-spec x No. of Pump ope)]		0.68	0.71	0.74	0.78	0.81	0.85	0.88	0.91	0.64	0.67	0.70	0.74	0.77
3.4 Required Power Consumption during peak load (P-spec x No. of Pump to be ope x10hrs/day) Notes: 1) No Speed Control	kWh/day	5,366	5,366	5,366	5,366	5,366	5,366	5,366	5,366	8,049	8,049	8,049	8,049	8,049
3.5 Annual Power Consumption [(3.4) x 365days/year)]	kWh/year	1,958,478	1,958,478	1,958,478	1,958,478	1,958,478	1,958,478	1,958,478	1,958,478	2,937,717	2,937,717	2,937,717	2,937,717	2,937,717
4. O&M Costs														
4.1 Electric Tariff and Equipment Costs														
(a) Electric Tariff	US$/kWh	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
(b) Equipment Cost (Total)	Mil.US$	1.98							2.40					
-3pumps		1.98							1.98					
-1pump (Future)		0.00							0.42					
(c) Exchange rate	¥/$	110	110	110	110	110	110	110	110	110	110	110	110	110
4.2 Estimated O&M Costs														
(a) Electric Charge [(3.5) x(4.1-a)]	US$/year		117,509	117,509	117,509	117,509	117,509	117,509	117,509	176,263	176,263	176,263	176,263	176,263
(b) Personnel Costs (8.)	US$/year		62,640	62,640	62,640	62,640	62,640	62,640	62,640	62,640	62,640	62,640	62,640	62,640
(c) Spare Parts Costs [(4.1-b) x 3%/year]	US$/year		59,400	59,400	59,400	59,400	59,400	59,400	72,000	72,000	72,000	72,000	72,000	72,000
(d) Total	US$/year		239,549	239,549	239,549	239,549	239,549	239,549	252,149	310,903	310,903	310,903	310,903	310,903
5. Income of Water Charge														
(a) Average Water Tariff	US$/M3		0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
(b) Leakage Ratio			0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
(c) Actual Water Supply Volume in a day [(1.4) x Leakage Ratio]	M3/day		32,593	34,028	35,525	37,088	38,720	40,423	41,600	44,150	46,225	48,351	50,624	53,120
(d) Annual Income of Water Supply	US$/year		475,864	496,802	518,662	541,483	565,308	590,182	607,360	644,588	674,884	705,929	739,107	775,552
6. Cost Balance (Income - O&M cost) [(4.2-d) - (5.-d)]	US$/year		236,316	257,254	279,113	301,934	325,759	350,633	355,211	333,685	363,981	395,026	428,204	464,649

No.2 Distribution Area (Sphinx)

2. Capacity of Distribution Pump Station

2.1 No. of Pump to be installed														
(a) No. of Units (operation)	unit	2	2	2	2	2	2	2	2	3	3	3	3	3
(b) No. of Units (stand-by)	unit	1	1	1	1	1	1	1	1	1	1	1	1	1
2.2 Calculation of Requried Pump Capacity														
(a) Specific gravity of pump liquid (γ)		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
(b) Requried Flow Rate of each Pump (Q-pump)	M3/min/unit	13.7	14.3	14.9	15.5	16.2	16.9	17.7	18.2	12.9	13.5	14.1	14.8	15.5
(Q-pump=Qh-max /60/No. of Units)														
(c) Total Head (H)	m	50	50	50	50	50	50	50	50	50	50	50	50	50
(d) Pump efficiency (η)		0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
(e) Excess (C)		1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
(f) Required motor out put (P)	kW/unit	156	163	170	178	185	194	202	208	147	154	162	169	177
($P = 0.163 \times \gamma \times$ Q-pump $\times H / \eta \times C$)														
2.3 Spec. of Pump to be installed (Capacity in 2005 shall be adopted.)														
(a) Pump Flow Rate (Q-spec)	M3/min/unit	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2
(b) Motor output (P-spec)	kW/unit	208	208	208	208	208	208	208	208	208	208	208	208	208

3. Pump Operation Mode and Power Consumption

3.1 Hourly Flow Rate during Pump Operation (Peak Time)														
10:00～11:00		1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
11:00～12:00		1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
12:00～13:00		1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28
13:00～14:00		1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28
14:00～15:00		1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
15:00～16:00		1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
16:00～17:00		1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13
17:00～18:00		1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13
18:00～19:00		1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
19:00～20:00		1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30
20:00～21:00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21:00～22:00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Average		1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18
3.2 Average Flow Rate during Peak Time [(3.1-ave) x Qh-ave/60]														
Average Flow Rate	M3/min	24.8	25.9	27.1	28.3	29.5	30.8	32.1	33.1	35.2	36.8	38.5	40.3	42.3

