

## **CHAPTER 3 OUTLINE OF PROJECT SITE**



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### 3-1 Location and Socioeconomic Conditions of Project Site

#### 3-1-1 Location

The Monib District, i.e., the Project Site, is located in south Giza (see Location Map of Project Site) and Omrania West where the water supply and sewer facilities were improved by Japan's grant aid in March, 1991 is located to the immediate north of the Project Site. A trunk road which connects Cairo to the pyramids runs a few kilometres north of the Project Site. With Cairo on the opposite side of the Nile being a distance of only some 10km, the Project Site forms part of the Greater Cairo Region.

#### 3-1-2 Socioeconomic Conditions

The Project Site is a newly emerging residential area with a rapid population increase in recent years, taking advantage of the facts that the distance to central Giza is as short as some 4km and that the commuting time to Cairo will be drastically reduced with the completion of the ring road, construction of which is currently in progress (see 2-3-2).

The prominent industry is commerce, mainly consisting of retailers. The area is presently best described as a residential-cum-commercial area with no large factories. The residential area in the Monib District is divided into 4 blocks by main roads. The sprawl of housing areas in the Project Site in the last 20 years is shown in Fig. 3-1.

Of these 4 blocks, the increasing concentration of housing is particularly noticeable in Block A in the north of the Project Site bordering Omrania West and Block C which is at the centre of the Project Site and which is a commercial area with many retail shops. Much of the housing in these 2 blocks, in fact, consists of 6-10 storey buildings, resulting in a particularly high population density. The characteristics of each block are described in Table 3-1.

The Project Site is known among the districts of Giza for its concentration of low income people. The high population density and the slow progress in the improvement of the public infrastructure, including water supply and sewer facilities, have contributed to the creation of inferior living conditions. The health environment of local inhabitants is particularly poor and demands the urgent improvement of both the general living and health standards, through the construction of water supply and sewer facilities, both of which are essential integral parts of the public infrastructure.

Table 3-2 shows the land size, present population and estimated future population in the year 2010 of the Project Site.

Table 3-1 Characteristics of Housing in Project Site

Block	Area	Description
A	North of Dr. Mohamed Fouad Sahed Street	Northernmost part of the Project Site bordering Omrania West. Housing development particularly progressing in the last 20 years with many high-rise (6-10 storey) apartment buildings.
B	Area between Mohamed Fouad Sahed Street and Terra Nirsa Street	Macaroni factory at the centre of the block is the largest factory in the Project Site and acts as the block's symbol. Housing development conducted with the construction of the factory but slow in progress compared to Block A and Block C. Much farmland still remains in the midst of the residential area.
C	Area between Terra Nirsa Street and Monib Street	Commercial centre of the Project Site with many new high-rise apartments together with old houses. Most buildings are 6-10 storeys and the population density has almost reached saturation point.
D	South of Monib Street	Southernmost part of the Project Site with much farmland. Housing development in progress although slower than in Block A and Block C. Remaining farmland will gradually become residential areas.

Table 3-2 Size and Population of Project Site

Item	Figure
Area	185ha
Present Population (1990)	Approx. 133,000 (Population Density: 718 persons/ha)
Estimated Future Population (2010)	Approx. 247,000 (Population Density: 1,335 persons/ha)

Source: Giza City

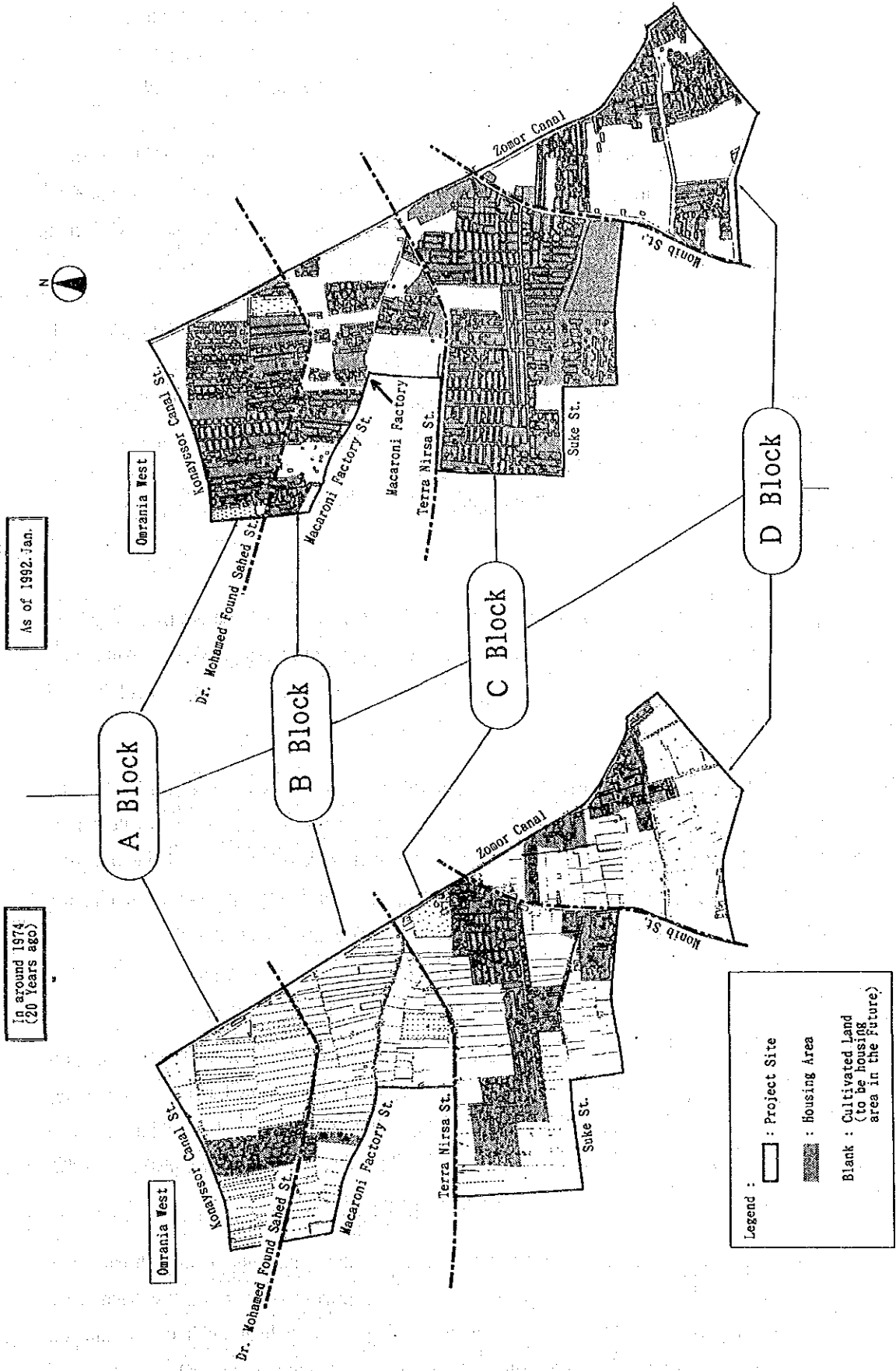


Fig. 3-1 Recent Development of Residential Areas in Project Site

## 3-2 Natural Conditions

### 3-2-1 Topography and Geology

The Greater Cairo Region is situated at the southern end of the Nile Delta and is surrounded by hills of some 200m above sea-level. The Monib District is located in southern Giza on the west bank of the Nile and generally consists of flat land. Existing geological survey data offer the following descriptions of the Monib District.

- upto approximately 1.5-2.5m below the ground surface: : clay layer containing limestone and red brick
- 2.5m below the ground surface up to a depth of 10m : intricate deposit formation of silty clay layers and sandy soil layers

There are no large cobble stones or gravel in the Project Site.

### 3-2-2 Groundwater Level

Existing survey data indicate that the groundwater level fluctuates because of changes in the water level of the Nile, seepage from the canal and wells and leakage from both water supply and sewer networks, reaching its highest level in December and lowest level in July and August.

The groundwater level in the Project Site is generally 1-3m below the ground level. The groundwater level at El Casabugi Street, where the construction of a sewer trunk line is planned, is likely to be approximately 1m below the ground level in view of the fact that the water level of the Zomor Canal which runs parallel to the Street, is usually 1m below the ground level except in winter which is the slack season for farming.

### 3-2-3 Weather

Statistical data for the last 20 years show that the mean annual temperature in the Greater Cairo Region is approximately 21.8°C and that the mean temperature in winter (November-March) is approximately 16°C. While the mean temperature in summer (May-September) is approximately 27°C, the maximum temperature may well reach 40-45°C with a large temperature difference between day and night.

The mean annual rainfall in areas along the Mediterranean coast is some 190mm and only a mere 25mm in the Greater Cairo Region. Rain sometimes takes the form of a localised downpour, causing damage. The humidity is very low with mean annual humidity of approximately 53%. The lowest humidity of approximately 40% is recorded in May while the highest humidity of approximately 62% is recorded in November.

Sandstorms called Hamseen occasionally sweep across the Greater Cairo Region from the west in March and April. The wind speed is an average of some 9 m/s. Mist occurs in the Greater Cairo Region on some 11 days a year, mainly in early spring and early summer.

### 3-3 Social Conditions

#### 3-3-1 Conditions of Public Infrastructure

##### (1) Ports

Port Alexandria is generally used for the unloading of construction equipment and materials from Japan. In addition to Port Alexandria, Port Suez and Port Said are also available. As Port Alexandria is a free port, many regular Japanese liners call at the port. In view of the availability of excellent unloading facilities, making a long wait for unloading unnecessary, Port Alexandria provides the convenience required for the Project.

##### (2) Roads

###### 1) Roads Between Port Alexandria and Project Site

Port Alexandria is located at the western corner of the Nile Delta and 2 trunk roads, locally called Desert Road and Agriculture Road, connect the port with the Project Site. Of these 2 roads, Desert Road is usually used for the transportation of construction equipment and materials because of the following characteristics.

- The road width and median strip are wider than those of Agriculture Road.
- The distance is shorter by several tens of kilometres.
- The traffic volume is smaller.
- The road does not have any flyovers or bridges.
- The road has very few intersections with branch roads and seldom passes through populated areas.
- The road is well paved.
- There is little danger of people, cattle or donkeys crossing the road.

###### 2) Roads Around Project Site

Pyramid Street and King Faisal Street, the major trunk roads in the Greater Cairo Region, run to the north of the Project Site and these trunk roads are the arteries from central Cairo to other major urban centres. Although traffic on these roads is heavy, it runs smoothly except during the morning and evening rush hours because

of the wide width of the roads (9-11m in each direction) and well maintained asphalt paving.

These trunk roads and the Project Site are connected by El Kasabgy Street, El Cornesh Street, Monib Street and Osman Moharam Street, etc. Of these, El Cornesh Street, which runs from the South Giza Waterwoks to the Project Site, has a width of 30m and is a particularly busy road. Traffic congestion at Monib Square where El Cornesh Street crosses the Cairo-Aswan railway line is hectic during the rush hours with buses, passenger vehicles and horse-carts vying to get through.

### 3) Roads in Project Site

The locations and widths of roads in the Project Site are given in Fig. 3-2 and Table 3-3 respectively.

Table 3-3 Road Widths in Project Site

Road (Street)	Width
El Cornesh Street	approx. 30m
El Kasabgy Street	9-12m
Konayssah Canal Street	5- 8m
Dr. Mohamed Fouad Sahed Street	3- 4m
Macaroni Factory Street	approx. 3m
Terra Nirsa Street	8-10m
Gamal Abd El Nasr Street	5-10m
Suke Street	10-15m
Monib Street	15-20m
Osman Moharam Street	approx. 15m
Oroubar Street	4- 8m
Branch Roads in Residential Areas	3- 4m

El Kasabgy Street and Monib Street, the 2 main roads in the Project Site, are paved although the paving is worn in some places. El Kasabgy Street runs along the Zomor Canal and is the only trunk road on the west bank connecting central Giza and the Monib District, the densely populated Project Site. As such, it is used by trucks, taxis and regular bus services. While El Kasabgy Street has a road width of 9-12m, houses are built right upto the road boundary in a some 200m section near Monib Street, causing traffic jams. Monib Street has a road width of 15-20m. The



branch roads in residential areas are only partially paved and the surface is frequently uneven.

Monib Square where El Cornesh Street crosses the Cairo-Aswan railway line is a waiting spot for buses and omnitaxis. Traffic congestion is becoming the normal state because of the heavy traffic and the presence of many street stalls.

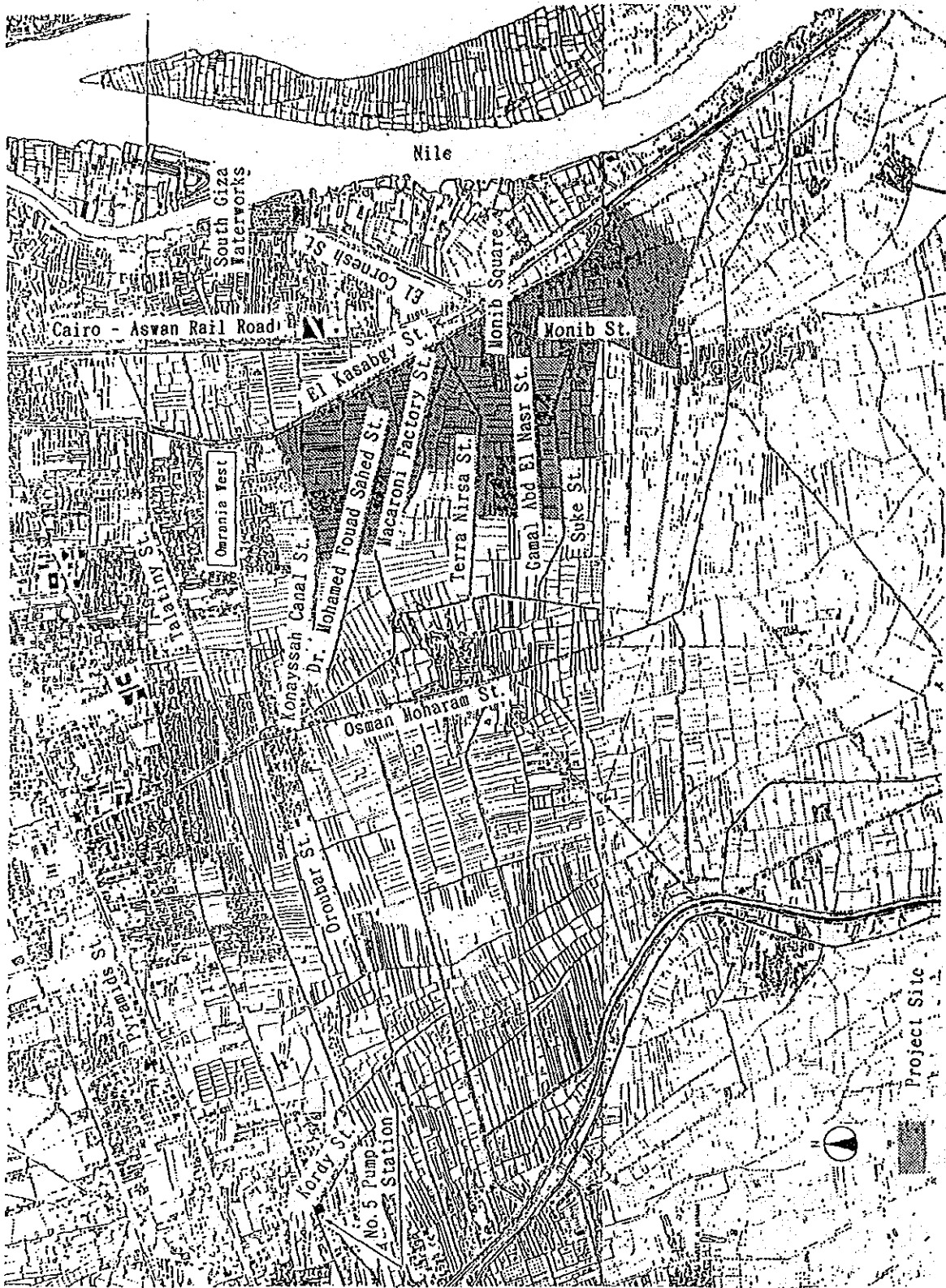


Fig. 3-2 Road Locations in Project Site

### (3) Railways

- 1) The Cairo-Aswan railway line runs parallel to El Kasabgy Street to the east of the Project Site. The water supply branch line (diameter: 300-600mm) planned under the Project will be laid across this railway line which consists of double tracks (approximately 16m wide) at the planned crossing point. The track bed is slightly above the road on either side.
- 2) Trains are pulled by diesel engines but do not run at high speed near the Project Site. The train load seems comparable to that of Japan Railways.

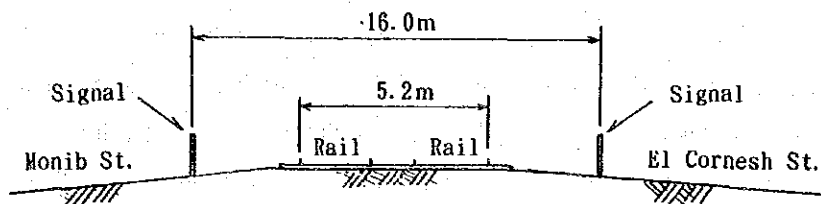


Fig. 3-3 Cross-Section of Railway Line

### (4) Canals

- 1) The Zomor Canal runs to the east of the Project Site and supplies irrigation water to farmland on the outskirts of Giza on the west bank of the Nile. The canal is the dug-in type and has hardly any man-made slope protection works on either bank.
- 2) The cross-section of the Zomor Canal near the Project Site is shown in Fig. 3-4. It usually dries up from mid-January to mid-February due to the lowering of the water level of the Nile, providing the opportunity for canal improvement work. The water quality is very poor due to contamination by sewage and rubbish.

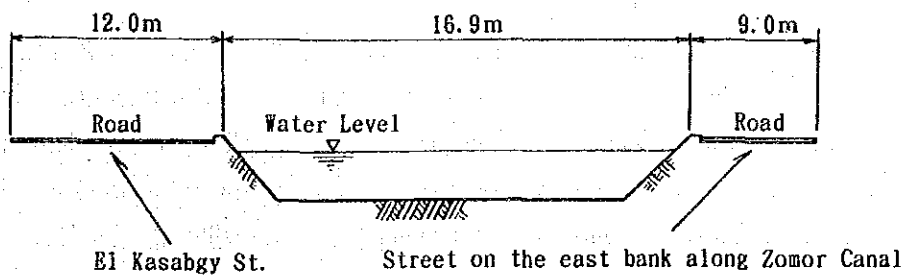


Fig. 3-4 Cross-Section of Zomor Canal

## (5) Power Supply and Telephone Lines

### 1) Power Supply Lines

There is no special high voltage transmission line exceeding 33KV in the Project Site. Instead, high voltage distribution lines of 10.5KV and low voltage distribution lines of 220-380V are directly buried below the ground to form the power supply network. These lines are usually buried under the road at a distance of some 0.8m from the end of the house. The burying depth is deeper than 80cm for high voltage cables (10.5KV) and deeper than 50cm for low voltage cables (220-380V).

There is no special protection for cables buried below ordinary roads. Conduit pipes are used at sections where cables cross trunk roads. In the case of high voltage cables recently buried, a sheet indicating the cable location may have also been buried above the cables. The types of power cables and burying methods in the Project Site are shown in Table 3-4.

Table 3-4 Power Cables in Project Site

Type	Voltage	Cable Type	Burying Method and Depth
High Voltage	10.5KV 3-phase 3-wire	armoured cable for direct burying	Direct Burying: - standard road section min. earth cover: 0.8m - trunk road crossing section max. earth cover: 2.0m
Low Voltage	220/380V 3-phase 4-wire	as above	Direct Burying: min. earth cover: 0.5m max. earth cover: 2.0m

### 2) Telephone Lines

Telephone lines in the Project Site are directly buried, forming an extensive network. The important trunk line is buried at a depth of approximately 2m and a width of approximately 1m along the east bank of the Zomor Canal [opposite side of the canal to the planned routes for the water supply branch line (diameter: 300-600mm) and sewer trunk line] but this should not affect the Project.

## (6) Hospitals

There are 3 small hospitals in the Project Site. The El Monib Special Hospital, the largest, has only some 30 beds. The hospital locations and sizes in terms of the available number of beds are shown in Fig. 3-5 and Table 3-5 respectively.

Table 3-5 Hospitals in Project Site

(as of December, 1991)

Name	Number of Beds
El Monib Hospital	about 20
El Monib Special Hospital	about 30
El Gamih Hospital	about 15

Source: Giza City

The water supply and sewer services for these hospitals are outlined below.

### Water Supply Facilities

- El Monib and El Monib Special Hospitals: potable water from public taps.
- El Gamih Hospital: groundwater from private well.
- Discharge of wastewater to cesspits for ground infiltration due to absence of sewer facilities.

## (7) Schools

There is one primary school and 2 secondary schools in the Project Site, all of which are located on either El Kasabgy Street or Suke Street, the main roads in the Project Site. The school locations and number of students are given in Fig. 3-5 and Table 3-6 respectively.

Table 3-6 Schools and Number of Students in Project Site

Name	Number of Students
El Stam Primary School	approximately 2,000
Taha Hosin Prep and Secondary School	approximately 3,000
El Monib Prep and Secondary School	approximately 9,000

Source: Giza City

The largest school in terms of the number of students is Monib Secondary School with some 9,000 students which is rather disproportionately large for the population of the Project Site, suggesting students also travel from neighbouring areas.


The water supply and sewer services for these schools are outlined below.

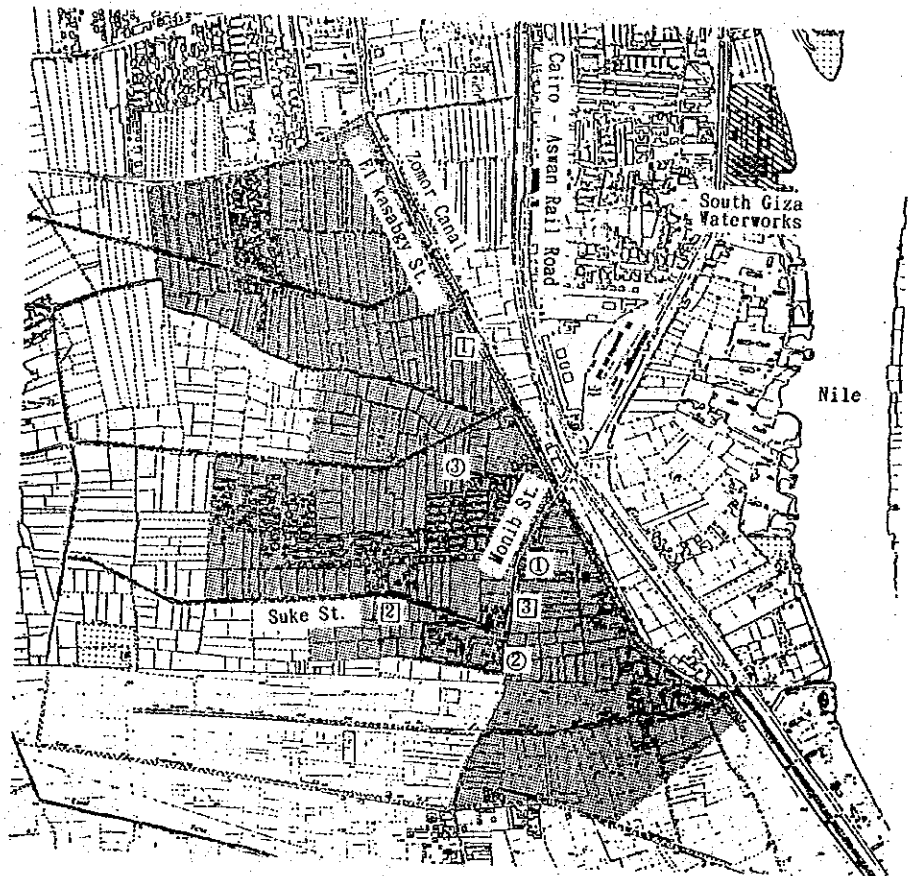
Water Supply Facilities

- Potable water from public taps.

Sewer Facilities

- Discharge of wastewater to cesspits for ground infiltration due to absence of sewer facilities.

Symbol	Description
	Project Site
①	El Monib Hospital
②	El Monib Special Hospital
③	El Gamih Hospital
1	El Slam Primary School
2	Taha Hosin Prep & Secondary School
3	El Monib Prep & Secondary Shool



( Source : Giza City )

Fig. 3-5 Locations of Hospitals and Schools in Project Site

### 3-3-2 Buildings and Living Environment

Most buildings in the Project Site are 4-10 storeys high. While reinforced concrete is used for columns, beams and slabs, bricks are used for walls, suggesting the insufficient resistance to vibration, external impact and deformation, etc.

Judging from the observation results of new buildings under construction, the foundation may not have sufficient bearing capacity.

Local inhabitants live among sheep and chickens, etc. The illegal dumping of solid waste on roads and empty land and the overflow of sewage from cesspits create poor sanitary conditions.