3.3 Ratio of Average Flow Rate agaist Total Pump Flow Rate [(3.2)/(Q-spec x No. of Pump ope)]		0.68	0.71	0.74	0.78	0.81	0.85	0.88	0.91	0.64	0.67	0.71	0.74	0.78
3.4 Required Power Consumption during peak load (P-spec x No. of Pump to be ope x10hrs/day) Notes: 1) No Speed Control	kWh/day	4,158	4,158	4,158	4,158	4,158	4,158	4,158	4,158	6,238	6,238	6,238	6,238	6,238
3.5 Annual Power Consumption [(3.4) x 365days/year]	kWh/year	1,517,820	1,517,820	1,517,820	1,517,820	1,517,820	1,517,820	1,517,820	1,517,820	2,276,731	2,276,731	2,276,731	2,276,731	2,276,731
4. O&M Costs														
4.1 Electric Tariff and Equipment Costs														
(a) Electric Tariff	US$/kWh	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
(b) Equipment Cost	Mil.US$	1.57							1.92					
-3pumps		1.57							1.57					
-1pump (Future)		0.00							0.35					
(c) Exchange rate	¥/$	110	110	110	110	110	110	110	110	110	110	110	110	110
4.2 Estimated O&M Costs														
(a) Electric Charge [(3.5) x (4.1-a)]	US$/year		91,069	91,069	91,069	91,069	91,069	91,069	91,069	136,604	136,604	136,604	136,604	136,604
(b) Personnel Costs (8.)	US$/year		62,640	62,640	62,640	62,640	62,640	62,640	62,640	62,640	62,640	62,640	62,640	62,640
(c) Spare Parts Costs [(4.1-b) x 3%/year]	US$/year		47,100	47,100	47,100	47,100	47,100	47,100	57,600	57,600	57,600	57,600	57,600	57,600
(d) Total	US$/year		200,809	200,809	200,809	200,809	200,809	200,809	211,309	256,844	256,844	256,844	256,844	256,844
5. Income of Water Charge														
(a) Average Water Tariff	US$/M3		0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
(b) Leakage Ratio			0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
(c) Actual Water Supply Volume in a day [(1.4) x Leakage Ratio]	M3/day		25,269	26,381	27,542	28,754	30,019	31,339	32,240	34,300	35,912	37,564	39,329	41,280
(d) Annual Income of Water Supply	US$/year		368,929	385,161	402,108	419,801	438,272	457,556	470,704	500,776	524,312	548,431	574,207	602,688
6. Cost Balance (Income - O&M cost) [(4.2-d) - (5.-d)]	US$/year		168,119	184,352	201,299	218,992	237,463	256,747	259,395	243,932	267,469	291,587	317,363	345,844

(Case B)

7. Total Cost Balance(No.1 Area + No.2 Area)	US$/year	404,435	441,606	480,412	520,926	563,223	607,380	614,606	577,618	631,450	686,613	745,568	810,493

8. Data for Personnel Costs

	Total No. persons (person/day)	Salary (US$/day)	Shift	Total (per day) (US$/day)	Total (per month) (US$/month)	Total (per year) (US$/year)
Chief Engineer	1	21	1	21	630	7,560
Mechanical Operator	1	7.5	3	22.5	675	8,100
Electrical Operator	1	7.5	3	22.5	675	8,100
Worker	6	5.5	3	99	2970	35,640
Guard Man	1	3	3	9	270	3,240
Total					5,220	62,640

The Basic Design Study on the Project for Improvement of Water Supply System at the Southern Pyramids Area in Giza City
Study on Operation and Maintenance (O&M) Costs

Case C (Flow rate control system: Number of pumps)

	(Unit)	1998 (FY1997)	1999	2000	2001	2002	2003	2004	2005 (FY2004)	2006	2007	2008	2009	2010
1. Study Conditions of the Project														
1.1 Site Area														
No.1 Area (Konayessa/Talbia)	km2	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
No.2 Area (Sphinx)	km2	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Total	km2	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
1.2 Population in the Project Area														
Annual Increasing Ratio		1.044	1.044	1.044	1.044	1.044	1.044	1.044	1.044	1.047	1.047	1.046	1.047	1.047
No.1 Area (Konayessa/Talbia)	person	185,832	194,009	202,545	211,457	220,761	230,475	240,615	251,000	262,797	275,148	287,805	301,332	315,495
No.2 Area (Sphinx)	person	144,072	150,411	157,029	163,939	171,152	178,683	186,545	195,000	204,165	213,761	223,594	234,103	245,105
Total	person	329,904	344,420	359,574	375,396	391,913	409,157	427,160	446,000	466,962	488,909	511,399	535,435	560,600
1.3 Design Water Consumption														
Design Maximum Water Consumption per Person-Day	m3/day	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
1.4 Design Water Consumption of Daily Maximum (Qd)														
No.1 Area (Konayessa/Talbia)	M3/day	39,025	40,742	42,534	44,406	46,360	48,400	50,529	52,000	55,187	57,781	60,439	63,280	66,400
No.2 Area (Sphinx)	M3/day	30,255	31,586	32,976	34,427	35,942	37,523	39,174	40,300	42,875	44,890	46,955	49,162	51,600
Total	M3/day	69,280	72,328	75,511	78,833	82,302	85,923	89,704	92,300	98,062	102,671	107,394	112,441	118,000
(% of the Volume at Year 2010)	%	58.7	61.3	64.0	66.8	69.7	72.8	76.0	78.2	83.1	87.0	91.0	95.3	100.0
1.5 Average Hourly Flow Rate (Qh-ave: Qd/24)														
No.1 Area (Konayessa/Talbia)	M3/h	1,626	1,698	1,772	1,850	1,932	2,017	2,105	2,167	2,299	2,408	2,518	2,637	2,767
No.2 Area (Sphinx)	M3/h	1,261	1,316	1,374	1,434	1,498	1,563	1,632	1,679	1,786	1,870	1,956	2,048	2,150
1.6 Maximum Hourly Flow Rate(Qh-max : Qh-ave x Coeffcient houly maximum:1.3)														
No.1 Area (Konayessa/Talbia)	M3/h	2,114	2,207	2,304	2,405	2,511	2,622	2,737	2,817	2,989	3,130	3,274	3,428	3,597
No.2 Area (Sphinx)	M3/h	1,639	1,711	1,786	1,865	1,947	2,033	2,122	2,183	2,322	2,432	2,543	2,663	2,795
1.7 Required Water Reservoir Capacity (5hr capacity of one day consumption)														
No.1 Area (Konayessa/Talbia)	M3	8,130	8,488	8,861	9,251	9,658	10,083	10,527	10,833	11,497	12,038	12,591	13,183	13,833
No.2 Area (Sphinx)	M3	6,303	6,580	6,870	7,172	7,488	7,817	8,161	8,396	8,932	9,352	9,782	10,242	10,750