### 3-4 Outline of Water Supply and Sewer Services

#### 3-4-1 Water Supply Facilities

The planned water supply improvement work in the Project Site will be part of the overall water supply improvement work for the west bank of the Nile as described earlier (see 2-2-2).

At present, water supply branch lines (both large and small diameter pipes) cover part of the Project Site using the South Giza Waterworks as the supply source. Only a small number of households along these existing lines receive direct water supply and account for only some 5% of the total number of households in the Project Site. Most local inhabitants obtain water from public taps, travelling water wagons and wells. The area is, therefore, suffering from a chronic domestic water shortage. The existing water supply lines in the Project Site are shown in Fig. 3-6.

The current conditions and problems of water supply facilities in the Project Site are summarised below.

- 1) There are no public water supply facilities in the Project Site apart from those near El Kasabgy Street and Monib Street.
- 2) The number of public taps along El Kasabgy Street and Monib Street is limited.
- 3) Some local inhabitants have wells at their own expense to draw groundwater. As these wells are rather shallow (5-6m deep), the well water tends to be contaminated by seepage water from cesspits, resulting in unsanitary conditions for those using groundwater.

- 4) Many local inhabitants are obliged to collect a limited volume of domestic water (10-20 ltr/person/day) using buckets or the like from public taps located far from their homes in apartment buildings (4-10 storey buildings). This heavy work is usually the duty of women and children.
- 5) The provision of few fire hydrants means a high risk of fire.

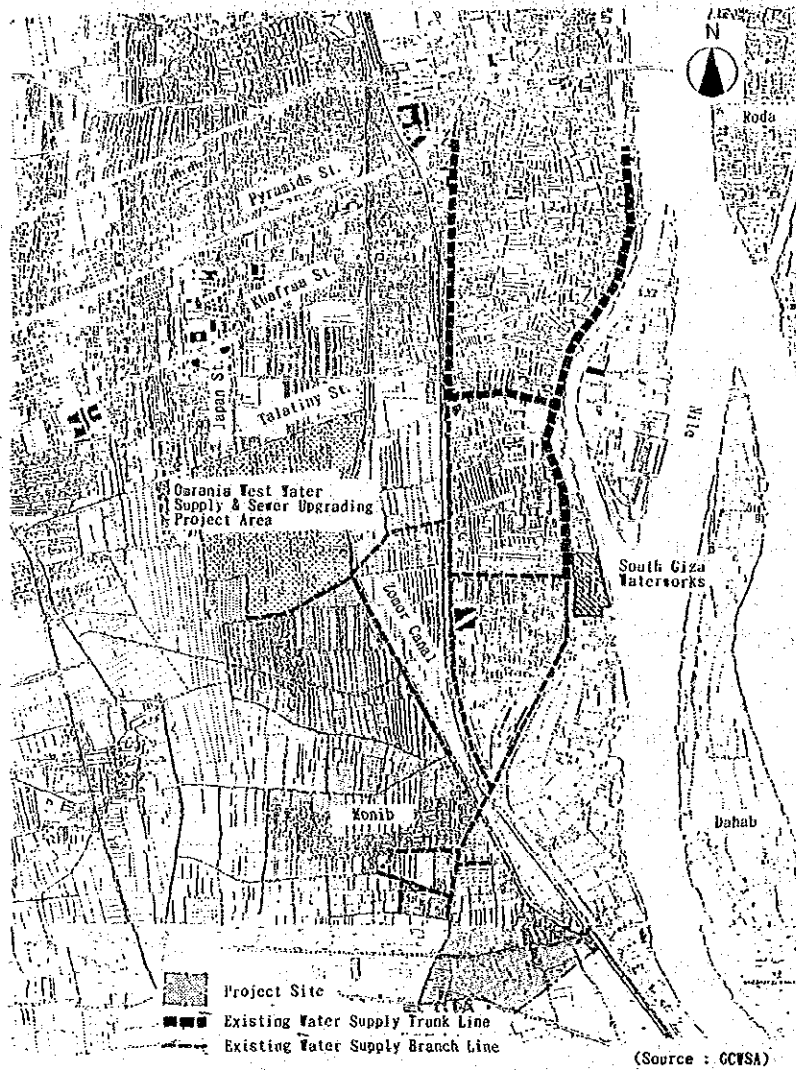


Fig. 3-6 Existing Water Supply Lines in Project Site



### 3-4-2 Sewer Facilities

The planned sewer improvement work in the Project Site will be part of the overall sewer improvement work for the west bank of the Nile (see 2-2-3) as in the case of water supply improvement work.

There are no sewer facilities in the Project Site at present and the outflow of sewage onto roads creates unsanitary conditions.

The current conditions and problems of sewer facilities in the Project Site are summarised below.

- 1) No public sewer facilities are provided in the Project Site.
- 2) Each apartment building or group of 2-3 buildings has a cesspit by the road and sanitary sewage disposed is collected 2 or 3 times/week by a vacuum vehicle of GOSD.
- 3) The sanitary sewage collection service using vacuum vehicles has not expanded in line with the population increase. In addition, some inhabitants with little disposable income cannot use this service for which a fee is charged, resulting in overflow from their cesspits.
- 4) Overflow from cesspits has become almost a part of daily life in and around Monib Street and Gamal Abd El Nasr Street where the population density is particularly high, creating an unhealthy environment.
- 5) Some sanitary sewage collected by vacuum vehicles is dumped into the Zomor canal in the Project Site, adversely affecting not only the sanitary conditions in areas along the canal but also the water quality of the Nile.

### 3-4-3 Evaluation of Omrania West Project

#### (1) Outline of Omrania West Project

The request for Japan's grant aid for the Project for Omrania West Water Supply and Sewer Upgrading, Giza City (hereinafter referred to as the Omrania West Project) with a project area of 58.82ha and a planned design service population of 175,460 in 2010 was made by the Government of Egypt. In response to this request, the Government of Japan authorised grant aid consisting of 1,010 million yen for Phase I in Japan's fiscal year 1988 and 1,170 million yen for Phase 2 in fiscal 1989.

The location of Omrania West is shown on the location map for the Project and the project implementation body was the Giza City which is the same as for the Project.

Table 3-7 outlines the water supply and sewer facilities involved in the Omrania West Project.

Table 3-7 Contents of Project for Omrania West Water Supply and Sewer Upgrading

Phase	Work Undertaken by Japanese Side	Work Undertaken by Egyptian Side
I	<ul style="list-style-type: none"> <li>• Construction of water supply main branch lines: 1,810m (diameter: 600mm, including ancillary facilities)</li> <li>• Construction of sewer trunk lines: 754m (diameter: 1,200mm, including manholes)</li> <li>• Construction of sedimentation basin: 4.9m × 16.2m × 7.1m</li> <li>• Provision of materials for water supply branch lines: 6,310m (diameter: 100-600mm)</li> <li>• Provision of materials for sewer branch lines: 1,380m (diameter: 175-375mm)</li> <li>• Provision of sewer pipeline cleaning vehicles               <ul style="list-style-type: none"> <li>- high pressure jet cleaning vehicles (2)</li> <li>- vacuum vehicles (2)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Construction of water supply branch lines: 6,310m (diameter: 100-600mm)</li> <li>• Construction of sewer branch lines: 1,380m (diameter: 175-375mm)</li> </ul>
II	<ul style="list-style-type: none"> <li>• Construction of water supply branch lines: 2,880m (diameter: 600mm, including ancillary facilities)</li> <li>• Construction of sewer trunk lines: 1,440m (diameter: 1,200mm, including manholes)</li> <li>• Installation of grit and trash removing equipment</li> <li>• Provision of materials for water supply branch lines: 6,160m (diameter: 100-300mm)</li> <li>• Provision of materials for sewer branch lines: 2,950m (diameter: 175-375mm)</li> </ul>	<ul style="list-style-type: none"> <li>• Construction of water supply branch lines: 6,160m (diameter: 100-300mm)</li> <li>• Construction of sewer branch lines: 2,950m (diameter: 175-375mm)</li> </ul>

(2) Project Implementation Processes

- 1) Date of Submission of the Request: July, 1987
- 2) Period of Preliminary Study: January 25 - February 7, 1988
- 3) Period of Basic Design Study: May 11 - June 19, 1988
- 4) Signing Date of E/N

Phase I : November 1, 1988

Phase II : June 22, 1989

- 5) Commencement Date of Construction Work

Phase I : June 6, 1989

Phase II : December 1, 1989

- 6) Completion Date of Construction Work

Phase I : March 10, 1990

Phase II : February 9, 1991

(3) Target Achievement Performance

The contents of the Omrania West Project, as in the case of the Project, followed the targets and policies of Egypt's Long-Term Perspective Plan and Second 5-Year Plan as described in 2-3-1 and the water supply facility plan and sewer facility plan were in line with the Study of Water Supply in Giza City and the Greater Cairo Waste Water Master Plan respectively.

All the work to be undertaken by the Japanese side was completed on schedule, as was the work to be undertaken by the Egyptian side, i.e., the construction of water supply and sewer branch lines using materials provided by Japanese side, by October, 1991, the planned completion date.

(4) Effects of the Project

All the water supply facilities constructed under the Omrania West Project, including branch lines constructed by the Egyptian side, are now operating without problems and have contributed to the improvement of the living and sanitation conditions. As intended, the local inhabitants are benefiting from these facilities and the facilities enjoy a good reputation among both government organizations and local inhabitants.

Measures to minimise construction hazards to local inhabitants, including adoption of the pipe jacking method, silent piler method, liner plate sheathing method and under-pressure drilling and tapping method, have also been praised. The transfer of technology has had positive technical impacts on the Egyptian side and no negative impacts in relation to the construction method employed and transferred technology have yet been recorded.

In appreciation of Japan's assistance, the Government of Egypt has renamed one street as Japan Street and the Amina Mohamed Pump Station as the Japanese Friendship Pump Station.

The main positive effects of the Omrania West Project, confirmed through the field survey for the Project, are listed in Table 3-8.

Table 3-8 Positive Effects of Omrania West Project

Category	Positive Effects
Water Supply Facilities	<ol style="list-style-type: none"> <li>1. Improved living and health environments due to a stable supply of potable water.</li> <li>2. Improved security in local life due to the installation of fire hydrants.</li> <li>3. Liberation of women and children from the hard work of water transportation.</li> </ol>
Sewer Facilities	<ol style="list-style-type: none"> <li>1. With the consolidation of the sewer trunk and branch lines, the sewer capacity was increased to lift the previous limitation on discharge, having eradicated the overload situation of the sewer trunk and branch line network while resulting in the following positive effects.               <ol style="list-style-type: none"> <li>1) Upgrading of the living environment and improvement of the poor health and sanitation conditions.</li> <li>2) Stabilisation of daily life.</li> </ol> </li> <li>2. The provision of a sedimentation basin, bar screen with mechanical rakes and sand pumps, etc., at the Japanese Friendship Pump Station has achieved the following effects.               <ol style="list-style-type: none"> <li>1) Improved protection and performance of pumps due to mechanical removal of rubbish and sand contained in sewage.</li> <li>2) Improved function and stable operation of pump stations.</li> <li>3) Liberation from unhygienic hard work to maintain pumping facilities.</li> </ol> </li> </ol>

## **(5) Prospect of Self-Reliant Development**

In implementing the Omrania West Project, the Egyptian side established the Project Steering Committee within the administrative frameworks of the Giza Governorate (responsible and coordinating organization) and the Giza City (the executing organization) after signing of the E/N. The Committee held joint meetings with related organizations (GCWSA, GOSD, Cairo Distribution Company and Gas Corporation) to smoothly implement the project.

The responsibility for operating and maintaining the completed water supply and sewer facilities was transferred from the Giza City to GCWSA and GOSD respectively. As both organizations have sufficient manpower, equipment and technical expertise, the operation and maintenance of these facilities is being conducted with no problems.

As described in 2-2-2-(2)-3) and 2-2-3-(2)-3), however, revision of the present water charge system is of crucial importance to continue to conduct appropriate maintenance as the financial situation of both GCWSA and GOSD is not particularly satisfactory with the present system and level of charges.

The smooth implementation of the construction of branch lines by the Egyptian side on schedule was, in fact, facilitated by the priority budgetary allocation by the Ministry of Planning.

The state of the operation and maintenance of the main water supply and sewer facilities constructed under the Omrania West Project are described below.

### **1) Water Supply Facilities**

The survey on the valves and fire hydrants requiring constant maintenance following the commencement of use did not find any faults or breakdowns and all facilities were operating properly.