No.1 Distribution Area (Konayessa and Talbia)

2. Capacity of Distribution Pump Station

2.1 No. of Pump to be installed														
(a) No. of Units (operation)	unit	4	4	4	4	4	4	4	4	5	5	5	5	5
(b) No. of Units (stand-by)	unit	1	1	1	1	1	1	1	1	1	1	1	1	1
2.2 Calculation of Requried Pump Capacity														
(a) Specific gravity of pump liquid (γ)		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
(b) Requried Flow Rate of each Pump (Q-pump)	M3/min/unit	8.8	9.2	9.6	10.0	10.5	10.9	11.4	11.7	10.0	10.4	10.9	11.4	12.0
(Q-pump=Qh-max /60/No. of Units)														
(c) Total Head (H)	m	50	50	50	50	50	50	50	50	50	50	50	50	50
(d) Pump efficiency (η)		0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
(e) Excess (C)		1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
(f) Required motor out put (P)	kW/unit	101	105	110	115	120	125	130	134	114	119	125	131	137
(P = 0.163 x γ x Q-pump x H/ η x C)														
2.3 Spec. of Pump to be installed (Capacity in 2005 shall be adopted.)														
(a) Pump Flow Rate (Q-spec)	M3/min/unit	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7
(b) Motor output (P-spec)	kW/unit	134	134	134	134	134	134	134	134	134	134	134	134	134

3. Pump Operation Mode and Power Consumption

3.1 Hourly Flow Rate during Pump Operation (Peak Time)														
10:00~11:00		1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
11:00~12:00		1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
12:00~13:00		1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28
13:00~14:00		1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28
14:00~15:00		1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
15:00~16:00		1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
16:00~17:00		1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13
17:00~18:00		1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13
18:00~19:00		1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
19:00~20:00		1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30
20:00~21:00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21:00~22:00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Average		1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18
3.2 Average Flow Rate during Peak Time [(3.1)-ave x Qh-ave/60]														
Average Flow Rate	M3/min	32.0	33.4	34.9	36.4	38.0	39.7	41.5	42.7	45.3	47.4	49.6	51.9	54.5

(Case C)

Item	Unit													
3.3 Ratio of Average Flow Rate agaist Total Pump Flow Rate [(3.2)/(Q-spec x No. of Pump ope)]		0.68	0.71	0.74	0.78	0.81	0.85	0.88	0.91	0.77	0.81	0.85	0.88	0.93
3.4 Required Power Consumption during peak load (P-spec x No. of Pump to be ope x10hrs/day)	kWh/day	5,366	5,366	5,366	5,366	5,366	5,366	5,366	5,366	6,707	6,707	6,707	6,707	6,707
Note: Pump operation mode is as follows:														
No.1 pump	kWh/day	1,341	1,341	1,341	1,341	1,341	1,341	1,341	1,341	1,341	1,341	1,341	1,341	1,341
No.2 pump	kWh/day	1,341	1,341	1,341	1,341	1,341	1,341	1,341	1,341	1,341	1,341	1,341	1,341	1,341
No.3 pump	kWh/day	1,341	1,341	1,341	1,341	1,341	1,341	1,341	1,341	1,341	1,341	1,341	1,341	1,341
No.4 pump	kWh/day	1,341	1,341	1,341	1,341	1,341	1,341	1,341	1,341	1,341	1,341	1,341	1,341	1,341
No.5 pump	kWh/day	0	0	0	0	0	0	0	0	1,341	1,341	1,341	1,341	1,341
3.5 Annual Power Consumption [(3.4-total) x 365days/year)]	kWh/year	1,958,478	1,958,478	1,958,478	1,958,478	1,958,478	1,958,478	1,958,478	1,958,478	2,448,097	2,448,097	2,448,097	2,448,097	2,448,097
4. O&M Costs														
4.1 Electric Tariff and Equipment Costs														
(a) Electric Tariff	US$/kWh	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
(b) Equipment Cost (Total)	Mil.US$	2.31							2.66					
-3pumps		2.31							2.31					
-1pump (Future)		0.00							0.35					
(c) Exchange rate	¥/$	110	110	110	110	110	110	110	110	110	110	110	110	110
4.2 Estimated O&M Costs														
(a) Electric Charge [(3.5) x(4.1-a)]	US$/year		117,509	117,509	117,509	117,509	117,509	117,509	117,509	146,886	146,886	146,886	146,886	146,886
(b) Personnel Costs (8.)	US$/year		62,640	62,640	62,640	62,640	62,640	62,640	62,640	62,640	62,640	62,640	62,640	62,640
(c) Spare Parts Costs [(4.1-b) x 3%/year]	US$/year		69,300	69,300	69,300	69,300	69,300	69,300	79,800	79,800	79,800	79,800	79,800	79,800
(d) Total	US$/year		249,449	249,449	249,449	249,449	249,449	249,449	259,949	289,326	289,326	289,326	289,326	289,326
5. Income of Water Charge														
(a) Average Water Tariff	US$/M3		0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
(b) Leakage Ratio			0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
(c) Actual Water Supply Volume in a day [(1.4) x Leakage Ratio]	M3/day		32,593	34,028	35,525	37,088	38,720	40,423	41,600	44,150	46,225	48,351	50,624	53,120
(d) Annual Income of Water Supply	US$/year		475,864	496,802	518,662	541,483	565,308	590,182	607,360	644,588	674,884	705,929	739,107	775,552
6. Cost Balance (Income - O&M cost) [(4.2-d) - (5.-d)]	US$/year		226,416	247,354	269,213	292,034	315,859	340,733	347,411	355,263	385,558	416,603	449,782	486,226

No.2 Distribution Area (Sphinx)

2. Capacity of Distribution Pump Station

2.1 No. of Pump to be installed														
(a) No. of Units (operation)	unit	4	4	4	4	4	4	4	4	5	5	5	5	5
(b) No. of Units (stand-by)	unit	1	1	1	1	1	1	1	1	1	1	1	1	1
2.2 Calculation of Requried Pump Capacity														
(a) Specific gravity of pump liquid (γ)		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
(b) Requried Flow Rate of each Pump (Q-pump) (Q-pump=Qh-max /60/No. of Units)	M3/min/unit	6.8	7.1	7.4	7.8	8.1	8.5	8.8	9.1	7.7	8.1	8.5	8.9	9.3
(c) Total Head (H)	m	50	50	50	50	50	50	50	50	50	50	50	50	50
(d) Pump efficiency (η)		0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
(e) Excess (C)		1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
(f) Required motor out put (P) (P = 0.163 x γ x Q-pump x H/ η x C)	kW/unit	78	81	85	89	93	97	101	104	88	93	97	101	106
2.3 Spec. of Pump to be installed (Capacity in 2005 shall be adopted.)														
(a) Pump Flow Rate (Q-spec)	M3/min/unit	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1
(b) Motor output (P-spec)	kW/unit	104	104	104	104	104	104	104	104	104	104	104	104	104

3. Pump Operation Mode and Power Consumption

3.1 Hourly Flow Rate during Pump Operation (Peak Time)													
10:00~11:00	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
11:00~12:00	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
12:00~13:00	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28
13:00~14:00	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28
14:00~15:00	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
15:00~16:00	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
16:00~17:00	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13
17:00~18:00	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13
18:00~19:00	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
19:00~20:00	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30
20:00~21:00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21:00~22:00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Average	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18
3.2 Average Flow Rate during Peak Time [(3.1-ave) x Qh-ave/60]													
Average Flow Rate M3/min	24.8	25.9	27.1	28.3	29.5	30.8	32.1	33.1	35.2	36.8	38.5	40.3	42.3