### **2) Sewer Facilities**

#### **(a) Japanese Friendship Pump Station**

- ① Since the completion of the Omrania West Project, various facilities at this pump station have been functioning with no problems and all equipment has been well maintained.
- ② Operation and maintenance of the pump station is conducted by 3 shifts consisting of one full-time engineer and some 18 operators and



providing local inhabitants with many benefits. Moreover, its objectives were in line with those of master plans and it has greatly contributed to the upgrading of water supply and sewer services in Giza City. In view of these positive effects, the original development targets and objectives of the Omrania West Project, intending to meet urgent requirements in Egypt, are found appropriate.

The contents of the 2 construction phases, i.e., Phase I and Phase II, and the scope of work to be undertaken by each government in each phase are also found appropriate. Moreover, the originally set work quality and schedule were satisfactorily met.

#### (7) Implementation Efficiency

Upgrading of the water supply and sewer facilities in Omrania West was long called for to improve the notably poor public infrastructure in the area. Nevertheless, the low prospect of profitability of the water supply and sewer services made it difficult to secure a loan for the upgrading project. Furthermore, self-reliant implementation of the project was also found to be impossible due to the scale of the required investment.

The Omrania West Project was implemented under the above circumstances and the scope of the Japanese cooperation in financial terms was appropriate. All related stages, from the preliminary study to the basic design, signing of the E/N, detailed design and construction work, were efficiently completed with a total project duration, from the request by the Government of Egypt to the completion of the construction work, of 3 years and 8 months.

One minor set-back was a delay in regard to the construction agreement due to the late approval of the E/N by the People's Assembly of Egypt which resulted in a very tight construction schedule.

As a result of the policy to maximise the local procurement of materials and equipment as long as the specifications and quality, delivery and price conditions were met, the straight reinforced concrete pipes for the pipe jacking work were locally manufactured based on Japanese standards following the transfer of the relevant technologies, contributing to the creation of local employment and improvement of the technical level.

In regard to other Japanese assistance in the water supply and sewer sectors, a loan was provided by Japan for the Greater Cairo Region Water Supply Improvement Project in 1982. However, there is no direct link between this project and the Omrania West Project. Various master plans prepared by aid organizations in other donor countries are regarded as master plans for the Omrania West Project and there is an obvious link. In

contrast, there is no essential need to link the Omrania West Project with other projects in progress at the same time.

#### (8) Feedback of Evaluation Results

1) For the proper maintenance on the facilities of the Omrania West Project, the Egyptian Side should take the following measures.

##### (a) Water Supply Facilities

- ① Some manhole covers are covered by sand transported from the desert by strong wind or rubbish dumped by local inhabitants to a thickness of some 5cm and their locations are difficult to identify. Although this does not pose a serious threat to the function, it would be preferable from a maintenance point of view to remove the sand and/or rubbish more frequently.
- ② The function of the fire hydrants is maintained as in the case of manholes. Given their nature as emergency facilities to fight fires, however, test discharge should be conducted regularly to check the proper functioning together with the consolidation of an emergency response system.

##### (b) Japanese Friendship Pump Station

###### ① Effective Use of Operation and Maintenance Manuals

As described earlier, the sewer facilities are operated and maintained by the engineer assigned to the Pyramid Pump Station. However, the operation and maintenance manuals prepared and delivered to the Egyptian side by the equipment manufacturers and contractor are not kept at this engineer's office. Consequently, the said engineer supervises the operation and maintenance while relying on expertise acquired through OJT during the Omrania West Project and his past experience.

The facilities in question have so far been running smoothly with no breakdowns. Nevertheless, preventive maintenance should be regularly conducted to ensure reliable operation and functioning of the facilities over a long period of time. From this point of view, maintenance work suggested in the manuals should be conducted. In short, the manuals provided under the Omrania West Project should be kept at the office for easy access by those responsible for the operation and maintenance of the facilities to achieve better operation and maintenance results.



② Repair of Damaged Paintwork

In the case of mechanical equipment associated with the sedimentation basin, damaged paintwork of the machine installation table for the bar screen with mechanical rakes and sand pumps, etc., and also damaged paintwork of parts of the gate operating handle is visible. Since damaged paintwork contributes to shortening machine life, the necessary repairs should be conducted in line with the relevant paint specifications.

③ Storage of Spare Sand Pump

A sand pump provided as spare parts under the Omrania West Project is left outdoors in their original packings. This should be stored indoors at the storage of the Pyramid Pump Station or in a similar place to ensure the proper functioning of the Japanese Friendship Pump Station over a long period of time.

(c) Sewer Trunk lines

As in the case of the manholes for the water supply lines, some manholes are covered by sand blown from the desert by strong wind and rubbish dumped by local inhabitants to a depth of some 5cm. Although their function is not particularly affected, it is preferable that the sand and rubbish be removed more frequently.

(d) Sewer Pipeline Clearing Vehicle

① Effective Use of Operation and Maintenance Manuals

As in the case of the facilities at the Japanese Friendship Pump Station, the operation and maintenance manuals for the sewer facilities are not kept by the personnel responsible for such activities. Consequently, operation and maintenance is conducted on the basis of past experience and also expertise acquired through OJT under the Omrania West Project of the engineers in charge. The adoption of preventive maintenance is necessary for the proper functioning of the facilities over a long period of time and maintenance based on the manuals is essential. In view of this, GOSD should ensure the proper provision and use of the relevant manuals to upgrade the current operation and maintenance system.

## ② Repair of Damaged Parts

Partial damage to some vehicles is observed. Although the present damage does not directly affect the vehicle performance, repairs should be conducted to restore the vehicles to the original specifications in view of safe driving.

- High Pressure Jet Cleaning Vehicles

Damaged lamp on control panel :

The lamp is essential for safe night work and must be replaced.

Damaged high pressure hose :

The hose cover is damaged and the internal wire is exposed in places.

The damaged sections should be cut off or the damaged hose should be replaced in view of safety.

- Vacuum Vehicles

Rust at inspection hatch at top of sediment storage tank :

Sanding of the rust and repainting in line with the paint specifications are required to prevent the further progress of the rust.

## 2) Items to be improved for the implementation of the Project

In the Omrania West Project, the contract for the construction was postponed due to the delay of the approval by the People's Assembly of Egypt.

Therefore, the Egyptian Side should pay their special attention to expedite the approval of the People's Assembly of Egypt.

## **CHAPTER 4 CONTENTS OF THE PROJECT**



## CHAPTER 4 CONTENTS OF THE PROJECT

### 4-1 Objectives of the Project

The public infrastructure in Giza City in the Giza Governorate, where the Project Site is located, is far below the level of Cairo City on the opposite side of the Nile as described in Chapter 1 despite the fact that Giza City is part of the Greater Cairo Region. The situation in the Monib District, i.e., the Project Site, which has a present population of some 133,000 is particularly poor because of its omission from urban development and the people are living under poor and unsanitary living conditions.

In an attempt to redress this serious situation, Giza City has prepared the Upgrading Plan of Water Supply and Sewer Systems in South Giza, which covers the Monib District, to improve the local living and sanitation conditions. However, it has found it difficult to implement this plan due to the deterioration of public finance in Egypt. The low prospect of securing a loan due to the limited profitability of this sector has also contributed to the long delay in plan implementation.

Against this background, the Project intends to establish a stable life for the local inhabitants and to improve the sanitation conditions in the Monib District, Giza City which is by and large a residential area for low income people through the construction of water supply and sewer facilities to provide reliable water supply and sewer services.

### 4-2 Examination of Requested Contents

#### 4-2-1 Appropriateness and Necessity of the Project

The Project Site has a strong concentration of low income people. The high population density and long delay in the provision of public infrastructure, including water supply and sewer facilities, have resulted in extremely poor living and sanitation conditions even though the area is part of the Greater Cairo Region. The urgent implementation of the Project is, therefore, deemed necessary to improve the local living and sanitation conditions by means of constructing water supply and sewer facilities, the essential components of the public infrastructure. Implementation of the Project is expected to greatly contribute to the betterment of local life as in the case of the Omrania West Project, the positive effects of which on living and sanitation conditions have been confirmed (see 3-4-3). The Project is a subordinate plan of a master plan prepared by the Egyptian authorities but not yet implemented due to the critical financial situation in Egypt. As implementation of the Project is essential for the overall improvement of the public infrastructure in Giza City, the Project is rightly judged to meet the requirements

in Egypt. As shown in Fig. 3-1, the Project Site is divided into 4 blocks. While the increasing concentration of housing and high population density are particularly notable in Block A and C, the population density in Block B and D is very low because the housing development has been relatively slow and the farm land is still found scattered. Therefore, it can be judged that the Project implementation, as a Japan's grant aid, to the area of Block A and C where the benefit of the Project by the construction of water supply and sewer facilities will be tremendous given, is deemed appropriate. For Block B and D, however, the area to be served by the branch lines of water supply and sewer facilities should be determined in consideration of the situation of housing development. In view of the present situation of water supply and sewer facilities improvement efforts in Egypt, the expected positive effects of the Project and Egypt's financial situation, the provision of Japan's grant aid for the Project appears highly appropriate.

#### 4-2-2 Project Implementation and Management

##### (1) Administrative Continuity

As described later in 4-3-1, the Giza City will act as the implementation body for the Project while GCWSA and GOSD will be responsible for technical issues, including the planning, operation and maintenance of the facilities to be constructed under the Project. Sections of GCWSA relating to the Project will be the Network Section and other sections with a total number of staff of some 4,000. The Vice Chairman for Technical Affairs will be responsible for the smooth implementation of the Project. In the case of GOSD, the West Bank Giza Governorate Section of the Operation and Maintenance Department with some 350 staff members will conduct the implementation of the Project under the supervision of the Chairman.

These sections responsible for the operation and maintenance of the new facilities will have sufficient manpower and the required technical capability because (1) they already have similar responsibilities for the much larger existing facilities in the Greater Cairo Region, (2) they are successfully meeting similar responsibilities for the facilities constructed under the Omrania West Project and (3) the scale of the new facilities is very small compared to the scale of existing facilities in the Greater Cairo Region. The present manpower level and organization of GCWSA and GOSD are consequently judged appropriate for the operation and maintenance requirements of the new facilities.

## (2) Financial Continuity

As described later in 4-3-5, the facilities to be constructed under the Project will constitute important parts of the public infrastructure to ensure industrial activities in the area as well as the stable and healthy life of local inhabitants. The Egyptian side must conduct proper systematic maintenance, including preventive maintenance, of these facilities with the main component of maintenance work being regular and ad hoc inspections as shown in Table 4-1.

Table 4-1 Classification of Maintenance Work

Category	Description
Regular Inspection	Inspection of damage and malfunctions, etc., to prevent accidents and to maintain the facilities in good conditions.
Ad Hoc Inspection	Inspections conducted in extraordinary circumstances, such as at the time of a natural disaster or accident.

Regular inspections will be the main pillar of ordinary maintenance work. With regard to the operation and maintenance cost of the new facilities, the following estimate has been prepared.

- Water Supply Facilities : annual average of approximately 33,000 LE  
(some 10,000 U.S. dollars)
- Sewer Facilities : annual average of approximately 66,000 LE  
(some 20,000 U.S. dollars)

Remarks: 1 US\$ = 3.313 LE (as of February 1992)

Judging from the planned levels of the new service charges (see 2-2-2-(2)-3 and 2-2-3-(2)-3), the estimated population, required water supply volume, industrial structure and general income level in the Project Area, the revenue in 1995 (planned year of project completion) is estimated to be some 230,000 LE (approximately 70,000 US dollars) for the water charge and some 100,000 LE (approximately 30,000 US dollars) for the sewer charge. Based on the past performance of the GCWSA and GOSD, the ratio of the operation and maintenance cost in the total revenue is some 25% for the water supply facilities and some 80% for the sewer facilities. The resulting operation and maintenance budget for the planned facilities will, therefore, be some 56,000 LE (approximately 17,000 US dollars) for the water supply facilities and some 80,000 LE (approximately 24,000 US dollars) for the sewer facilities. This estimated budget size will be sufficient to meet the estimated operation and maintenance expenditure for both services.

Nevertheless, both organizations will be required to improve the efficiency of operation and maintenance work by public relations in order to enlist the understanding and cooperation of local inhabitants for appropriate use of the newly constructed facilities in view of their public character and necessary service charge level. They should also try to reduce the cost.

#### 4-2-3 Linkage or Overlapping With Similar Projects or Other Aid Projects

##### (1) Water Supply Facilities

The Project is based on the water supply network improvement programme envisaged in the "Study of Water Supply in City of Giza" which was prepared in 1987 with German assistance (see 2-3-3-(1)). Japan is the only country to which the Government of Egypt has made a request for assistance for the Project.

##### (2) Sewer Facilities

GOSD is currently constructing the Abu Nomros Main Collector to upgrade the sewer network in South Giza (see 2-3-3-(2)) pursuant to the Greater Cairo Wastewater Project Master Plan and the contents of the Project are in line with the present construction plan of GOSD. Japan is the only country to which the Government of Egypt has made a request for assistance for the Project.