3.3 Ratio of Average Flow Rate agaist Total Pump Flow Rate [(3.2)/(Q-spec x No. of Pump ope)]		0.68	0.71	0.74	0.78	0.81	0.85	0.88	0.91	0.77	0.81	0.85	0.89	0.93
3.4 Required Power Consumption during peak load	kWh/day	4,158	4,158	4,158	4,158	4,158	4,158	4,158	4,158	5,198	5,198	5,198	5,198	5,198
(P-spec x No. of Pump to be ope x10hrs/day)														
Note: Pump operation mode is as follows:														
No.1 pump	kWh/day	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040
No.2 pump	kWh/day	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040
No.3 pump	kWh/day	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040
No.4 pump	kWh/day	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040
No.5 pump	kWh/day	0	0	0	0	0	0	0	0	1,040	1,040	1,040	1,040	1,040
3.5 Annual Power Consumption	kWh/year	1,517,820	1,517,820	1,517,820	1,517,820	1,517,820	1,517,820	1,517,820	1,517,820	1,897,275	1,897,275	1,897,275	1,897,275	1,897,275
[(3.4) x 365days/year]														
4. O&M Costs														
4.1 Electric Tariff and Equipment Costs														
(a) Electric Tariff	US$/kWh	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
(b) Equipment Cost (Total)	Mil.US$	1.80							2.06					
-3pumps		1.80							1.80					
-1pump (Future)		0.00							0.26					
(c) Exchange rate	¥/$	110	110	110	110	110	110	110	110	110	110	110	110	110
4.2 Estimated O&M Costs														
(a) Electric Charge [(3.5) x (4.1-a)]	US$/year		91,069	91,069	91,069	91,069	91,069	91,069	91,069	113,837	113,837	113,837	113,837	113,837
(b) Personnel Costs (8.)	US$/year		62,640	62,640	62,640	62,640	62,640	62,640	62,640	62,640	62,640	62,640	62,640	62,640
(c) Spare Parts Costs [(4.1-b) x 3%/year]	US$/year		54,000	54,000	54,000	54,000	54,000	54,000	61,800	61,800	61,800	61,800	61,800	61,800
(d) Total	US$/year		207,709	207,709	207,709	207,709	207,709	207,709	215,509	238,277	238,277	238,277	238,277	238,277
5. Income of Water Charge														
(a) Average Water Tariff	US$/M3		0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
(b) Leakage Ratio			0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
(c) Actual Water Supply Volume in a day	M3/day		25,269	26,381	27,542	28,754	30,019	31,339	32,240	34,300	35,912	37,564	39,329	41,280
[(1.4) x Leakage Ratio]														
(d) Annual Income of Water Supply	US$/year		368,929	385,161	402,108	419,801	438,272	457,556	470,704	500,776	524,312	548,431	574,207	602,688

6. Cost Balance (Income − O&M cost) [(4.2-d) − (5.-d)]	US$/year	161,219	177,452	194,399	212,092	230,563	249,847	255,195	262,499	286,036	310,154	335,930	364,411
7. Total Cost Balance(No.1 Area + No.2 Area)	US$/year	387,635	424,806	463,612	504,126	546,423	590,580	602,606	617,762	671,594	726,757	785,712	850,638

8. Data for Personnel Costs

	Total No. persons (person/day)	Salary (US$/day)	Shift	Total (per day) (US$/day)	Total (per month) (US$/month)	Total (per year) (US$/year)
Chief Engineer	1	21	1	21	630	7,560
Mechanical Operator	1	7.5	3	22.5	675	8,100
Electrical Operator	1	7.5	3	22.5	675	8,100
Worker	6	5.5	3	99	2970	35,640
Guard Man	1	3	3	9	270	3,240
Total					5,220	62,640

APPENDIX 8

RESULTS OF BORE HOLE TEST

Project : Water Supply System	Date : FEB. 1997
Location : Southern Pyramids Area/Giza	Method : Mechanical
Broehole No : 6	Cround elevation :
Ground water table Initial :	Final : 3.80 m

Depth m	Sample Type	SPT or q_{un}	Strata Log	Strata Elev.	Description of strata
	O			0.5	Backfill "silty CLAY, with Rubbish"
	■	q = 1.2			Dark brown stiff silty CLAY
2.0	■	q = 1.4			
	O	18			
4.0					
	O	21			
6.0					
	O	18			
8.0					
	O	22			
10.0				10.0	
	O	18			Light brown fine to medium SAND, Some silt
12.0				12.5	
	O	> 50			Siliceous light brown medium to fine SAND, traces of silt.
14.0	O	> 50			
	O	> 50			
16.0					
	O	> 50			
18.0					
	O	50			
20.0	O	> 50		20.0	

END OF BORING

Project : Water Supply System	Date : FEB. 1997
Location : Southern Pyramids Area/Giza	Method : Mechanical
Broehole No : 7	Cround elevation :
Ground water table Initial :	Final : 4.0 m

Depth m	Sample Type	SPT or q_{un}	Strata Elev.	Description of strata
	O		0.5	Backfill "silty CLAY. with gravel. Rock fragments"
				Brown clayey SILT, Traces of Sand.
2.0	■	q = 1.2	2.20	
	O	16		
4.0	■	q = 1.6		
	O	18		Dark brown stiff silty CLAY, Traces of Sand
6.0	■	q = 1.6		
	O	19		
8.0				
	O	25	8.5	Brown SILT, Some Sand, Traces of Clay.
			9.5	Brown Sandy. SILT, Traces of Clay.
10.0			10.5	Brown Silty fine SAND
	O	48	11.5	
12.0				
	O	> 50		
14.0	O	> 50		
	O	> 50		Siliceous light brown fine to medium SAND, traces of silt.
16.0				
	O	> 50		
18.0				
	O	> 50		
20.0	O	> 50	20.0	

END OF BORING

Project : Water Supply System		Date : FEB. 1997
Location : Southern Pyramids Area/Giza		Method : Mechanical
Broehole No : 8		Cround elevation :
Ground water table	Initial :	Final : 3.1 m