##### (3) Scheduling Requirements

While there is an Egyptian project relating to the water supply facility improvement under the Project, the project to expand the water production capacity of the South Giza Waterworks to 200,000m<sup>3</sup>/day has currently no tangible prospect of implementation due to the severe financial situation in Egypt. There is, therefore, no necessity to coordinate the construction schedule for the Project with those of other projects. Nevertheless, the early implementation of the project to expand the supply capacity of the South Giza Waterworks by 35,000m<sup>3</sup>/day, i.e., the water demand in the Project Site, and to construct water supply trunk lines is of crucial importance to fully exploit the potential benefits of the new facilities to be constructed under the Project. A request for Japanese assistance for this project has also been made by the Government of Egypt.

In the case of the new sewer facilities, the construction schedule must be coordinated with the progress of the construction of a lowerstream pump station and trunk lines to which the new sewer facilities will be connected. The schedules of the relevant projects are given in Table 4-2.



Table 4-2 Construction Schedules of Projects Related to the Project

Project	1989	1990	1991	1992	1993	1994	1995
① Abu Rawash Wastewater Treatment Plant (USAID)			—————	—————			
② Pyramids Culvert (USAID)	—————	—————					
③ Pyramids Collector (USAID)				—————	—————	—————	
④ Pyramids Pump Station (USAID)	—————	—————					
⑤ Abu Nomros Main Collector (GOSD)			—————	—————	—————		
⑥ No.5 (A) Pump Station (GOSD)		—————	—————	—————			
⑦ No.5 (B) Pump Station (Undecided)						—————	—————
The Project (including construction work to be undertaken by Egyptian side)					—————	—————	—————

Note: Names in brackets are aid or implementation organizations.

Source: CWO and GOSD)

Of the projects listed in Table 4-2, projects ①-⑥ are either completed or in progress or to be conducted by either USAID or GOSD. The actual construction sites and their mutual relationship are shown in Fig. 2-9.

As funding for projects ①-⑥ has been secured, their completion on schedule is expected. With regard to project ⑦, although a request for financial assistance has been made to the Government of Japan (see 2-4-2), the commencement date of project ⑦ will be at least one year after the commencement of the Project even the Japan's assistance is made. Consequently, it is likely that project ⑦ will not be completed before the completion of the Project. However, the Egyptian side claims that the No.5 (A) pump station can be temporarily used to deal with sewage from the Project Site provided that the volume remains relatively small even if project ⑦ is not completed before the completion of the Project. On this basis, the construction work for the Project can commence in accordance with the schedule shown in Table 4-2 without causing any problems at the time of its completion.

The expansion of the South Giza Waterworks, for which Japanese assistance is also sought, must be coordinated with the completion of the No. 5 (B) pump station as the No.5 (A) pump station will be unable to handle the increased wastewater flow caused by the increased water supply of the expanded South Giza Waterworks if the expansion project is made.

#### 4-2-4 Project Components

The Project is divided into three components, i.e., (1) water supply facility construction plan, (2) sewer facility construction plan and (3) plan to provide branch line materials for both water supply and sewer networks, all of which have a target area of the Monib District.

All three components relate with one another and the real effects of the Project cannot be materialised without coordination between these three components.

As described earlier in 2-4-2, the Government of Egypt hopes that the Government of Japan will provide further assistance for (1) the South Giza waterworks expansion project to increase the water supply capacity of the waterworks to the design water supply volume for the year 2010, the target year of the Project, (2) the construction of water supply trunk lines to ensure a stable water supply in the Project Site and (3) the No. 5 (B) pump station construction project.

The relationship between the Project components is shown in Fig. 4-1.

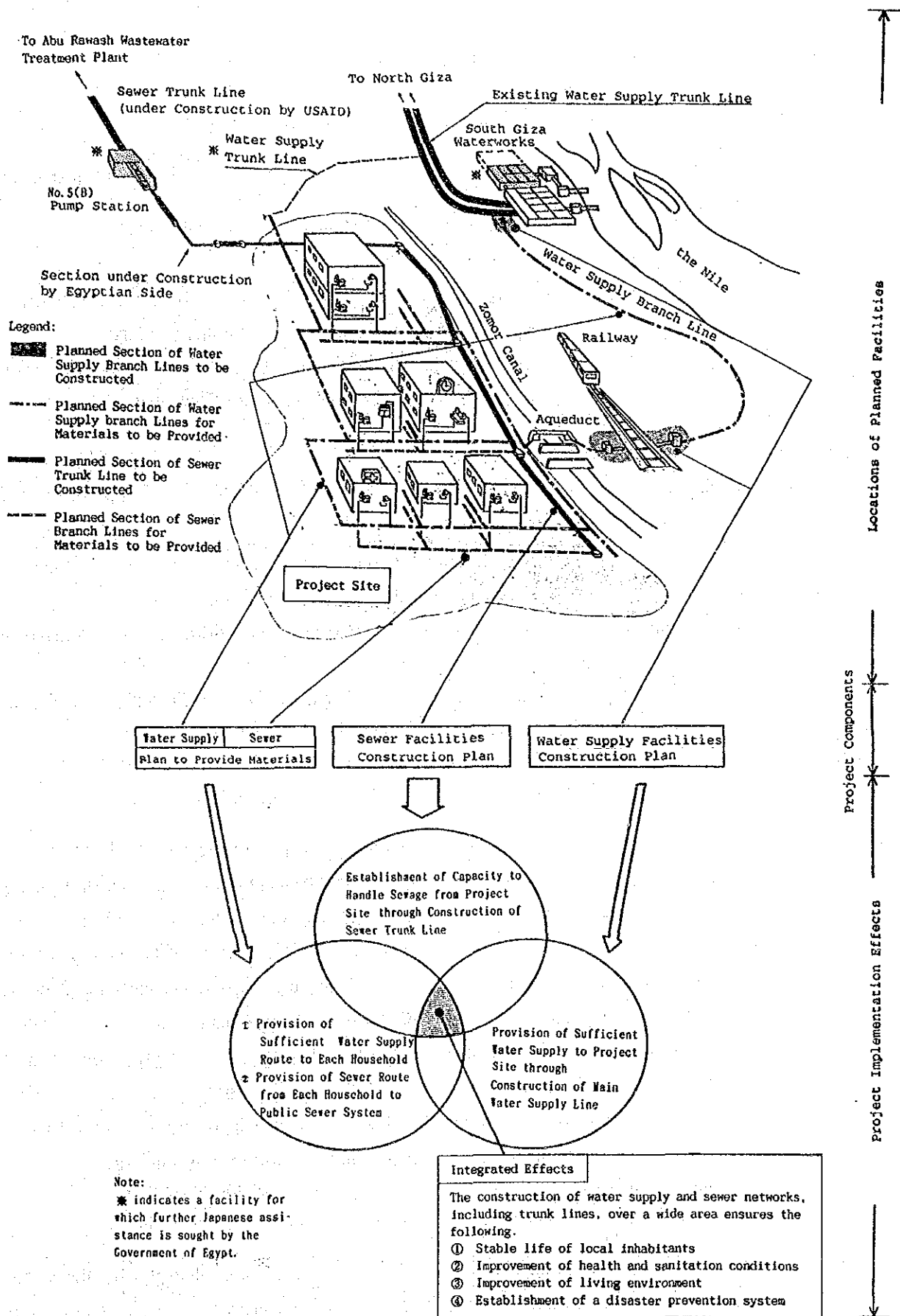


Fig. 4-1 Relationship Between Project Components

#### 4-2-5 Contents of Requested Facilities and Materials

##### (1) Suitability of Project Size

The requested contents of the Project, consisting of construction and material provision plans as described in 4-2-4, are as follows.

##### (Facility Construction Plans)

- Water Supply Facility : construction of branch line (diameter: 500mm, approximately 60m at railway crossing section)
- Sewer Facility : construction of trunk line (diameter: 1,600-2,000mm, approximately 1.8km with gravity flow system)

##### (Material Provision Plan)

- Water Supply Materials : for branch lines (diameter: 300-600mm, approximately 4.7km)  
for branch lines (diameter: less than 300mm, approximately 20km)
- Sewer Materials : for branch lines (diameter: 300-600mm, approximately 4.5km)  
for branch lines (diameter: less than 300mm, approximately 20km)

##### 1) Facility Construction Plans

Of the requested contents, the construction of the water supply branch line (diameter: 500mm, at the railway crossing section) requires use of the pipe jacking method to ensure safe, undisrupted train operations. The same method is also required for the construction of the sewer trunk line in view of (1) heavy traffic volume of both vehicles and pedestrians, (2) difficulty to secure sufficient work sites due to narrow road width, (3) soft ground and high groundwater level despite the fairly deep planned pipe burying depth, (4) presence of many underground facilities and (5) necessity to ensure the safety of buildings near construction sites. Nevertheless, the current technical level and expertise in Egypt are judged to be inadequate for the execution of this construction method by Egyptian side.

##### 2) Material Provision Plan

The contents of the materials requested by the Government of Egypt for the water supply and sewer branch lines are judged to be necessary for the construction of such facilities over a wide area. The actual quantities of these materials, however,

must be kept to a minimum to facilitate the urgent improvement of water supply and sewer services while ensuring the maximum benefits. The degree of housing development in the Project Site and the targets of the Project will, of course, be taken into consideration in the decision on the optimal quantities. In short, the quantities of the materials to be provided under the Project will be the minimum quantities which will achieve the expressed objectives of the Project.

The contents of the materials requested by the Government of Egypt are deemed essential to conduct the improvement of water supply and sewer services in the Project Site. However, the quantity of branch lines to be supplied should be determined in accordance of the policy as described in 4-2-1. In case that the required quantity becomes bigger than the request, the quantity to be supplied should be decided judging from the scale of benefit of the Project as well as the appropriateness of the Project as Japan's grant aid.

## (2) Points of Special Note in Requested Contents

### 1) Cooperation for Detailed Design of Branch Lines

Approval by the Ministry of Planning has already been granted for the construction of the water supply and sewer branch lines, materials for which will be provided by Japan as part of the Project, to be undertaken by the Egyptian side. Budgetary appropriation for this work will be authorised after the completion of the relevant detailed design documents.

The Giza City is well aware of the need to coordinate the schedule for the detailed design work and branch line construction work with the schedule of the construction work to be undertaken by the Japanese side for the Project in order that the new water supply and sewer facilities to be constructed under the Project and also similar facilities of which construction is in progress by GCWSA and GOSD will be efficiently used without delay to improve the living and sanitation conditions in the Project Site. Consequently, the Giza City strongly hopes that the said detailed design work will be conducted by the Japanese side due to their financial conditions

The contents of the completed design documents must be easily understood by local construction companies for their construction work. It will be appropriate for this design work to be included in the scope of work of the Japanese consultant for the Project who will be able to use a local consultant to harmonise the design philosophy and policies for the Project by presenting the local consultant with basic design criteria. Assignment of the detailed design work for the branch lines to the

Japanese side also appears appropriate in view of the fact that the Japanese consultant must approve the design criteria and design drawings and control the progress of the design work and delivery dates of the documents submitted by the local consultant.

It is estimated that the construction of the branch lines will take approximately 2 years to complete, far exceeding the schedule period of completion for the construction work to be conducted by the Japanese side.

It will, therefore, be difficult to make an arrangement whereby the Japanese consultant supervises the above construction of the branch lines as such supervision is not within the framework of Japan's grant aid system. Giza City fully understands the system because of its involvement in the Omrania West Project and has clearly indicated that a local consultant will be appointed to supervise the work in question.

In case that Giza City conducts the design work, there are some difficulty as mentioned below.

- (a) If Giza City conducts the design work, the Egyptian national budgetary system will require appropriation of the required amount in the fiscal 1992/93 budget, making early 1994 the earliest date for design completion. As a result, coordination with the construction schedule of the Japanese side will be impossible.
- (b) There is currently no prospect of securing the budget described in (a) above due to the tight financial situation of Giza City.

In short, the inclusion of the detailed design work for the branch lines to be included in the scope of Japanese side in the Project is deemed appropriate because the use of an Egyptian consultant to conduct the work will create new jobs in Egypt and because the omission of the work in the Project would delay the construction of the branch lines, in turn resulting in a long delay in materialising the improvement effects of the Project for the living and sanitation conditions in the Project Site.