Depth m	Sample Type	SPT or q_{un}	Strata Elev.	Description of strata
				Backfill "Rock fragments, silty CLAY and Sand"
2.0	O		2.0	
	■	q = 1.5		Dark brown stiff to very stiff silty clay, traces of sand.
4.0	O	12		
	■	q = 1.6		
6.0	O	15		
	■	q = 1.9		
8.0	O	18		
	O	21		
10.0	■	q = 1.6	10.5	
	O	23		Dark grey very stiff silty CLAY. Traces of Sand.
12.0	■	q = 2.1	12.8	
	O	37	13.5	Dark grey silty CLAY with Sand.
14.0				Siliceous light brown fine to medium SAND. Traces of silt.
	O	44		
16.0	O	> 50	16.5	
				Siliceous light brown graded SAND. Traces of gravel.
18.0	O	> 50		
20.0	O	> 50	20.0	

END OF BORING

Project : Water Supply System
Location : Southern Pyramids Area/Giza
Broehole No : 9
Ground water table Initial : Final : 3.20 m

Date : FEB. 1997
Method : Mechanical
Cround elevation :

Depth m	Sample Type	SPT or q_{un}	Strata Elev.	Description of strata
2.0	O		2.5	Backfill "grey silty CLAY, organic matter"
	■	q = 1.3		Brown stiff silty CLAY
	O	11		
4.0	■	q = 1.4		
	O	14		
6.0	■	q = 1.8		
	O	18		
8.0	■	q = 1.6	8.00	
	O	23		Brown stiff clayey SILT, Traces of Sand
10.0			10.5	
	O	30		Brown silty SAND, Some clay
12.0				
	O	> 50	12.5	Siliceous light brown fine to medium SAND, Traces of silt.
			13.3	
14.0				
	O	> 50		
16.0	O	> 50		
	O	> 50		
18.0				
20.0	O	23	19.70 20.0	Light brown clayey SILT, Traces of Sand.

END OF BORING

4 . 1 . 3 Grain Size Distribution :-

The results of six tests were utilized to ensure the visual classification of the soil samples. The results of these tests are annexed to this report.

4 . 1 . 4 Pocket Pentrometer :-

The results of the unconfined compressive strength of the cohesive soil strata using pocket penetrometer are shown on the borehole logs of this report.

4 . 1 . 5 Unconfined Compression Test :-

The results of unconfined compressive strength of some cohesive strata determined using the tri - axial compression apparatus are outlined in the following table, while the detailed output are given in the annexes,

B.H No	Depth (m)	Unconfined compressive strength (kg/cm^2)	cohesion (kg/cm^2)
1	2-00-3.00	2.40	1.20
2	2-50-4.00	2.30	1.15
3	3.00-4.50	1.90	0.95
4	2.00-3.50	1.84	0.92
5	3.00-4.50	1.68	0.84
6	3.00-4.50	2.40	1.20
7	4.00-5.50	1.84	0.92
8	4.00-5.50	1.92	0.96
9	4.00-5.50	1.05	0.52
10	8.00-9.50	2.40	1.20
11	8.00-9.50	3.12	1.56

4 . 1 . 6 Physical properties of cohesive soil strata :-

The following physical properties were determined for rèpreŝentative samples of the cohesive soil strata . The following table contains a summary of these results .

B.H NO	Depth (m)	N.M.C (%)	γ bulk gm/cm^3	Gs	e	γ dry gm/cm^3
1	2.00-3.00	26.3	1.988	2.704	0.718	1.574
2	2.5 -4.00	26.7	1.981	2.698	0.726	1.564
3	3.00-4.50	30.4	1.927	2.699	0.826	1.478
4	2.00-3.50	31.2	1.909	2.691	0.849	1.455
5	3.00-4.50	32.8	1.890	2.688	0.889	1.423
6	3.00-4.50	29.6	1.939	2.705	0.808	1.496
7	4.00-5.50	31.30	1.902	2.694	0.860	1.449
8	4.00-5.50	30.70	1.913	2.696	0.842	1.464
9	4.00-5.50	33.40	1.882	2.695	0.910	1.411
10	8.00-9.50	29.20	1.941	2.699	0.797	1.502
11	8.00-950	23.70	2.022	2.704	0.654	1.635