## 2) Cooperation for Under-Pressure Drilling and Tapping Work

The Egyptian side has made a request to the Study Team for the adoption of the under-pressure drilling and tapping method using special technologies for the connection work (one connection) between the water supply branch line (diameter: 600mm) to be constructed by the Egyptian side using materials provided by Japan along El Cornesh Street near the South Giza Waterworks and the existing trunk line (diameter: 1,000mm) in view of the fact that the temporary suspension of water supply from the trunk line, which has a design service population as high as approximately 680,000 (calculated based on an average flow rate of 1.78m<sup>3</sup>/sec cited by the "Study of Water Supply in City of Giza"), will be very difficult to be accepted as such suspension would have a serious impact on daily life, industrial activities and fire-fighting in Giza City.

The under-pressure drilling and tapping method was used by the Japanese side in the Omrania West Project and proved very successful in assisting the improvement of the water supply network (see 3-4-3-(4)). The benefits are extremely visible and it is highly evaluated by the Egyptian side.

Inclusion of the under-pressure drilling and tapping work (one connection) in the scope of the Project is, therefore, deemed appropriate based on the above considerations.

### 4-2-6 Necessity for Technical Cooperation

The water supply and sewer facilities to be constructed under the Project are in line with similar facilities commonly used in Egypt (see 4-2-2-(1)) and, therefore, the related organizations, engineers and workers responsible for these facilities have sufficient knowledge and technical experience to smoothly conduct the operation and maintenance of the new facilities.

The provision of technical cooperation for operation and maintenance purposes of the new facilities is, therefore, deemed unnecessary.

### 4-2-7 Basic Policies for Cooperation Implementation

Implementation of the Project by Japan's grant aid is deemed appropriate in view of the Project's conformity to the frameworks of master plans, expected positive effects, realistic feasibility and the organization, capability, budgetary arrangements and operation and maintenance capability of the Egyptian side to implement the Project and also in view of the confirmation that the expected effects of the Project will satisfy the

criteria set by Japan's grant aid. Consequently, the project outline is examined and the basic design for the Project is conducted in the following sections assuming the provision of Japan's grant aid for the Project. Please note that the appropriateness of accepting the Egyptian request for the inclusion of the under-pressure drilling and tapping work and the detailed design work for the branch lines in the Project has already been discussed in 4-2-5.

With regard to the scope of providing branch line materials, the construction of branch lines in farmland will result in increased land prices, thereby contributing to the financial gain of individuals (landowners). As such contribution is considered inappropriate under Japan's grant aid, the provision of materials requested for such purpose is omitted from the scope of the Project. Table 4-3 compares the target scope of the original Egyptian request (see "Study item of the Project" in Table 2-17) with the actual target scope of the Project.

Table 4-3 Comparison Between Target Scope of Egyptian Request and Target Scope of the Project

Item	Egyptian Request	Project
<b>(Water Supply Facilities)</b>		
• Construction of Branch Line: dia. 500mm at railway crossing section	○ (1 site)	○ (same as left)
• Provision of Materials for Branch Lines: dia. 300-600mm	○ (Served area 185ha)	○ (same as left)
• Provision of Materials for Branch Lines: dia. less than 300mm	○ (Served area 185ha)	○ (see Remarks)
• Under-Pressure Drilling and Tapping Work: between 1,000mm line and 600mm line	○ (one connection)	○ (same as left)
• Detailed design work for branch lines	○ (Served area 185ha)	○ (see Remarks)
<b>(Sewer Facilities)</b>		
• Construction of Trunk Line: dia. 1,600-2,000mm, (gravity flow system)	○ (approximately 1.8km)	○ (same as left)
• Provision of Materials for Branch Lines: dia. 300-600mm	○ (Served area 185ha)	○ (same as left)
• Provision of Materials for Branch Lines: dia. less than 300mm	○ (Served area 185ha)	○ (see Remarks)
• Detailed design work for branch lines	○ (Served area 185ha)	○ (see Remarks)

Remarks : The served area for the branch lines shall be the area except farm land and low population density area, approximately 110ha. The minimum required quantity of the branch lines for the served area will be supplied.



#### 4-3 Project Outline

##### 4-3-1 Executing Organization and Operational Structure

Responsible and executing organization for the Project on the Egyptian side are the same as those for the Omrania West Project.

- Responsible and coordinating organization : Giza Governorate
- Executing organization : Giza City

As described earlier in 2-2-2(2) and 2-2-3(2), the planning, operation and maintenance of water supply and sewer facilities in the Greater Cairo Region are the responsibility of GCWSA and GOSD. Technical issues involved in the Project must be confirmed and approved by these 2 organizations prior to implementation. Moreover, the authority and responsibility for the operation and maintenance of the facilities to be constructed under the Project will be transferred to GCWSA and GOSD from Giza City once completed.

##### 4-3-2 Plan of Operation (Activity)

The Egyptian side hopes for the urgent improvement of the living and sanitation conditions in the Project Site through the implementation of the Project using a safe, proven construction method which will not have any adverse effect on local life, production activities, traffic and existing buildings.

In view of the requirements for the construction work in the Project, the facility construction plan and materials procurement plan must take certain points into consideration as described below.

###### (1) Facility Construction Plan

- 1) The plan contents must conform to those of master plans.
- 2) The construction method and sites should be carefully selected so as not to disrupt local life, industrial activities and traffic and so as not to cause damage to the local living environment and/or existing buildings and structures, etc.
- 3) The contents and scales of the water supply and sewer facilities to be planned should be in line with the objectives of the Project.
- 4) The maximum use of local products and manpower should be encouraged to contribute to industrial development, vitalisation of the economy and increased employment in Egypt as long as the decision to use them will not hamper the progress of the Project.

- 5) Construction work should be planned to be completed within a single fiscal year of Japan.
- 6) The planned facilities should fulfil the functions envisaged in the Project while keeping their cost to a minimum.

(2) Materials Procurement Plan

- 1) The planned quantities of the materials should be the minimum requirements to achieve the objectives of the Project.
- 2) The maximum use of local products and manpower should be encouraged to contribute to industrial development, vitalisation of the economy and increased employment in Egypt as long as the decision to use them will not hamper the progress of the Project.
- 3) The planned quantities of the materials should fulfil the functions envisaged in the Project while keeping their cost to a minimum.

4-3-3 Location and Conditions of Project Site

The Project Site is the Monib District in South Giza with an area of 185ha and a planned design service population of 247,000.

The Project Site is adjacent to the area subject to the Omrania West Project (see Location Map). The roads (Pyramids Street and El Cornesh Street) which will mainly be used for the transportation of materials to the Project Site are paved and were used for the same purpose in the Omrania West Project without causing any problems. Consequently, it appears reasonable to assume that there will be no problems in regard to road transportation for the Project.

It is planned that public land owned and managed by the Giza Governorate, etc., in and around the Project Site will be used to accommodate a storage yard (approximately 2,500m<sup>2</sup>) for construction machinery and materials and also a temporary site office (approximately 3,600m<sup>2</sup>).

#### 4-3-4 Outline of Facilities and Materials

The facilities to be constructed and the materials to be provided under the Project are outlined in Table 4-4.

Table 4-4 Outline of Project-Related Facilities and Materials and Their Planned Use

Category		Item	Size	Purpose
Water Supply Facilities	Construction	Branch Lines	Pipe jacking work with 500mm diameter pipes at railway crossing section (approx. 60m)	To secure water supply from South Giza Waterworks to Project Site while maintaining train operations
		Under-Pressure Drilling and Tapping Work	Connection between 1,000mm trunk line and 600mm branch line (1 connection)	To secure water supply to Project Site while preventing suspension of water supply to other areas
	Provision of Materials	Materials for Branch Lines (pipe diameter of 300-600mm)	Necessary but minimum extension of branch lines (including ancillary facilities: gate valves, wash-out valves, air valves and fire hydrants)	To secure water supply to Project Site from trunk lines
		Materials for Branch Lines (pipe diameter of less than 300mm)	Necessary but minimum extension of branch lines (including ancillary facilities: gate valves, wash-out valves, air valves and fire hydrants)	To secure water supply to households and other places of water consumption in Project Site
Sewer Facilities	Construction	Trunk Line	Pipe jacking work with 1,800-2,000mm pipes for a length of some 1.8km	To secure discharge of sewage generated in Project Site and other areas
	Provision of Materials	Materials for Branch Lines (pipe diameter of 300-600mm)	Necessary but minimum extension of branch lines	To secure discharge of sewage generated in Project Site
		Materials for Branch Lines (pipe diameter of less than 300mm)	Necessary but minimum extension of branch lines	To secure sewage discharge from households and other places

#### 4-3-5 Operation and Maintenance Plan

##### (1) Securing Operation and Maintenance Cost through Water Charge System

The Government of Egypt is required to urgently improve the poor living and sanitation conditions in the Project Site to meet the expectations of local inhabitants and to conduct appropriate operation and maintenance of the new facilities to ensure their long, uninterrupted service. It will be essential to continuously secure the necessary cost for such operation and maintenance and the collection of an appropriate water charge with the full understanding of local inhabitants of the necessity for such collection will be necessary.

In this connection, the Government of Egypt is required to take the following actions.

- 1) As described earlier in 2-2-2-3), GCWSA will be required to make efforts to improve the financial situation by implementing the water tariff readjustment plan through the examination of the water tariff that more nearly reflect the costs of producing and distributing the potable water.
- 2) GCWSA will be required to make efforts to collect the water tariff from each household and public facility without fail as well as to promote the installation of water meter on each household and public facility through investigating whether the meters are adequately provided.
- 3) GOSD will be required to have a consultation with GCWSA for "improvement of water metering system to establish the wastewater quantities to be paid for" as recommended in the draft of SYSTEM MANAGEMENT PLAN for GOSD (October, 1989) and thereby reconsider the surcharge on the water tariff which is assessed for wastewater service and used for the maintenance and operation work of the wastewater system.

## (2) Operation and Maintenance System and Principles

As described earlier in 4-2-2, the operation and maintenance of the new facilities, including the control of spare parts, will be conducted by the following organizations.

Water Supply Facilities : Network Section (some 4,000 employees), GCWSA  
 Sewer Facilities : West Bank Giza Governorate Section (some 350 employees),  
 Operation and Maintenance Department, GOSD

It is judged that the present organization, manpower and budget of both GCWSA and GOSD are adequate to deal with the operation and maintenance of the new facilities as (1) both organizations have sufficient manpower, facilities and equipment, etc., to maintain the new facilities, (2) the operation and maintenance requirements of the new facilities do not involve any special technology or technique and (3) the increase of the operation and maintenance cost necessitated by the new facilities is extremely small and can be easily met the size of the present budget of these organizations.

Nevertheless, it will be necessary to introduce preventive maintenance measures focusing on reliability, safety, efficiency improvements and cost reduction and to practice appropriate operation and maintenance to properly maintain the functions of the new facilities over a long period of time. For this purpose, continuous efforts should be made to conduct regular checks on the organization, manpower, operation and maintenance performance, and also to improve the technical capability.

The basic principles of the desirable operation and maintenance are given in Fig. 4-2.

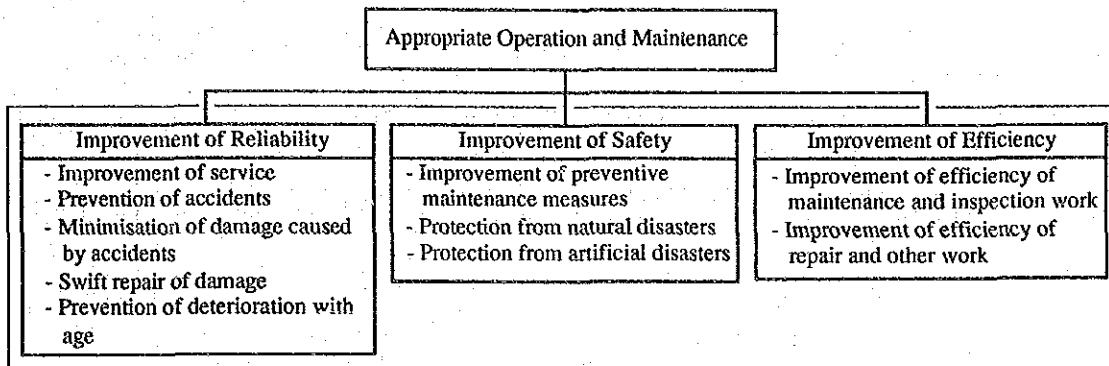


Fig.4-2 Basic Operation and Maintenance Principles of Water Supply and Sewer Facilities

Reorganization of GOSD is currently underway with the assistance of USAID (see 2-2-2) and the positive effects of this reorganization are expected to be felt in the immediate future.

(3) Regular Inspection Items

Given the conditions of the Project Site and the contents of the planned facilities, regular inspections should be conducted for certain items following the completion of the Project. Table 4-5 and Table 4-6 list such items for water supply and sewer facilities respectively. GCWSA and GOSD should implement the required regular inspections in accordance with the requirements described in the respective table.