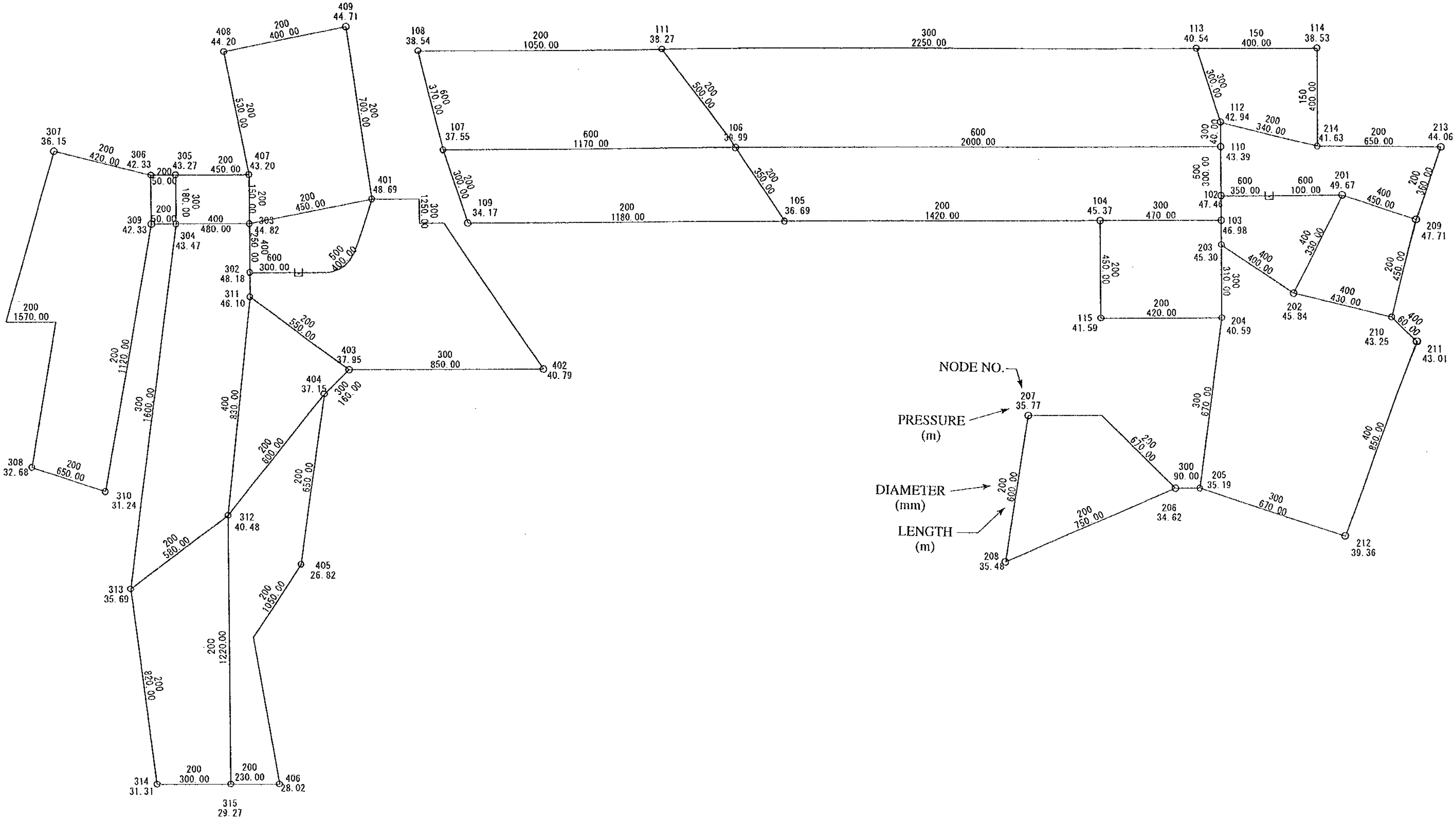
Where N . M . C = natural moisture content, Gs = specifc gravity e = void ratio, γ bulk, γ dry = natural unit weight and dry density of soil .

5) SUBSURFACE GROUND CONDITIONS :-

According to the results of field and laboratory testing , the soil profile at the site of borings can be described as follows :

APPENDIX 9

RESULTS OF NETWORK ANALYSIS FOR WATER DISTRIBUTION PIPELINES



RESULTS OF NETWORK ANALYSIS
FOR WATER DISTRIBUTION PIPELINES

HYDRAULIC ANALYSIS RESULTS

PIPELINE DATA

LINE	FROM	TO	LENGTH m	DIA. mm	FLOW m3/s	HEAD LOSS m	VELOCITY m/s
1-A	101	102	350.00	600	0.666	3.54	2.355
1-B	102	103	80.00	400	0.172	0.48	1.370
1-C	103	104	470.00	300	0.093	3.61	1.309
1-D	104	105	1420.00	200	0.026	7.68	0.838
1-E	106	105	350.00	200	0.036	3.29	1.130
1-F	106	107	1170.00	600	0.112	0.44	0.396
1-G	107	108	370.00	600	0.033	0.01	0.116
1-H	105	109	1180.00	200	0.007	0.53	0.218
1-I	107	109	300.00	200	0.039	3.38	1.247
1-J	102	110	300.00	500	0.483	4.07	2.458
1-K	110	106	2000.00	600	0.292	4.40	1.033
1-L	106	111	500.00	200	0.021	1.72	0.656
1-M	108	111	1050.00	200	0.012	1.27	0.373
1-N	110	112	40.00	300	0.114	0.45	1.608
1-O	112	113	300.00	300	0.095	2.40	1.337
1-P	113	114	400.00	150	0.001	0.02	0.049
1-Q	113	111	2250.00	300	0.038	3.28	0.533
1-R	104	115	450.00	200	0.014	0.78	0.452
2-A	101	201	100.00	600	0.366	0.33	1.295
2-B	201	202	330.00	400	0.247	3.83	1.962
2-C	202	210	430.00	400	0.133	1.58	1.056
2-D	210	211	60.00	400	0.140	0.24	1.115
2-E	211	212	850.00	400	0.121	2.65	0.964
2-F	202	203	400.00	400	0.077	0.54	0.612
2-G	203	204	310.00	300	0.118	3.71	1.664
2-H	204	205	670.00	300	0.074	3.39	1.045
2-I	212	205	670.00	300	0.071	3.17	1.007
2-J	205	206	90.00	300	0.084	0.58	1.188
2-K	206	207	670.00	200	0.023	2.85	0.735
2-L	207	208	600.00	200	0.007	0.29	0.226
2-M	206	208	750.00	200	0.023	3.13	0.729
2-N	201	209	450.00	400	0.098	0.96	0.784
2-O	209	213	360.00	200	0.037	3.65	1.177
2-P	209	210	450.00	200	0.037	4.46	1.162
2-Q	213	214	650.00	200	0.026	3.43	0.827
2-R	214	114	400.00	150	0.012	2.10	0.687
2-S	103	203	150.00	300	0.070	0.68	0.986
2-T	112	214	340.00	200	0.010	0.32	0.323
2-U	115	204	420.00	200	0.001	0.01	0.038
3-A	301	302	300.00	600	0.505	1.82	1.786
3-B	302	303	250.00	400	0.221	2.36	1.756
3-C	303	304	480.00	400	0.187	3.35	1.490
3-D	304	305	180.00	300	0.032	0.20	0.460
3-E	305	306	50.00	200	0.052	0.94	1.647
3-F	306	307	420.00	200	0.045	6.18	1.439
3-G	307	308	1570.00	200	0.016	3.47	0.516
3-H	310	308	650.00	200	0.010	0.56	0.311
3-I	302	311	150.00	400	0.271	2.08	2.160
3-J	311	312	830.00	400	0.184	5.62	1.467
3-K	312	313	580.00	200	0.029	3.79	0.928
3-L	313	314	820.00	200	0.035	7.38	1.104
3-M	314	315	300.00	200	0.021	1.04	0.658
3-N	312	315	1220.00	200	0.037	12.21	1.169
3-O	304	313	1600.00	300	0.062	5.78	0.870
3-P	309	310	1120.00	200	0.033	9.09	1.043
3-Q	304	309	50.00	200	0.057	1.14	1.823
3-R	309	306	180.00	200	0.001	0.00	0.047
4-A	301	401	400.00	500	0.224	1.31	1.140
4-B	407	305	450.00	200	0.023	1.93	0.740
4-C	401	402	1250.00	300	0.094	9.90	1.331
4-D	402	403	850.00	300	0.059	2.85	0.836
4-E	403	404	160.00	300	0.073	0.80	1.035
4-F	404	405	650.00	200	0.045	9.33	1.420
4-G	406	405	1050.00	200	0.011	1.20	0.362
4-H	315	406	230.00	200	0.026	1.25	0.840

HYDRAULIC ANALYSIS RESULTS

PIPELINE DATA

LINE	FROM	TO	LENGTH m	DIA. mm	FLOW m3/s	HEAD LOSS m	VELOCITY m/s
4-I	401	303	450.00	200	0.029	2.87	0.917
4-J	303	407	150.00	200	0.038	1.61	1.215
4-K	407	408	530.00	200	0.001	0.01	0.030
4-L	409	408	400.00	200	0.012	0.51	0.384
4-M	401	409	700.00	200	0.027	3.98	0.861
4-N	311	403	550.00	200	0.051	10.16	1.627
4-O	312	404	600.00	200	0.034	5.33	1.096

HYDRAULIC ANALYSIS RESULTS

NODAL DATA

NODE NO.	ELEVATION m	DEMAND m3/s	PRESSURE m
102	20.00	0.011	47.46
103	20.00	0.010	46.98
104	18.00	0.052	45.37
105	19.00	0.055	36.69
106	19.00	0.124	39.99
107	21.00	0.040	37.55
108	20.00	0.021	38.54
109	21.00	0.046	34.17
110	20.00	0.077	43.39
111	19.00	0.070	38.27
112	20.00	0.009	42.94
113	20.00	0.056	40.54
114	22.00	0.013	38.53
115	21.00	0.013	41.59
201	21.00	0.021	49.67
202	21.00	0.037	45.84
203	21.00	0.029	45.30
204	22.00	0.045	40.59
205	24.00	0.061	35.19
206	24.00	0.038	34.62
207	20.00	0.016	35.77
208	20.00	0.030	35.48
209	22.00	0.025	47.71
210	22.00	0.029	43.25
211	22.00	0.019	43.01
212	23.00	0.050	39.36
213	22.00	0.011	44.06
214	21.00	0.024	41.63
302	21.00	0.013	48.18
303	22.00	0.024	44.82
304	20.00	0.036	43.47
305	20.00	0.004	43.27
306	20.00	0.008	42.33
307	20.00	0.029	36.15
308	20.00	0.026	32.68
309	20.00	0.023	42.33
310	22.00	0.023	31.24
311	21.00	0.036	46.10
312	21.00	0.084	40.48
313	22.00	0.056	35.69
314	19.00	0.014	31.31
315	20.00	0.031	29.27
401	21.00	0.074	48.69
402	19.00	0.035	40.79
403	19.00	0.037	37.95
404	19.00	0.063	37.15
405	20.00	0.056	26.82
406	20.00	0.015	28.02
407	22.00	0.014	43.20
408	21.00	0.013	44.20
409	21.00	0.015	44.71

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