Table 4-5 Regular Inspection Items for Water Supply Facilities Planned in the Project

Item	Inspection Frequency	
	Monthly	Annually
1. Water leakage and its scale	<input type="radio"/>	
2. Ground subsidence and its scale		<input type="radio"/>
3. Conditions of valves, fire hydrants and manhole covers, etc.	<input type="radio"/>	
4. Damage to facilities	<input type="radio"/>	
- damage by underground work, road work, building work and/or vehicle traffic		
- damage by uneven ground subsidence		
- damage by cleaning equipment		
- damage by deterioration due to age		
5. Availability of emergency materials	<input type="radio"/>	
6. Function of fire hydrants		<input type="radio"/>
7. Function of wash-out valves		<input type="radio"/>
8. Conditions of manhole covers (damaged cover, gap between ground and cover due to wear and/or uneven height, piling up of sediment)	<input type="radio"/>	
9. Internal conditions of manholes (uneven ground subsidence, cracks in walls, corrosion of foot rest, piling up of sediment)	<input type="radio"/>	
10. Damage to aqueduct painting		<input type="radio"/>

Table 4-6 Regular Inspection Items for Sewer Facilities Planned in the Project

Item	Inspection Frequency	
	Monthly	Annually
1. Flow capacity and sedimentation	<input type="radio"/>	
2. Ground subsidence		<input type="radio"/>
3. Damage to facilities	<input type="radio"/>	
- damage by underground work, road work, building work and/or vehicle traffic		
- damage by uneven ground subsidence		
- damage by unacceptable sewage		
- damage by deterioration due to age		
4. Inflow of groundwater		<input type="radio"/>
5. Inflow of unacceptable sewage and generation of harmful gases	<input type="radio"/>	
6. Conditions of manhole covers (damaged cover, gap between ground and cover due to wear and/or uneven height, piling up of sediment)	<input type="radio"/>	
7. Internal conditions of manholes (scouring of invert, uneven ground subsidence, cracks in walls, corrosion of foot rest, piling up of sediment)	<input type="radio"/>	

## **CHAPTER 5 BASIC DESIGN**





## CHAPTER 5 BASIC DESIGN

### 5-1 Design Policies

#### 5-1-1 Policies Relating to Natural Conditions

##### (1) Temperature and Humidity

The Greater Cairo Region in which the Project Site is located has a mean temperature of approximately 27°C in summer (April-October) as described earlier in 3-2-3. As the daytime temperature can reach 40-45°C, the heat is intense. The mean annual humidity of approximately 53% indicates that the Project Site has a very dry climate.

Sewer lines in the Greater Cairo Region are often clogged by sand from the desert and rubbish dumped by local inhabitants, making a sewage standstill and creating favourable conditions for the generation of sulphides under the high temperature and low humidity. These sulphides pose a threat of corrosion to the inner walls of pipes. To prevent such sulphide corrosion, the use of epoxy resin painting, PVC lining or blue bricks, i.e., acid-resistant bricks, for the inner faces of concrete sewer lines (pipes and manholes) is stipulated as standard practice. This practice should be employed in the case of the Project.

##### (2) Rainfall

As described earlier in 3-2-3, the rainfall of some 25mm/year in the Greater Cairo Region is extremely low and there are only 2-3 rainy days/year. Consequently, the sewer network in the Greater Cairo Region generally lacks facilities for the drainage of rainwater except in central Cairo. The available facilities are clogged by sand and rubbish and do not function properly. Nevertheless, no damage due to rain has been recorded. In view of this situation, the sewer lines to be designed under the Project will not be accompanied by rainwater drainage facilities and the design wastewater flow will entirely consist of sanitary sewage.

#### 5-1-2 Policies Relating to Construction Work

##### (1) Project-Related Permits and Approvals

The sites for the new water supply and sewer lines to be constructed under the Project are public roads where such public services as water pipes, sewer pipes, power cables and telephone cables are buried. In addition, the planned routes include railway and canal crossing points. The construction work will, therefore, require permits and

approvals from various organizations, including the Giza City, GCWSA, GOSD, Egyptian Electricity Company, Giza Telephone Exchange, Egyptian State Railway, Giza Irrigation Authority and the Police.

In view of the fact that the planned construction schedule (to be described later) is very tight, the construction work for the sewer trunk lines will be conducted by 2 shifts to cover 24 hours/day. Smooth acquisition of the necessary permits and approvals is essential to complete the work on schedule. The basic design shall reflect the technical requirements for water supply and sewer facilities, design criteria and work regulations and customs in Egypt to ensure smooth progress of the work. As in the case of the Omrania West Project, it is important that the Giza City (project implementation body) establish a project promotion committee to coordinate between the Japanese consultant and contractor and project-related organizations in Egypt, including government ministries and agencies.

## (2) Related Laws and Regulations

The laws and regulations in Egypt related to the implementation of the Project are listed in Table 5-1 and the basic design must take these laws into consideration.

Table 5-1 Laws and Regulations in Egypt Related to Project Implementation

Title	Description
Import and Export Regulations	stipulates prohibited items for import
Labour Law	law governing work and employment conditions
General Sales Tax Law	law governing taxation on consumption which was introduced in May, 1991

## (3) Technical Levels of Local Construction Companies and Consultants

There are some 10 large construction companies in the Greater Cairo Region which specialise in or are conversant with water supply and sewer line construction work predominantly using the open-cut method. Even though 2 companies are currently capable of employing the pipe jacking method, their scope of work using this method is limited because of the lack of diverse equipment.

As the water supply and sewer branch line piping materials to be provided by Japanese side can be laid using the open-cut method, however, the use of local companies for laying work is appropriate.

There are more than 10 consultants in Egypt capable of designing water supply and sewer facilities. Some are jointly designing the Greater Cairo Wastewater Project with U.S. and British consultants and their technical level appears to be fairly high.

#### (4) Quality and Quantity of Labour Force

Egypt has a working population of some 15.2 million (as of 1991). With a high unemployment rate of some 15%, the Government of Egypt has been continuously introducing measures to create employment opportunities to reduce the unemployment rate.

The technical standard of Egyptian construction workers is fairly high compared with other developing countries and a large number of engineers and skilled workers work abroad, especially in Gulf countries. The employment opportunities created by government measures and the Gulf War situation in 1990-1991 have prompted their gradual return to Egypt.

There is an ample workforce in the construction sector to conduct construction work for water supply and sewer facilities and it is judged that there will be no problem in securing both engineers and skilled workers for the implementation of the Project.

#### (5) Quality and Availability of Local Materials and Equipment

The main construction materials, such as reinforcing bars, cement, forms, sand and gravel, are produced in ample quantity in Egypt. While such materials as steel sheet piles and H-section steel used for temporary structures are also produced in Egypt, their procurement in sufficient quantity to meet the tight schedule of the planned construction work appears difficult.

Most construction machinery and equipment can be procured locally. Typical exceptions are such special machinery as pipe jacking machines, grouting machines and under-pressure drilling and tapping machines, etc.

The ductile cast iron pipes and PVC pipes used for water supply facilities are produced in ample quantity with good quality in Egypt. However, pipe fittings such as ductile cast iron bends, valves and fire hydrants will be imported from Japan as they are not produced in Egypt. Reinforced concrete pipes to be used with the pipe jacking method for sewer trunk lines are available locally in ample quantity and with good quality. In view of the fact that the pipe jacking machinery will be imported from Japan as described later, however, the local manufacturer of reinforced concrete pipes should be approached in consideration of altering the pipe specifications to suit those of the

Japanese machinery. The clay pipes used for sewer branch lines are widely available in Egypt with small and medium diameters.

### 5-1-3 Policies Relating to Utilisation of Local Construction Companies, Materials and Equipment

#### (1) Local Construction Companies

For foreign-assisted, large-scale water supply and sewer projects in Egypt, it is the general practice for the foreign contractor to hire local engineers, technicians and workers to conduct the actual construction work. In the case of small projects implemented with domestic funds, local construction companies conduct the work, mostly using the open-cut method. Two companies are currently capable of employing the pipe jacking method but lack sufficient technical expertise. In addition, they can only work with large pipes with a diameter of 2,200mm or more because of the limited range of their machinery.

It is planned that the pipe jacking method will be used for the Project at the section where a water supply branch line (diameter: 500mm) crosses the railway tracks and for the entire length of the sewer trunk line. As the pipe diameter is not more than 2,000mm, the machinery of local companies cannot be used. The use of well experienced Japanese engineers to supervise the pipe jacking work is planned because of (i) the requirement for supervisors to be conversant with machines imported from Japan and (ii) the very demanding working conditions, such as the limited availability of extra work space and heavy traffic in terms of both vehicles and pedestrians. Engineers, skilled workers and ordinary workers to be supervised by these Japanese engineers will be recruited locally.

At the site to connect the new water supply branch line (diameter: 600mm) to the existing trunk line (diameter: 1,000mm), the under-pressure drilling and tapping method will be used as described later. Since this technology is not available locally, machines and engineers to conduct this particular work will be sent from Japan.

#### (2) Construction Materials and Equipment

In principle, construction materials and equipment will be procured in Egypt. However, those items (referred to in 5-1-2 and 5-4-4) of which procurement in Egypt is either difficult or impossible will be procured in Japan. In addition, those items of which the quality is unstable or the price is prohibitively high will also be imported from Japan.

#### 5-1-4 Policies Relating to Operation and Maintenance of Constructed Facilities

Although the implementation body for the Project is the Giza City, the operation and maintenance responsibility for the water supply and sewer facilities to be constructed under the Project will be transferred to GCWSA and GOSD respectively following the completion of the said facilities.

Both organizations are very large with more than 10,000 employees (see 2-2-2 and 2-2-3) and are responsible in their respective fields of work for the entire Greater Cairo Region. Given the fact that the Project Site only accounts for less than 1% of the Greater Cairo Region, the present operation and maintenance capabilities of both organizations should be sufficient to meet the new responsibility for the new facilities.

Nevertheless, clear confirmation of the necessary funds, systems and principles, and regular inspection items for maintenance and operation work is necessary as described in 4-3-5 to ensure the appropriate operation and maintenance of the new facilities over a long period of time.

#### 5-1-5 Policies Relating to Scope and Level of Facilities, Materials and Equipment

The main water supply and sewer facilities to be constructed under the Project are shown in Fig. 5-1.

##### (1) General

The basic policies for the basic design of the water supply and sewer facilities to be constructed under the Project are explained below.

- 1) The facilities plan will be prepared to promote the transfer of technologies, such as those relating to the pipe jacking method, and to encourage the local procurement or leasing of construction materials and equipment as much as possible.
- 2) The facilities plan will take the present financial situation of the Giza City into full consideration and will be designed to make the operation and maintenance of the facilities following transfer to GCWSA and GOSD by the Giza City less demanding by reducing the technical, cost and labour requirements.
- 3) The facilities plan will be prepared while encouraging the understanding and cooperation of local inhabitants and others of the importance of the implementation of the Project.

- 4) The facilities plan will be prepared while ensuring the safety of buildings, local inhabitants, passersby and transport facilities. Disruption of daily life and commercial activities will be kept to a minimum.
- 5) The facilities plan will be prepared in view of Egyptian and Japanese construction companies safely completing their assignments on time while keeping the construction cost at a reasonable level.

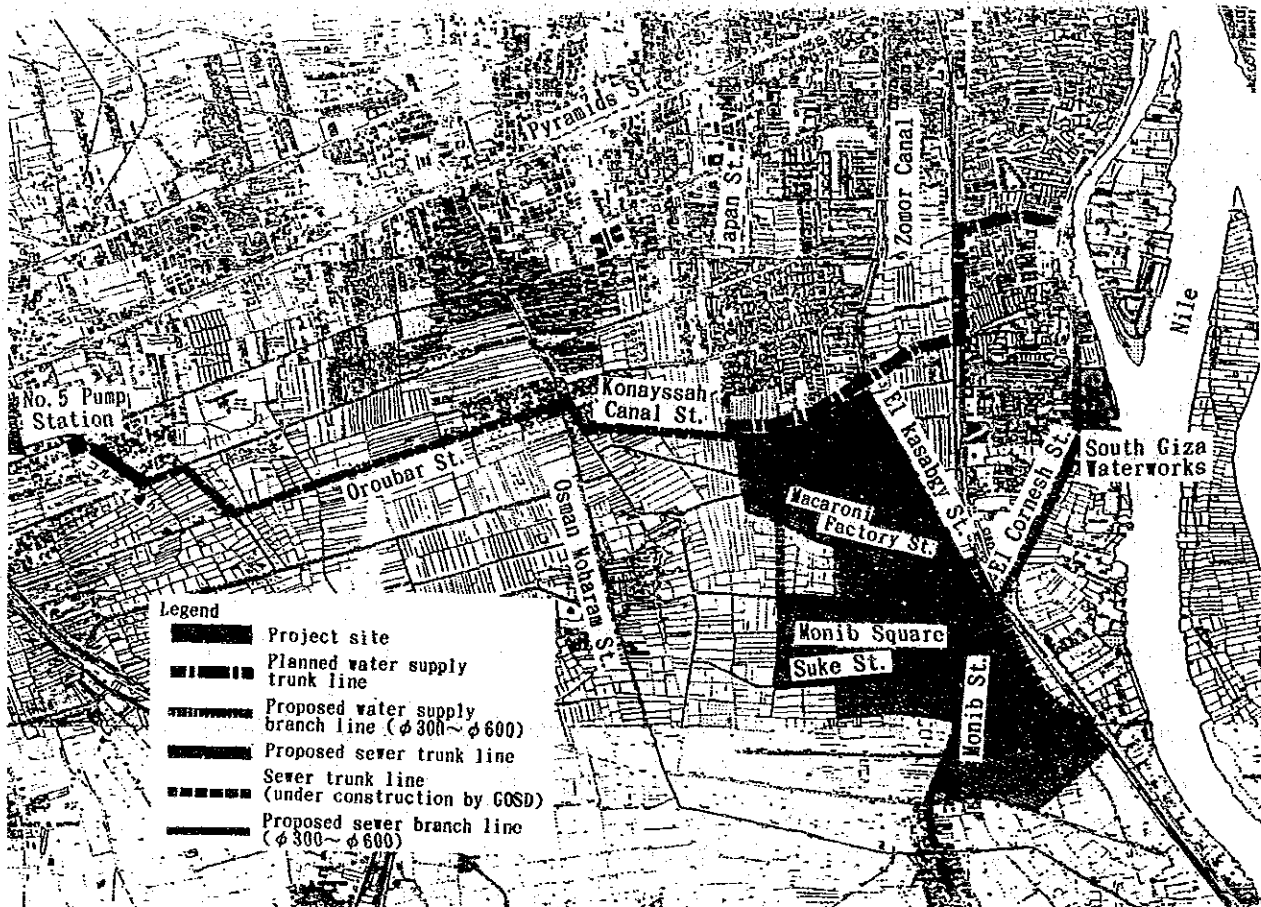


Fig. 5-1 Proposed Main Water Supply and Sewer Facilities

## (2) Water Supply Facilities Plan

The basic design of the water supply facilities to be constructed under the Project will be prepared based on the following policies.

- 1) The water supply facilities plan for the Project will be prepared to upgrade the relevant facilities in the Project Site with the main purpose of upgrading and improving both the living and sanitation conditions in the Project Site by means of

providing water supply branch lines and ancillary facilities for households and public buildings which are currently suffering from an inadequate water supply due to the absence of the relevant facilities. The provision of such facilities is called for by "the Study of Water Supply for City of Giza" prepared with German assistance, requested by the Government of Egypt to the Government of Japan as the grant aid project and found necessary through the field survey for the Project.

- 2) The Project Site will be the Monib District (185ha) as stipulated by the Upgrading Plan of Water Supply and Sewer System in South Giza prepared by Giza City.
- 3) In view of the contents of the request by the Egyptian Government and the results of the Omrania West Project, the laying work of the water supply branch pipes to be provided by the Japanese side will be included as far as possible in the scope of work to be conducted by the Egyptian side in accordance with the funds and technical expertise of the Egyptian side. However, work requiring special technologies and/or techniques not available locally will be excluded from this general rule. The scope of work to be conducted by each side is shown in Table 5-2.

Table 5-2 Division of Water Supply Facilities Construction Work

	Both Procurement and Construction by Japanese side	Procurement by Japanese Side and Construction by Egyptian Side
Pipes for Branch Lines		○
Aqueduct		○
Pipes for Branch Line at Railway Crossing	○	
Connection between Existing Trunk Line (Ø1,000m) and New Branch Line (Ø600mm)	○	

- 4) The facilities plan will be prepared with appropriate routes and burying depths to ensure safe train operation, no disruption of the use of the Zomor Canal and minimum disruption of the existing facilities (such as water supply pipes, sewer pipes, power cables and telephone cables, etc.)
- 5) The facilities plan will be in line with the contents of "the Study of Water Supply for City of Giza" prepared with German assistance and should achieve the provision of the design water volume and design water pressure following the upgrading and expansion of the Giza, South Giza and Embaba Waterworks in accordance with the said study.

- 6) In principle, the technical standards used in the Project planning will be those used in Japan. In view of the fact that many of the materials and equipment are actually produced in Egypt, the material strength and shapes/measurements applicable to connection points with existing, as well as future, water supply facilities should conform to Egyptian standards and criteria.

(3) Sewer Facilities Plan

The basic design of the sewer facilities to be constructed under the Project will be prepared based on the following policies.

- 1) The sewer facilities plan for the Project will be prepared to upgrade the relevant facilities in the Project Site with the main purpose of upgrading and improving both the living and sanitation conditions in the Project Site by completing the Abu Nomros Main Collector and constructing new sewer branch lines and ancillary facilities for households and public buildings which are currently suffering from poor drainage and sewage overflow onto roads due to the absence of sewer facilities. The provision of such facilities is in progress under the Abu Nomros Main Collector Construction Project prepared by GOSD, requested by the Government of Egypt to the Government of Japan as the grant aid project and found necessary through the field survey for the Project.
- 2) The Project Site will be the Monib District (185ha) as stipulated by the Upgrading Plan of Water Supply and Sewer System in South Giza prepared by Giza City.
- 3) In view of the contents of the request by the Egyptian Government and the results of the Omrania West Project, it is reasonable to assume that the Egyptian side is capable of conducting the laying work of the branch line pipes to be provided by the Japanese side and, therefore, this work will be conducted by the Egyptian side using local technologies. The scope of work to be conducted by each side is shown in Table 5-3.

Table 5-3 Division of Sewer Facilities Construction Work

	Both Procurement and Construction by Japanese side	Procurement by Japanese Side and Construction by Egyptian Side
Sewer Trunk Line	○	
Sewer Branch Lines		○



- 4) The sewer trunk line to be included in the Project will be the sections of the Abu Nomros Main Collector route, the construction of which is currently in progress by GOSD, where Egyptian construction technologies are considered to be short of requirements because of the burying depth, geological conditions, groundwater level and site conditions involved. The contents of the facilities plan will be in line with those of the Abu Nomros Project. The plan of the sewer trunk line should also be compatible with the No.5 (B) Pump Station Construction Project as the sewage carried by the Abu Nomros sewer trunk line will flow into this pump station.
- 5) The facilities plan will consist of routes and burying depths which will minimise disruption of the existing underground facilities (water supply pipes, sewer pipes, power cables and telephone cables, etc.)
- 6) With regard to the technical standards used in the Project planning, Japanese technical standards must be met for the sewer trunk line pipes as the pipe jacking machinery will be procured in Japan. The standards used for the Greater Cairo Wastewater Project which is currently in progress with U.S. assistance and also those for existing sewer facilities will be applied as far as other sewer facilities to be constructed under the Project are concerned.

#### (4) Provision of Piping Materials for Branch Lines

The plan to provide piping materials for the water supply and sewer branch line under the Project will be prepared based on the following policies.

- 1) As described later in 5-3-3, the construction of water supply and sewer branch lines in the Project Site will have many benefits. Planning priority will be given to the housing and highly dense population area where the provision of water supply and sewer branch lines is urgently required.
- 2) Those areas currently used as farmland will be omitted from the scope of the Project on the grounds that water supply and sewer branch lines will be constructed concurrent with their urbanisation in the future.
- 3) Consideration will be given to the benefiting of such public buildings as schools and hospitals from the Project.
- 4) Water supply branch lines are already in place in some parts of the Project Site. The Project will incorporate the maximum use of these existing facilities.
- 5) The quantities of the piping materials to be provided under the Project will include extra on the design quantity to allow for cutting loss and detouring.

- pipes for water supply branch lines : approx. 2% extra
- pipes for sewer branch lines : approx. 3% extra

#### 5-1-6 Policies Relating to Construction Period

The Project aims at upgrading living and sanitation conditions by means of constructing water supply and sewer facilities throughout the Project Site to serve local households and public buildings which are currently suffering from extremely poor water supply and also from the poor drainage, as well as overflow, of sewage due to the absence of the relevant facilities. In view of the pressing nature of the problems in the Project Site, the Government of Egypt hopes for the early implementation of the Project.

As described in 5-1-5, the work to be undertaken by the Japanese side for the Project will be the laying of the water supply branch lines (diameter: 300-600mm) in relatively short sections where special technologies are required and the laying of the entire sewer trunk line. The Japanese pipe jacking method will be employed to overcome the severe construction conditions, including geological conditions, deterring the application of local technologies and to ensure the completion of the Project on schedule.

The most critical part of the construction work will be the pipe jacking work for the sewer trunk line. In view of the permissible construction period under the Japan's grant aid system and also of the desire for early completion on the part of the Egyptian side, the construction work will be conducted using two shifts to cover 24 hours/day.

The time factors for the Project based on the above are as follows.

<u>Project Time Factors</u>	
1. Phase	: 1 phase
2. Detailed Design	: 3 months
3. Procurement of Materials and Equipment and Actual Construction Work	: 12 months

## 5-2 Examination of Design Conditions

### 5-2-1 Water Supply Facilities

The design conditions for the water supply facilities listed in Table 5-4 have been confirmed through a series of consultations with Giza City, GCWSA and other related organizations.

Table 5-4 Design Conditions for Planning of Water Supply Facilities

Item	Design Conditions	Authority	
<b>1. Branch Lines</b>			
1) Project Site	Monib District, Giza City	Upgrading Plan of Water Supply and Sewer System in South Giza	
2) Target Year	2010		
3) Size of Project Site	185ha		
4) Design Service Population	247,000 person		
5) Design Mean Water Consumption Per Head Per Day	140 ltr/person/day	Study of Water Supply for Giza City	
6) Design Maximum Water Consumption Per Day	35,000m <sup>3</sup> /day (247,000×0.14+34,580m <sup>3</sup> /day)		
7) Water Consumption Per Head Per Day	190m <sup>3</sup> /ha/day (34,580+185=186.9m <sup>3</sup> /ha/day)		
8) Pipe Diameter	300-600mm		
- Branch Line	less than 300mm		
9) Types of Pipes	ductile cast iron pipe (steel pipes for Zomor Canal crossing section)		consultation with Giza City, GCWSA and study results
- Branch Line (300-600mm)	PVC pipe		
- Branch Line (less than 300mm)	approx. 1.2m		
10) Standard Earth Cover			
<b>2. Ancillary Equipment</b>			
1) Joint Type of Pipe	T-joint (except joints with gate valves and piping at railway crossing section)	consultation with GCWSA and study results	
2) Joint Type of Pipe at Railway Crossing Section	mechanical joint		
3) Types of Gate Valves	400-600mm: butterfly valve less than 400mm: sluice valve		
4) Gate Valve Installation Points	aqueduct, railway crossing section, wash-out and branching off points		
5) Wash-out Installation Points	convex sections		
6) Air Valve Installation Points	concave sections		
7) Fire Hydrant Interval			
- Branch Line (300-600m)	approx. 150m (no installation on El Cornesh Street)		
- Branch Line (less than 300mm)	150-200m		

### 5-2-2 Sewer Facilities

The design conditions listed in Table 5-5 for the sewer facilities to be constructed under the Project have been confirmed through consultations with Giza City and GOSD.

Table 5-5 Design Conditions for Planning of Sewer Facilities

Item	Design Conditions	Authority
1) Project Site	Monib District, Giza City	Upgrading Plan of Water Supply and Sewer System in South Giza
2) Target Year	2010	
3) Size of Project Site	185ha	
4) Design Service Population	247,000	
5) Drainage System	combined system	
6) Design Mean Sanitary Wastewater Flow Per Head Per Day	140 ltr/person/day	consultation with GOSD and study results
7) Design Maximum Sanitary Wastewater Flow Per Head Per Day	190 ltr/person/day	
8) Design Flow Velocity	minimum: 0.6m/sec maximum: 1.5m/sec	
9) Coefficient of roughness of sewer pipes	0.013	
10) Flow Velocity Formula	Manning's formula	
11) Diameter of Sewer Trunk Line	Plan 1 : uniform diameter of 2,000mm Plan 2 : two diameters of 1,800mm and 2,000mm Plan 3 : two diameters of 1,650mm and 2,000mm (one of these will be selected based on the comparison results relating to required construction period, cost, etc.)	
12) Types of Pipes - Trunk Line - Branch Lines	reinforced concrete pipes for pipe jacking method clay pipes	